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Commonwealth of the Northern Mariana Islands

Final Comprehensive Highway Master Plan 2009

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Table of Contents

List of Tables

List of Figures

List of Appendices

EXECUTIVE SUMMARY

Introduction

The Commonwealth of the Northern Marianas Islands (CNMI) is a commonwealth in political union with the United States situated in the western Pacific Ocean. The three main islands in the CNMI are Saipan, Tinian and Rota, each with its own unique features. Saipan is the largest and relies on tourism for much of its economic well-being. Neighboring Tinian relies greatly on casino gambling. Rota is located further south and has a moderate tourism industry emphasizing eco-tourism. The CNMI has an estimated 2007 population of 84,546 (the official 2000 census count was 69,221).

A Comprehensive Highway Master Plan for the CNMI should accommodate the needs of each island, while also integrating their common needs into a unified transportation and plan.

Objectives

The main objective of this Comprehensive Highway Master Plan is to update the previous Comprehensive Highway Master Plan that was published in 1997. This Master Plan will provide a unifying framework for future transportation planning in the CNMI through the following actions:

- It identifies a roadway classification scheme that will assist the Department of Public Works in prioritizing transportation improvements
- It identifies deficiencies and constraints in both the existing and expected future transportation network, and provides short-range and long-range recommendations for improvements to alleviate such deficiencies. These recommendations are also detailed for each of the three main islands.

Project Approach

This Highway Master Plan essentially updates the previous master plan. It provides updated traffic data, and forecasts for future year conditions for each of the three main islands. Roadway segments and intersections were analyzed to estimate traffic capacity and levels of service. This Master Plan reassesses previous accident data and provides the status of the recommended improvements from the earlier master plan.

Based on public scoping meetings and interviews and discussions with Department of Public Works (DPW) and other CNMI staff, further deficiencies and constraints in the existing roadway network were identified, and recommendations made for improvements.

Estimates of the costs of the various transportation improvements were made. Based on research of potential funding sources and methods, a financial plan for funding such improvements over the next 15 years is also presented.

Public Scoping and Public Informational Meetings

Public scoping meetings were held on August 1st, 2nd, and 3rd, 2006. Each meeting included an overview of the Purpose of the Master Plan and Study Process, the proposed study schedule, and a forum for comments, questions and answers. The scoping meetings were held to seek input from local officials, agencies, and stakeholders on the Comprehensive Highway

Master Plan Study update, including their concerns and suggestions about existing highways. Several overriding themes, issues or concerns were voiced which included, public safety, operational issues, drainage and facility conditions, and pedestrian and bicycle circulation.

After the final draft of the CNMI Highway Master Plan Study was released, public informational meetings were held on each island. Public informational meetings were held on August 28, 29, and 30, 2009. In attendance of each meeting were the Mayors of each island, the Director of DPW, and TSD/DPW Staff, consultant team and general public. Each meeting included a presentation of the process, assumptions, evaluation, findings, and results of the Master Plan. Following the presentation of the final Master Plan Study, a question and answer forum was provided. Concerns and questions received at the public informational meetings ranged from the timeframe for the implementation of the recommended improvements, funding, public safety, use of local workers, ranking of improvements, pedestrian and bicycle facilities, and the overall process.

Roadway Issues

Existing Pavement Conditions

Pavement condition on the roadway has been an issue on the three islands due to the use of the relatively endurable coral and acidic based pavement materials, and poor drainage on the roadways. Several pavement issues identified in the field include uneven areas, no paved shoulders, pot holes, cracks, and abruptly ended edge pavements. A few locations include Quartermaster Road, Gualo Rai Road, Capital Hill Road, Tun Herman Pan Road, and Kagman Road.

Existing Bike and Pedestrian Facilities

There are currently limited designated bike paths on Saipan, Tinian, or Rota along major roadways and in main tourist attractions. Bike lanes are provided on both sides of Beach Road; however, the striping has faded and is hardly visible. For other roadways, bicyclists are usually required to either use the roadway shoulders or sidewalks where provided or share the road with the vehicles on existing travel lanes.

Continuous pedestrian sidewalks are provided on both sides of Beach Road in the Garapan area where pedestrian activities are the highest on Saipan. Isolated sidewalks can also be found along some short segments of roadways. But in general, continuous sidewalks do not exist in the majority of the roads on Saipan, Tinian, and Rota. It is observed that pedestrians are required to walk on the travel way or landscaped area off the roads.

Roadway Safety

Accident data was collected from various sources for this highway master plan study. These data sources include the CNMI Highway Safety Programs Annual Report, raw accident data on Saipan provided by the Department of Public Safety (DPS) for the years 2003-2008, and information provided by the DPS during a project conference call in July 2008. This data was evaluated in order to identify some hot spots or high accident frequency locations on the island. The accident data reported in the previous master plan report was also re-evaluated in this study to check if any of the previously identified high frequency locations have been improved since the 1997 study.

Recommended Roadway Improvements

To maintain the mobility on the islands, the identified improvements are divided into long range and short range recommendations. The designated timeframe for long range improvements would be from 5 to 10 years whereas the designated timeframe for short range recommendations would be from 1 to 4 years. Recommended improvements are provided both on a project-wide basis for all three CNMI islands and specific roadway improvement projects for each of the three islands.

Project-Wide Improvements

Short Range Improvements

PS-1 Roadway Pavement and Delineation Maintenance and Improvement Program

PS-2 Roadway Classifications

Saipan Roadway Improvements

The short and long range improvements for Saipan are listed below and shown in Figure E1.

Short Range Improvements

SS - 1. Intersection Modifications at the following intersections

a. Chalan Monsignor Guerrero and Chalan Pale Arnold
b. Chalan Monsignor Guerrero and Beach Road
c. Chalan Pale Arnold and Navy Hill Road
d. Beach Road and Garapan Street
e. Tun Herman Pan and Flame Tree Drive
f. Beach Road and Chalan Monsignor Martinez

SS - 2. Install new traffic signal at the following intersections:

a. Beach Road and Quartermaster Road
b. Beach Road and Gualo Rai Road
c. Beach Road and CPL Derence Jack Road
d. Beach Road and Micro Beach Road
e. Beach Road and Tun Segundo Street

SS - 3. Add vehicle turnout along Isa Drive in Capital Hill

SS - 4. Relocate existing pedestrian crossing on Chalan Pale Arnold near Commonwealth where new museum and skate park is being constructed and signalized intersection of Commonwealth and Chalan Pale Arnold

SS - 5. Improve signage and relocate driveway on Chalan Tun Road in As Terlaje

SS - 6. Add pedestrian pathway on Micro Beach Road

SS - 7. Improve signage on Isa Drive (Route 31) near Kagman Road

SS - 8. Improve signage on As Perdido Road (Route 32)

SS - 9. Add mid-block or signalized crosswalks on Beach Road

SS - 10. Speed enforcement on Chalan Monsignor Guerrero and Chalan Pale Arnold

Figure E 1: Saipan Short Range and Long Range Improvements

SS - 11. Parking enforcement in Garapan

SS - 12. Vehicle Circulation in Garapan

SS - 13. Hazard Elimination along Route 30 (Chalan Pale Arnold)

Long Range Improvements

SL - 1. Construct new bridge and connection along Route 36

SL - 2. Upgrade and pave Lau Lau Road to Kagman

SL - 3. Realign Texas Road and modify Chalan Pale Arnold and Monsignor Guerrero to a four leg intersection

SL - 4. Realign Micro Beach Road between Beach Road and Chalan Pale Arnold. Widen roadway to provide a third lane that would become a WB left-turn lane, and add bike lanes. Add pedestrian pathway on Micro Beach Road**.**

SL - 5. Construct pedestrian facilities and bike lanes along Chalan Pale Arnold

SL - 6. Drainage upgrade along Chalan Monsignor Guerrero near Chalan Tun Herman Pan Road

SL - 7. Widen Beach Road from Chalan Monsignor Guerrero to Afetna to install two-way left-turn lane

SL - 8. Widen and improve Route 31

a. Widen and improve Route 31 from Kagman Road to Talofofo Road (Route 31 Reconstruction Project Phase IIB)

b. Widen and improve Route 31 from Talofofo Road to Chalan Pale Arnold (Route 31 Reconstruction Project Phase III)

SL - 9. Upgrade and improve Route 35 (Chalan Tun Herman Pan)

SL - 10. Widen and pave Route 316 (Chalan Savanna)

SL - 11. Upgrade and improve Route 310 towards Mt. Tapochao

Tinian Roadway Improvements

The short and long range improvements for Tinian are listed below and shown in Figure E2.

Short Range Improvements

TS - 1. Implement directional and guide sign program on Tinian especially in San Jose Village

Long Range Improvements

TL - 1. Upgrade and pave roadways and construct pedestrian facilities in San Jose Village

TL - 2. Upgrade and improve Broadway from Route 201 south to Limestone Forest Trail

TL - 3. Upgrade and improve major roadways in Lower Pina, Marpo and Carolinas

Rota Roadway Improvements

The short and long range improvements for Rota are listed below and shown in Figure E3.

Short Range Improvements

RS - 1. Implement directional and guide sign program on Rota especially in Song Song Village

RS - 2. Eliminate sight distance issue at Route 10 intersection leading to Route 100 in Song Song Village

RS - 3. Install positive traffic control on Route 100 between Bay Breeze Restaurant/Bar and East Harbor entrance

RS - 4. Hazard Elimination along Route 10

RS - 5. Comprehensive drainage study in Song Song Village

Long Range Improvements

RL - 1. Drainage upgrade along Route 10 from Tatachok Point south to Pinatang Park.

RL - 2. Upgrade and pave Route 101 from Route 10 (College of Marianas) and along Route 11 to Ginalahan Community

RL - 3. Complete, widen, and pave Route 100 from Song Song Village to Ginalahan Community and Airport

RL - 4. Expansion of roadway and other infrastructures to Dugi area from Route 103 in Gampapa and Pegnasu areas

RL - 5. Construct bike/pedestrian path along the coastal road and collector's area

RL - 6. Widen and upgrade roadways between Sinapalo area and Bird Sanctuary Park*

RL - 7. Widen and upgrade roadway connecting Gagani and Haofna

RL - 8. Upgrade and pave Route 102

RL - 9. Upgrade and pave Route 103

RL - 10. Upgrade and pave alternate routes from Song Song Village to Sailigal Hulo and to Ka'an

Figure E 2: Tinian Short Range and Long Range Improvements

Figure E 3: Rota Short Range and Long Range Improvements

CNMI Financial Plan

Estimates of the costs of the various transportation improvements were made. Based on research of potential funding sources and methods, a financial plan for funding such improvements over the next 14 years is also presented.

The CNMI Comprehensive Highway Master Plan Update consists of improvements totaling $255,955,300 over the 14-year period, with Short Range improvements totaling $12,390,300 over 4 years and Long Range improvements totaling $243,565,000 over the subsequent 10 years. Funding could be provided through the Covenant and the remainder could potentially be funded by a combination of local revenues, mainly taxes, development fees, Department of Interior appropriation measures, and other federal grants.

Project Evaluations

Table E1 ranks the improvement projects for each of the three main islands and for both short and long range time frames, based on the following five criteria and scores (where higher scores are better):

- Safety (score of 1 for minimal or no safety improvement, 2 for moderate improvement, 3 for substantial improvement, and 4 for exceptional improvement).

- Traffic Operations (score of 1 for minimal or no traffic flow improvement, 2 for moderate improvement, 3 for substantial improvement, and 4 for exceptional improvement).

- Environmental Impacts (score of 1 for potentially severe environmental impacts, 2 for potentially substantial impacts, 3 for potentially moderate impacts, and 4 for minimal to no impacts).

- Construction Costs (score of 1 for construction costs <$250,000, 2 for costs between $250,000 and $1M, 3 for costs between $1M and $10M, and 4 for costs over $10M).

- Operations and Maintenance Costs (score of 1 for potentially very high operations and maintenance cost, 2 for potentially high cost, 3 for potentially moderate cost, and 4 for minimal to no cost).

Table E 1: Ranked Short Range and Long Range Improvements

Island	Time Frame	Improvement		Construction Cost	SCORE					
					Safety	Traffic Operations	Environmental Impacts	Construction Costs	Operations & Maintenance Costs	Total Score
Saipan	Short Range Improvements	SS-8	Improve signage on As Perdido Road (Route 32)	$8,200	3	2	4	4	3	16
		SS-7	Improve signage on Isa Drive (Route 31) near Kagman Road	$35,300	3	2	4	4	3	16
		SS-4	Relocate existing pedestrian crossing on Chalan Pale Arnold near Commonwealth Drive	$345,700	3	2	4	3	4	16
		SS-1	Intersection Modifications at 6 locations	$552,400	3	3	4	3	3	16
		SS-5	Improve signage and relocate driveway on Chalan Tun Road in As Terlaje	$6,600	3	2	3	4	3	15
		SS-9	Add mid-block or signalized crosswalks on Beach Road	$20,200	3	1	4	4	3	15
		SS-2	Install new traffic signals at 5 locations	$1,502,900	3	4	3	2	3	15
		SS-10	Speed enforcement on Chalan Monsignor Guerrero and Chalan Pale Arnold	$45,200	3	2	4	4	1	14
		SS-6	Add pedestrian pathway on Micro Beach Road	$367,900	3	2	3	3	3	14
		SS-13	Hazard Elimination along Route 30 (Chalan Pale Arnold)	$2,703,000	4	2	3	2	3	14
		SS-3	Add vehicle turnout along Isa Drive in Capital Hill	$419,700	2	3	2	3	3	13
		SS-12	Vehicle Circulation in Garapan	$512,700	1	2	4	3	3	13
		SS-11	Parking enforcement in Garapan	$5,500	2	1	4	4	1	12
	Long Range Improvements	SL-6	Drainage upgrade along Chalan Monsignor Guerrero	$292,000	2	1	2	3	4	12
		SL-4	Realign Micro Beach Road between Beach Road and Chalan Pale Arnold. Widen roadway to provide a third lane that would become a WB left-turn lane, and add bike lanes. Add pedestrian pathway on Micro Beach Road.	$813,000	3	3	1	3	2	12
		SL-10	Widen and pave Route 316 (Chalan Savana)	$4,362,000	3	4	1	2	2	12
		SL-5	Construct pedestrian facilities and bike lanes along Chalan Pale Arnold	$7,366,000	3	2	2	2	2	11
		SL-7	Widen Beach Road from Monsignor Guerrero to Afetna Road to install Two-Way Left-Turn Lane	$7,588,000	3	4	1	2	1	11
		SL-8a	Widen and improve Route 31 from Kagman Road to Talofofo Road (Route 31 Reconstruction Project Phase IIB)	$8,307,000	3	4	1	2	1	11
		SL-8b	Widen and improve Route 31 from Talofofo Road to Chalan Pale Arnold (Route 31 Reconstruction Project Phase III)	$8,641,000	3	4	1	2	1	11
		SL-9	Upgrade and Improve Route 35 (Chalan Tun Herman Pan)	$7,542,000	3	3	1	2	1	10
		SL-11	Upgrade and improve Route 310 towards Mt Tapochao	$7,673,000	3	3	1	2	1	10
		SL-1	Construct new bridge and connection along Route 36	$9,762,000	2	3	1	2	2	10
		SL-3	Realign Texas Road and modify Chalan Pale Arnold and Monsignor Guerrero Road	$6,611,000	2	3	1	2	1	9
		SL-2	Upgrade and pave Laulau Road to Kagman	$11,009,000	3	3	1	1	1	9

Island	Time Frame	Improvement		Construction Cost	SCORE					
					Safety	Traffic Operations	Environmental Impacts	Construction Costs	Operations & Maintenance Costs	Total Score
Tinian	Short Range Improvements	TS-1	Implement directional and guide sign program on Tinian especially in San Jose Village	$46,000	2	2	3	4	3	14
	Long Range Improvements	TL-2	Upgrade and improve Broadway from Route 201 south to Limestone Forest Trail	$4,560,000	3	3	2	2	2	12
		TL-1	Upgrade and pave roadways and construct pedestrian facilities in San Jose Village	$6,655,000	3	3	1	2	1	10
		TL-3	Upgrade aand improve major roadways in Lower Pina, Marpo and Carolinas	$11,500,000	3	3	1	1	1	9
Rota	Short Range Improvements	RS-2	Eliminate sight distance issue at Route 10	$3,800	3	3	3	4	4	17
		RS-3	Install positive traffic control on Route 100	$12,200	3	3	3	4	3	16
		RS-1	Implement directional and guide sign program on Rota	$164,400	2	2	4	4	3	15
		RS-5	Comprehensive drainage study in Song Song Village	$69,000	2	1	3	4	4	14
		RS-4	Hazard Elimination along Route 10	$5,028,000	4	2	3	2	2	13
	Long Range Improvements	RL-1	Drainage upgrade along Route 10	$82,000	3	1	3	4	3	14
		RL-7	Widen and upgrade roadway connecting Gagani and Haofna	$9,854,000	3	4	1	2	1	11
		RL-4	Expansion of roadway and other infrastructures to Dugi area from Route 103 in Gampapa and Pegnasu areas	$3,068,000	3	3	1	2	1	10
		RL-5	Construct bike/pedestrian path along the coastal road and collector's area	$8,884,000	3	2	2	2	1	10
		RL-10	Upgrade and pave alternate routes from Song Song Village to Sailigal Hulo and to Ka'an	$9,871,000	3	3	1	2	1	10
		RL-6	Widen and upgrade roadways between Sinapalo area and Bird Sanctuary Park	$18,300,000	3	4	1	1	1	10
		RL-3	Complete, widen, and pave Route 100 from Song Song Village to Ginalahan Community and Airport	$26,957,000	3	4	1	1	1	10
		RL-9	Upgrade and pave Route 103	$17,692,000	3	3	1	1	1	9
		RL-8	Upgrade and pave Route 102	$19,421,000	3	3	1	1	1	9
		RL-2	Upgrade and pave Route 101 and along Route 11	$31,666,000	3	3	1	1	1	9

Note: Higher scores are better.

1 INTRODUCTION

The Commonwealth of the Northern Marianas Islands (CNMI) is a commonwealth in political union with the United States situated in the western Pacific Ocean. Figure 1 shows the CNMI in relation to other islands in the Pacific including the US territory of Guam. Figure 2 is a location map showing the relative distances between the three main islands in the CNMI, namely Saipan, Tinian and Rota. Each of these three islands has its own unique features. Saipan is the largest and relies on tourism for much of its economic well-being. Neighboring Tinian relies greatly on casino gambling. Rota is located further south and has a moderate tourism industry emphasizing eco-tourism.

A Comprehensive Highway Master Plan for the CNMI should accommodate the needs of each island, while also integrating their common needs into a unified transportation plan.

1.1 Objectives

The main objective of this Comprehensive Highway Master Plan is to update the previous Comprehensive Highway Master Plan that was published in 1997. This Master Plan will provide a unifying framework for future transportation planning in the CNMI through the following actions:

- It identifies a roadway classification scheme that will assist the Department of Public Works in prioritizing transportation improvements
- It identifies deficiencies and constraints in both the existing and expected future transportation network, and provides short-range and long-range recommendations for improvements to alleviate such deficiencies. These recommendations are also detailed for each of the three main islands.

1.2 Project Approach

This Highway Master Plan essentially updates the previous master plan. It provides updated traffic data, and forecasts for future year conditions for each of the three main islands. Roadway segments and intersections were analyzed to estimate traffic capacity and levels of service.

This Master Plan reassesses previous accident data and provides the status of the recommended improvements from the earlier master plan.

Based on public scoping meetings and interviews and discussions with DPW and other CNMI staff, further deficiencies and constraints in the existing roadway network were identified, and recommendations made for improvements.

Estimates of the costs of the various transportation improvements were made. Based on research of potential funding sources and methods, a financial plan for funding such improvements over the next 15 years is also presented.

Figure 1: Vicinity Map

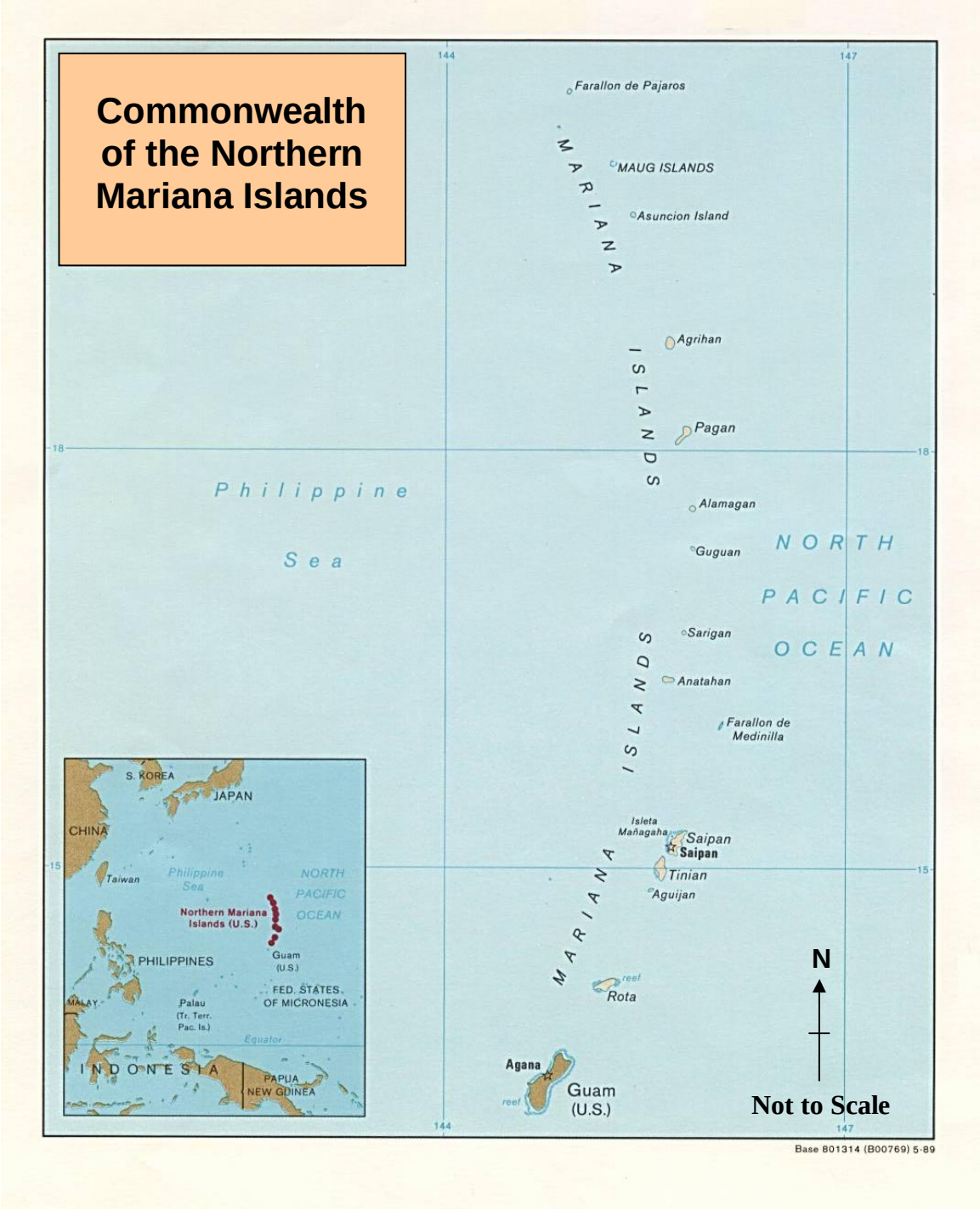
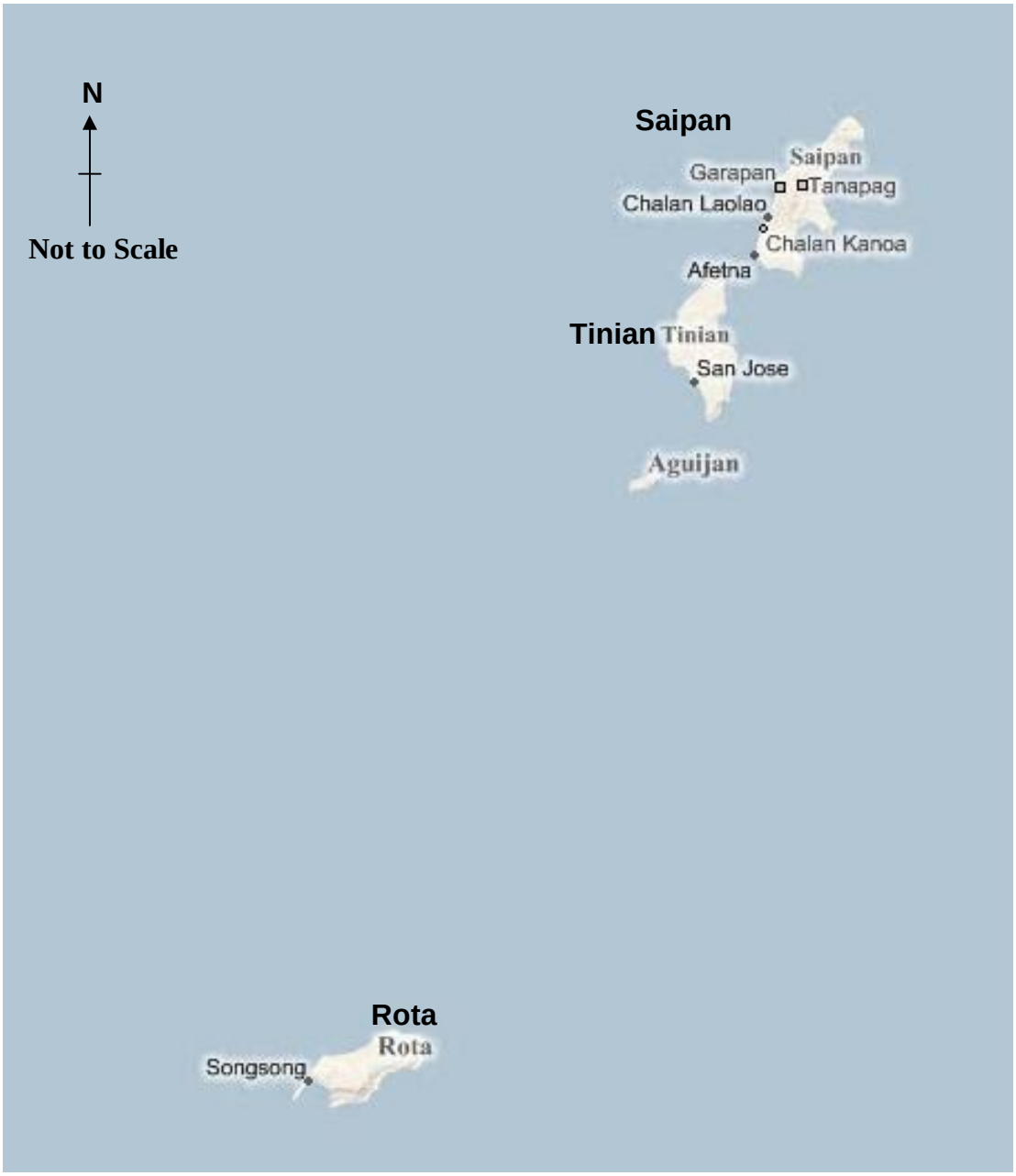


Figure 2: Location Map



Source: http://maps.live.com/

2 LAND USE AND SOCIOECONOMIC ISSUES

2.1 Population

The Commonwealth of the Northern Marianas Islands (CNMI) has a population of 84,546 (2007 estimate). The official 2000 census count was 69,221 including residents and non-residents which is approximately a 60 percent increase from the 1990 population of 43,345. Saipan's and Tinian's population have risen proportionally more than Rota's population. By 2000, 90 percent of the CNMI total population lived on Saipan, while only 5 percent lived on Rota and 5 percent lived on Tinian. Correspondingly, the population density has increased dramatically in Saipan from 836 persons per square mile in 1990 to 1342 in 2000; population density also rose from 54 to 90 in Tinian, and increased from 70 to 100 in Rota. Table 1 and Table 2 summarize the populations and population density on the CNMI, respectively.

Table 1: Population by Island - 1920 to 2000

Year	Total	Number of persons			
		Saipan	Rota	Tinian	N. Islands
2000	69,221	62,392	3,283	3,540	6
1995	58,846	52,698	3,509	2,631	8
1990	43,345	38,896	2,295	2,118	36
1980	16,780	14,549	1,261	866	104
1973	14,333	12,382	1,104	714	133
1967	10,986	9,035	1,078	610	263
1958	8,290	6,654	969	405	262
1935	4,297	3,194	788	24	291
1930	3,829	2,915	644	43	227
1925	3,493	2,639	487	180	187
1920	3,398	2,449	651	112	186

Source: 2002 CNMI Statistical Yearbook: Census reports for respective years: 1920-1935 for Natives Only and Census 2000 population and housing Profile

Table 2: Population Density by Island - 1920 to 2000

Year	Persons per Square Mile			
	Saipan	Rota	Tinian	N. Islands
2000	1342	100	90	0
1995	1133	107	67	0
1990	836	70	54	1
1980	313	38	22	2
1973	266	34	18	2
1967	194	33	16	5
1958	143	30	10	5
1935	69	24	1	5
1930	63	20	1	4
1925	57	15	5	3
1920	53	20	3	3

Source: 2002 CNMI Statistical Yearbook- Census reports for respective years: 1920-1935 for Natives Only and Census 2000 Population and Housing Profile

2.1.1 Saipan

The areas of population concentration in Saipan have shifted from the western to the eastern side of the island. In 1990, Saipan's population was heavily concentrated in Garapan followed by San Antonio, Koblerville and Chalan Kanoa. By 2000, in addition to these places, Tanapag, Kagman, Dandan and San Vicente had become major population places. Table 3 shows the population by village on Saipan.

Table 3: Population by Village, Saipan - 1990 to 2000

Village	Population	
	2000	1990
San Roque	983	911
Tanapag	3,318	1,602
Garapan	3,588	3,904
Capitol Hill	1,496	1,234
Kagman	3,026	293
San Jose	787	839
Susupe	2,083	1,776
Chalan Kanoa	3,108	2,549
San Antonio	4,741	2,887
Koblerville	3,543	2,811
Dandan	2,718	901
San Vicente	3,494	1,669
Gualo Rai	2,354	1,746
Navy Hill	1,001	419

Source: 2002 CNMI Statistical Yearbook: 1990 CPH-6-CNMI Table 6, Census 2000 Population and Housing Profiles

2.1.2 Tinian

Tinian's population nucleus is located in the village of San Jose, which is also the island's commercial center. The majority of the island's population resides in San Jose; however, Marpo Valley has emerged into becoming the island's secondary residential area.

2.1.3 Rota

Urbanized areas on Rota consist of Song Song and Sinapalo villages. Song Song is the center of commerce and government for the island. These two communities are linked by Rota's primary highway which services the airport in Sinapalo and the seaport in Song Song.

2.2 Non-Resident Population

About 58 percent of the total population in the CNMI was born elsewhere and migrated into the Commonwealth in 2000. The majority of all immigrants were temporary residents who resided in the Commonwealth under employment visas. The number of work permits issued to non-resident workers has decreased from 1997 to 2002 with the exception of an increase in 2000 as shown in Table 4.

Table 4: Permits Issued to Non-Resident Workers

Year	2002	2001	2000	1999	1997
Total	29,455	30,958	38,522	31,907	36,566

Source: 2002 CNMI Statistical Yearbook
Note: 1998 data not available

A smaller number of people came as spouses, family members, dependents of employed persons, or as students, missionaries or for other reasons. As it was in 1995 and 1990, the Filipino population is the largest single ethnic group in the Commonwealth in Saipan. Although not as dominant as in the previous census year, the Chamorros were still the most dominant ethnic group in Rota and Tinian.

Increasing immigration from outside the CNMI has resulted in significant changes in the demographic characteristics of the community. Some of these changes include:

- The population is getting older with a median age of 28.6 in 2000 up from 27.4 in 1990.
- A higher proportion of females employed.
- A lower male to female ratio. The gender ratio in 1990 was 111 males to 100 females; in 1995 it was 99 males for every 100 females; while in 2000 it was 86 males to every 100 females.
- An increasing number of people living in group quarters. In 2000, the number of people living in group quarters increased to 26 percent from 20 percent in 1995.

2.3 Household Size and Income

The 2005 CNMI Household, Income and Expenditures Survey indicated that Rota posted the highest per capita, household and family income among the three main islands in CNMI. Table 5 provides a summary of the household income on the CNMI islands.

Table 5: Household Income

2005	CNMI	Saipan	Tinian	Rota
Per Capita Income	$6,178	$6,017	$7,494	$8,592
Median Household Income	$17,138	$16,835	$21,538	$22,270
Mean Household Income	$25,172	$24,629	$32,318	$29,839
Median Family Income	$19,625	$19,174	$26,630	$24,514
Mean Family Income	$28,461	$29,933	$35,352	$32,583

2.4 Land Use Patterns

The Commonwealth of the Northern Mariana Islands (CNMI) is formed by a chain of 14 volcanic islands stretching over 375 miles north to south, with a total land area of 181 square miles. Of all those islands, there are only three inhabited islands: Saipan, Tinian and Rota.

2.4.1 Saipan

Saipan is the largest island of the CNMI with a total area of 44.55 sq mi (115.39km^2). It is divided into 11 Census Districts and further divided into villages as shown in Figure 3.

Census Districts 1 through 5 are connected along Saipan's southwestern extreme. They span a coastal arc beginning at the southern fringe of Chanlan Kanoa and extend through northern Susupe. It is served primarily by Beach Road and to a lesser extent by Texas Road for north-south mobility. In addition, As Perdido Road and Chalan Monsignor Guerrero serve the traffic generated in this area from the east to the west direction.

District 6 on Saipan's southwestern coast bridges the airport area and San Antonio. It includes the mixed residential area of Koblerville and San Antonio village. Koblerville and San Antonio have populations of 3,543 and 4,741 respectively and are home to the Coral Ocean Golf Course and Resort community which provides a 100-room hotel for its visitors. Chalan Monsignor Martinez serves the Koblerville community.

Along the coast to the north, District 7 features the village of San Jose and Gualo Rai. San Jose contains a mixture of residential and commericial uses, again with commercial uses dominating both sides of Beach Road. Beach Park offers a good view of the lagoon offshore. Chalan Monsignor Guerrero defines the northern edge of San Jose and provides area residents with access to Chalan Pale Arnold and to the airport further inland.

District 8 is primarily open space and undeveloped mountainous region. It includes the village of Tanapag and runs from the island's northwestern coast across the Talofofo ridge line to the As Teo-Chacha area. This area includes much of Capital Hill, the center of governmental operations. Chalan Pale Arnold is the most important roadway in this District. Isa Drive ties into Chalan Pale Arnold at the base of Capitol Hill, providing access to residential communities and government offices inland.

District 9 represents the island's northern area. The main residential area is found at San Roque, one of the island's smaller residential communities. The 2000 Census reports a total population of 983, a slight increase from 911 in the 1990 Census report.

District 10 is the island's largest District (by area), spanning the central and eastern mountainous region as well as the coastal community of Kagman. The area also encompasses Saipan International Airport in southern Saipan.

District 11's major focal points include Garapan, Gualo Rai, Navy Hill and parts of Capitol Hill. This District is the most urbanized. Offshore to the north is Tanapag Harbor. Garapan is the hotel/tourism District with a higher density of commercial, retail and hotels serving the tourist population. Several major hotels including Dai Ichi Hotel, Hyatt Regency and the Hafa Adai Hotel are located in this District.

2.4.2 Tinian

Tinian is the third largest island of the Mariana Islands. It is located approximately 4.5 km southeast, across the Saipan Channel, from Saipan. It has a land area of 101.01 km^2 (39 sq. mi.). Tinian is primarily an agricultural community with most of its population residing in San Jose followed by Marpo Valley. The majority of the areas in Tinian have been leased to the U.S. Federal Government for military contingency purposes. The "Military Retention Zone" (MRZ) boundary divides the island into northern and southern segments and approximately divides the island's two census Districts. Figure 4 provides a census district map of the island of Tinian.

District 1 includes Tinian International Airport, which is positioned atop a plateau in the central west corner of the island inside the MRZ. Along the island's northwestern coast is the new home to a Voice of America (VOA) radio relay station. The United States Information Agency, which has headquarters in Washington, D.C., chose Tinian as the site to build a new radio relay station to transmit VOA broadcasts. The VOA currently broadcasts more than 900 hours of programming weekly in 47 languages.

District 2 which ties in the rest of the island, contains the main village of San Jose on the southwestern coast and the low density residential area of Marpo. The village of San Jose holds most of the island's housing stock and all of the commercial and institutional uses. The Tinian Harbor lies along the coast of San Jose village and features berthing, transshipment and cold storage facilities. This 100 acre harbor has a 1000 foot long commercial dock. The island's power generation plant is in San Jose as well.

In 1989, the people of Tinian voted to accept casino gambling as an economic development opportunity. Tinian Dynasty Hotel and Casino first opened to public in 1998. With an estimated annual revenue of $150 million, it is the first five star hotel and casino in the entire CNMI. It is located on the southwest side of Tinian facing Taga Beach.

There are several planned developments, golf course facilities, and military plan in Tinian that are either under construction or will begin construction in the near future. These new projects are expected to draw an increased number of visitors to the island. Descriptions and statuses of these planned developments are provided below.

- Bridge Investment Group (BIG) (300 hotel condominiums and 100 townhouses and private villas) – Construction of the project has started with the building of the construction workers barracks and the main project will soon begin.

- Marianas Resort Development Company (MRDC) (405 rooms and 18-hole golf course) – The project has started with the submission of a preliminary EA study, and the detailed design of the hotel and golf course has been engaged.

- Neo Goldwings Paradise (NGP) (1,000 rooms and 18-hole golf course) – A public hearing for the casino conditional license has been scheduled. The company is currently negotiating with the Department of Public Lands to lease public land for the project.

- Military Warm Base – The Environmental Impact Statement (EIS) for the military build is underway and construction is projected to begin in 2010.

2.4.3 Rota

Rota is the southernmost island in the CNMI with a land area of 85.38 km^2 (32.97. sq. mi.). Most of the island remains in agricultural or natural habitat with a few, scattered agricultural, mixed-use residential, commercial and industrial uses located in the rural interior. Urbanized areas on Rota consist of Song Song and Sinapalo villages. Song Song is the center of commerce and government for the island. These two communities are linked by Rota's primary highway, which services the airport in Sinapalo and the seaport in Song Song.

Rota is divided into four Census Districts. Districts 1 and 4 cover the majority of the island while Districts 2 and 3 run to the village of Song Song at the peninsula of Rota. A District map of Rota can be found in Figure 5.

Rota's International Airport is located in District 1. In January 2006, the Commonwealth Ports Authority issued the official notice to proceed with the Runway Extension Project Phase I. This project includes the extension of 1,000 feet of the runway and a turnaround at each runway end, grooving, pavement marking, striping, lighting, runway guidance signs and security fence installation. Phase II of the project includes paving shoulders on both sides of the existing runway, new electrical conduits, new edge lighting, new generator and fuel tank and construction of a generator room. Phase II, however is still waiting for additional funding. The pre-final inspection was conducted on June 2007 and the completion date has yet to be determined.

Also within District 1 is Rota's first major hotel and golf course facility, the Rota Resort and Country Club, which sweeps over 560 acres of lush land.

Districts 2 and 3 cover the peninsula of Rota, where the village of Song Song resides. Rota's secondary residential village, Sinapalu, is located directly south of Rota's International Airport in District 2. The WWII Japanese Burial Site, Peace Memorial and Rota Zoo can also be found in this district.

The last Land Use Plan for Rota was completed in 1978 but was never adopted. Instead, the development pattern of the island is influenced by property ownership patterns, accessibility, population centers, topography, and proximity to ports and the island's water distribution system than it has from the guidance of public land use planning.

Figure 3: Saipan District Map

Figure 4: Tinian District Map

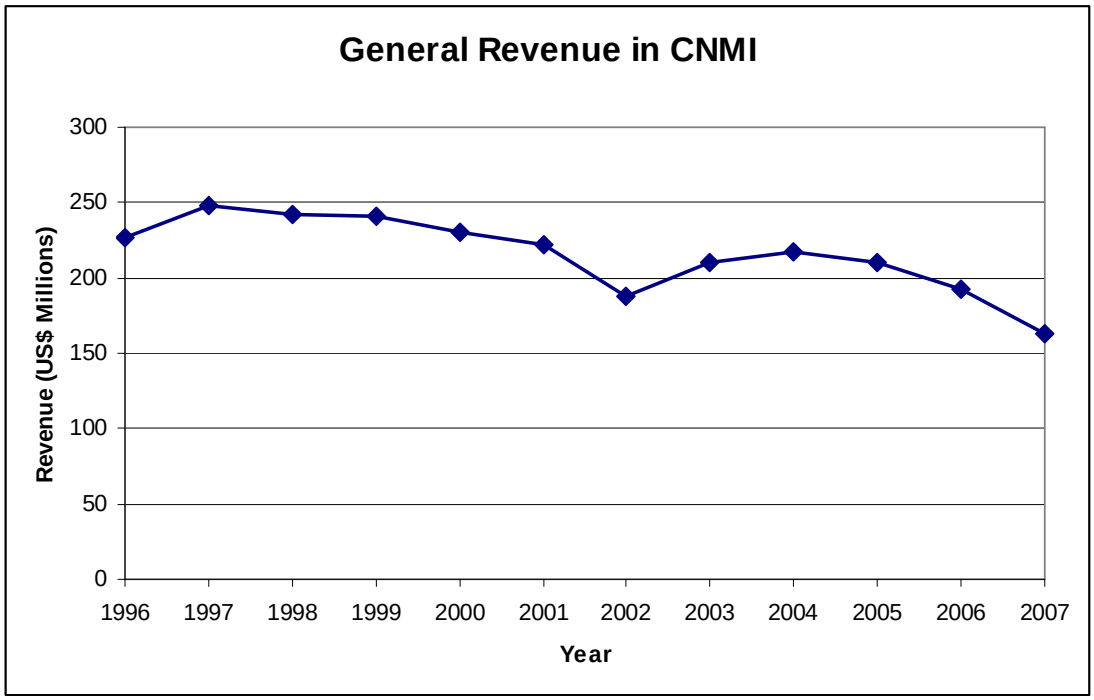
Figure 5: Rota District Map

2.5 Economy

2.5.1 Current Economic Conditions

The CNMI economy had grown very rapidly between 1986 and 1997 as reported in the previous Comprehensive Highway Master Plan. However, the rapid growing trend started to slow down and even depreciate beginning in 1997. The impact on the economy is reflected by the general revenue collected in the CNMI. In 1997, the local revenues were $248.0 million. In 2002, local revenues decreased 24% to $187.9 million. The amount of revenue slightly increased to $217.9 million in 2004, but decreased again since then to $163.0 million in 2007, the least amount of general revenue collected in the past 11 years. Figure 6 illustrates the local revenue collected between 1996 and 2007.

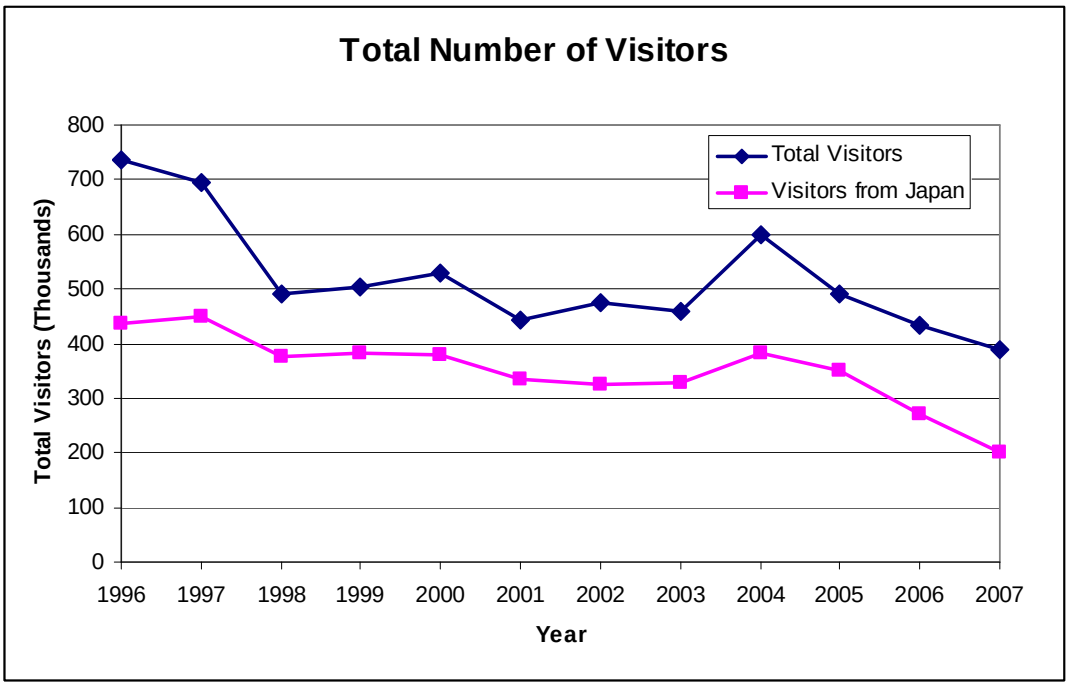
Figure 6: General Revenue in the CNMI between 1996 and 2007



2.5.2 Tourism

The tourism industry has been one of the leading economic sectors influencing the retail, service, hotel/resorts, entertainment, transportation, construction, recreation, business and government components in the CNMI. Although tourism is the leading economic industry, the number of visitor arrivals has been decreasing since 1996. In 1996, visitor arrivals to the CNMI reached a peak at 736,000, and has gradually decreased since then to 389,000 in 2007; a decrease of 47% in 11 years. This significant decrease in number of tourists could be attributed to a one-sided tourism economy primarily driven by the Japanese market, which made up over half of the total number of incoming travelers. The decreasing trend in the tourism industry could greatly affect new hotel and other new facilities developments in the CNMI, which could be one of the reasons for the economical downturn on the islands. Total numbers of visitor arrivals from year 1996 to 2007 are shown in Figure 7.

Figure 7: Total Number of Visitor Arrivals between 1996 and 2007



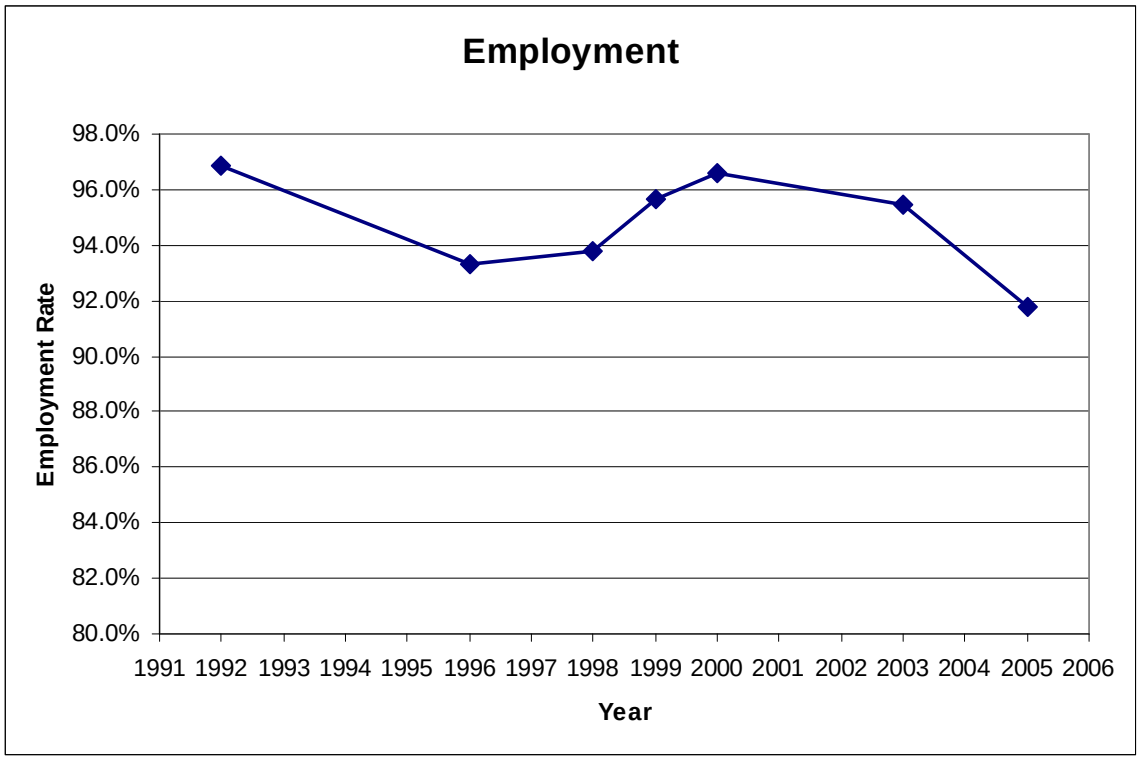
2.5.3 Employment Rate

According to the 2005 Household, Income, and Expenditures Survey (HIES), the total number of employed persons in the CNMI was roughly 35,400, which accounted for 92% of the total labor force in the CNMI. The unemployment rate is 8%. By reviewing the historic HIES data, the employment rate varied from 92% to 97% between 1992 and 2005 with a peak of 97% in 1992. The 2005 employment rate was the lowest of the seven years surveyed. Table 6 below summarizes the employment data for the seven survey years. The seven years employment rates are shown in Figure 8.

Table 6: Employment Rates in the CNMI

Year	Persons over 16	Total labor force	Employment	Employment %
1992	38,727	31,606	30,613	96.9%
1996	34,777	27,364	25,529	93.3%
1998	51,661	43,328	40,627	93.8%
1999	59,922	48,693	46,590	95.7%
2000	47,797	40,492	39,103	96.6%
2003	47,883	39,179	37,388	95.4%
2005	48,669	38,533	35,365	91.8%

Figure 8: Plot of Employment Rates in CNMI



3 PUBLIC SCOPING MEETINGS

Public scoping meetings were held on August 1st, 2nd, and 3rd, 2006. Each meeting included an overview of the Purpose of the Master Plan and Study Process, the proposed study schedule, and a forum for comments, questions and answers. The scoping meetings were held to seek input from local officials, agencies, and stakeholders on the Comprehensive Highway Master Plan Study update, including their concerns and suggestions about existing highways. Several overriding themes, issues, and concerns arose from the public scoping meetings. The topics included; transportation operational issues, public safety, drainage and erosion concerns, non-motorized circulation (pedestrian and bicycles) and future needs. Meeting notes of the scoping meeting are provided in Appendix A.

3.1 Saipan Scoping Meeting

The public scoping meeting was held on Saipan on August 3rd, 2006. The comments and concerns recorded in that meeting centered around several main themes that are addressed in this report through the following recommended actions:

1. To expedite the delivery process, there will be coordination and involvement with other public agencies such as the Police, Public Safety and the Zoning Board.

2. The evaluation and maintenance of the existing facility is being achieved through analysis of the current traffic and safety conditions, as well as network-wide recommendations such as improved signage, delineation, pavement conditions and enforcement.

3. Drainage and flooding problems will be improved through localized resurfacing at several locations that have been identified as problem areas where potholes, skidding accidents or flooding occurs, combined with the above-mentioned recommended improvement monitoring and maintenance program. Some areas with coral and dirt roads will be improved through widening or paving.

4. Accidents at curves will be improved through installation or improved maintenance of signage (including chevron signs) and guardrails in problem areas.

5. Illegal parking will be addressed through increased enforcement along roads such as Beach Road and in the Garapan area. Pedestrian facilities will be improved through additional crosswalks in the Garapan area and between existing crosswalks along Beach and Chalan Pale Arnold.

6. Traffic signals are being recommended at the Beach/Quartermaster and Beach/Micro Beach Road intersections, and also being considered for installation at the Chalan Tun Harman Pan/Flame Tree Road intersection, subject to meeting nationally adopted traffic signal installation warrants documented in the Manual of Uniform Traffic Control Devices (MUTCD).

7. Emergency access and improved transportation connectivity that enhances tourism will be improved by providing an alternative link to Kagman via Laulau Bay Drive and completing Route 36 in the northeast area of Saipan.

3.2 Tinian

The public scoping meeting was held on Tinian on August 1st, 2006. The comments and concerns recorded in that meeting centered around several main themes that are addressed in this report through the following recommended actions:

1. All islands will receive the same level of data collection, evaluation, and recommendations based on the assessment findings and needs.

2. The study focuses on the highway and roadways listed on the Territorial Highway System. The roadways that may not be under the Territorial Highway System may be considered and could be recommended for inclusion into the system and approved.

3. The CNMI Highway Master Plan Study only focuses on land transportation for motorized (vehicles) and non-motorized (bicycles and pedestrians).

4. Areas attracting a substantial amount of trips such as San Jose Village and the Casino area will be assessed including the circulation network and condition of the existing street system.

5. Recommended transportation improvements and modifications will be prioritized based on several factors including expected traffic volume on the facility, safety history, roadway condition, etc.

6. The condition of the existing street network, travel speeds and signs will be reviewed and evaluated. Where appropriate, improvements, changes and modifications will be recommended on applicable facilities.

7. Pedestrian and bicycle (non-motorized) circulation will be evaluated.

8. In San Jose Village and on principal routes the existing guide signs, roadside signs, and pavement delineation and markings will be assessed for condition and effectiveness.

9. Safety will be reviewed for areas that have a high accident rate or high potential for vehicle conflicts. Future guidelines for developments alongside the highway may be proposed for planning to prevent sight distance issues and potential roadway hazards (fixed objects).

10. Key routes improvements and the potential for re-routing trucks and heavy vehicles not through the Village will be investigated. Routing of trucks through San Jose and not through the Village will also be investigated.

3.3 Rota

The public scoping meeting was held on Rota on August 2nd, 2006. The comments and concerns recorded in that meeting centered around several main themes that are addressed in this report through the following recommended actions:

1. Drainage along the existing highways is a substantial problem especially after storms. Flooding and ponding on the roadways create a hazardous situation for drivers and is an environmental problem. Run off is not treated and goes directly into streams and the

ocean. Drainage improvements need to reduce ponding and to detain and treatment of the run off.

2. Existing roadway pavement delineation (striping) and markers are not visible and show considerable wear. There is a need to investigate a program to upgrade.

3. Another second highway or principal access route is needed from the Airport (north side) to Song Song Village (south side) in addition to Route 10. If Route 10 is damaged or blocked, access is very restricted between the north and Song Song Village. The need for additional access roads from other parts of island will be investigated.

4. In some areas there are sight distance issues, especially in Song Song Village. Existing walls, buildings, and vegetation, block line of sight and create potential sight distance issues.

5. The condition of many of the existing roadways is poor. Investigation of maintenance issues is needed.

6. Erosion of the principal highway (Route 10) along the beach near Song Song Village. Erosion from weather and waves reducing roadway shoulders and approaching roadway.

7. Some roadways are very narrow, especially Route 100. The cantilever bridge on Route 100 needs to be upgraded and possibly widened. Lights on the bridge would improve safety.

8. Roadways to Homestead Area need to be upgraded (paved and widened) due to increases in homes and new waterline construction.

9. Evaluation of speed limits needs to be reviewed, especially on Route 10. Consider geometrics, sight distances, curves etc.

10. Roadway signage evaluation considering sign distances, type of sign, and message.

11. Traffic controls considering stop signs and traffic signals – how to determine input and evaluation.

12. Review ROW setbacks to prevent buildings and walls directly adjacent to roadways and corners that will impact sight distances. Look at suggesting construction and planning codes for setbacks.

13. Guard rails and traffic controls for added safety around curves and dropoffs.

4 PUBLIC INFORMATIONAL MEETINGS FOR FINAL STUDY

Public informational meetings were held in April 28, 29, and 30, 2009 on each island. The public informational meetings were held to summarize and present the findings of the CNMI Highway Master Plan Study. Each meeting included an overview of the Master Plan and Study Process, assumptions, results and presented the findings. The improvements or alternatives were also discussed in detail. After the presentation and summary of the master plan study, a forum for comments, questions and answers followed. The public informational meetings were held attended by the Mayors of each island, Director of the Department of Public Works, TSD /DPW staff, stakeholders, and public. Summaries of the public informational meetings for each island are provided below. Meeting notes and sign-in rosters for each public informational meeting are provided in Appendix G

4.1 Rota Public Informational Meeting

The public informational meeting was held on Rota on April 28th, 2009. After the presentation of the study results, question and concerns were responded to and/or recorded for a follow-on response. The principal questions and concerns centered on the following themes:

1. Upgrades to existing routes that are experiencing more traffic demands such as Route 102 near the Rota Resort and Country Club and Route 11 to the Quarry.

2. Waste management facilities upgrades; however, this study only focuses on highways and transportation facilities.

3. Estimated timeframe for construction and implementation of recommended improvements.

4. Other projects scheduled for construction such as the West Harbor repair projects.

4.2 Tinian Public Informational Meeting

The public informational scoping meeting was held on Tinian on April 29th, 2009. After the presentation of the study results, question and concerns were responded to and/or recorded for a follow-on response. The principal questions and concerns centered on the following themes:

1. Upgrades to the highways on the north side of the island where the military is proposing to have a training facility. The current conditions of the highways are in poor condition and with the addition of the military traffic the roads will need to be upgraded.

2. Are highway improvements proposed for Routes 201 and 202 north of Broadway.

3. The status of the recommended improvements documented in the 1997 Highway Master Plan Study and what occurs with the current Highway Master Plan Study.

4. How were the short and long range improvements developed.

5. How can the CNMI get more support (financial) from the Federal Government for transportation improvements.

6. Has improvements been proposed for Route 302.

7. If right-of-way is needed for projects, how is this purchased and designated.

4.3 Saipan Public Informational Meeting

The public informational scoping meeting was held on Saipan on April 30th, 2009. After the presentation of the study results, question and concerns were responded to and/or recorded for a follow-on response. The principal questions and concerns centered on the following themes:

1. More drainage and storm water impacts and improvements should be looked. Only those drainage and storm water impacts that impact transportation facilities and highways are assessed and improvements developed.

2. Construction of the improvements should include local labor and work force.

3. The schedule of Master Plan Study completion and the implementation of the alternatives and improvements.

4. Consistency with the proposed Garapan re-circulation plan and the Master Plan Study.

5. Tourists, pedestrian and bicyclists safety.

6. The process and input on how the improvements were initially developed and decided upon.

7. The Master Plan Study covers Territorial Highways and public highways only. Private roadways and driveways are not included in the Master Plan Study.

5 EXISTING TRANSPORTATION CONDITIONS

This section of the report addresses existing transportation conditions of the islands including roadway facilities, traffic operations, roadway geometry, pavement, alternate modes, and other identified transportation elements. This information is useful in identifying existing roadway deficiencies or substandard roadway elements.

5.1 Existing Roadway Network

The existing roadway systems in the CNMI are categorized as primary roads, serving the major points; secondary roads, tending to connect village or communities; village roads, which function as local residential or intra-village streets; and tourist/scenic roads, serving the tourist attractions. Roadway systems on each of the three islands, Saipan, Tinian, and Rota are described in the following section.

5.1.1 Saipan

Saipan has the largest amount of existing roadway infrastructure among the three islands. There is a network of paved roadways, some of which are multi-lane arterial roadways. Some of the key roadways in the network included in the analysis are Beach Road, Chalan Pale Arnold, Chalan Monsignor Guerrero, Tun Herman Pan Road, Isa Drive, Chalan Monsignor Martinez, and As Perdido Road. Figure 9 depicts all the study roadway segments on Saipan.

Beach Road

Beach Road functionally begins at the road of Micro Beach in Garapan and continues south to Koblerville Road in the southern part of the island (Koblerville). The entire roadway segment is approximately 7 miles long. It is defined as a primary roadway serving as a north-south connection along the westerly coast line of the island.

Beach Road is a two-lane roadway between Micro Beach and Chalan Monsignor Guerrero, and it widens to a four-lane roadway south from there to Afetna Road. It then narrows to two lanes south of Afetna Road. The segment between Micro Beach Road and Garapan Street has been installed with a raised median to restrict some left-turn movements in and out of Beach Road. A signalized pedestrian crosswalk is provided outside the Duty Free Store (DFS) located south of CPL Derence Jack Road. These facilities help improve the safety for both vehicle and pedestrian access along Beach Road. Sidewalks are provided on both sides of Beach Road between Micro Beach Road and Garapan Street. In general, no sidewalks are provided on Beach Road south of Garapan Street. Table 7 summarizes the roadway segments on Beach Road and major characteristics for each roadway segment.

While side streets and driveways are generally stop-sign controlled along Beach Road, there are five signalized intersections along the corridor. They are located at Garapan Street, Chalan Monsignor Guerrero, Marianas High School entrance, Chalan Hajai, and As Perdido Road.

Table 7: Roadway Segments on Beach Road

Segment	Roadway Segment	# of lanes	Characteristics
S-1	Micro Beach Road to Garapan Street	2	• Raised-median with left-turn pocket at major intersections and driveways • On-street parking on both sides of street • Sidewalk on both sides of road • Pedestrian signal near the DFS Store • High pedestrian activities • Mainly Commercial and Retail Business
S-2	Garapan Street to Gualo Rai Road	2	• Undivided with two-way left-turn (TWLT) lanes • Mainly commercial and retail business
S-3	Gualo Rai Road to Quartermaster Road	2	• No raised- or striped-median • SB left-turn pocket provided at Quartermaster Road • Low-density commercial business
S-4	Quartermaster Road to Chalan Monsignor Guerrero	4	• No raised- or striped-median • No turn lanes for unsignalized intersections • Residential and commercial retails on east-side of road
S-5	Chalan Monsignor Guerrero to Chalan Hagoi	4	• No raised- or striped-median • Exclusive left-turn lanes provided at major intersections
S-6	Chalan Hagoi to As Perdido Road	4	• No raised- or striped-median • No turn lanes for unsignalized intersections • Residential and commercials retails along the segment • High pedestrian activities in the vicinity of the Grand and Diamond Hotel
S-7	As Perdido Road to Afetna Road	2	• Undivided with two-way left-turn (TWLT) lanes • Mixed development on sides of road • Faded pavement delineations
S-8	Afetna Road to Koblerville Road	2	• Undivided with two-way left-turn (TWLT) lanes • Mixed development on sides of road

Completed Roadway Improvements

The previous Highway Master Plan identified a few operational deficiencies along Beach Road together with some corresponding mitigations or recommendations of improvements. Since the completion of the previous master plan, a few of the roadway improvement projects on Beach Road have been completed and are intended to enhance vehicle access and safety of the roadway. The completed projects along with the added benefits are listed below.

1. Installation of a raised median between Micro Beach and Garapan Street – to eliminate some left-turn movements in and out of Beach Road from driveways and crossroads, and provide a left-turn lane for left-turn movements at specific locations along the route.

2. Traffic signal installation at Beach Road and Garapan Street – to improve operations and safety for vehicle and pedestrian access at these intersections.

Chalan Pale Arnold

Chalan Pale Arnold, previously known as Middle Road, begins at the north tip of Saipan and continues south to Chalan Monsignor Guerrero in San Jose. The entire roadway is approximately 12 miles long and serves as a major connector between the north and south parts of the island. According to the existing CNMI roadway classification, Chalan Pale Arnold is classified as a primary roadway south of As Matius Road to Chalan Monsignor Guerrero. The road north of As Matius is classified as a secondary roadway.

Chalan Pale Arnold is a two-lane undivided roadway north of As Matius Road, and the rest of the corridor south of Matius is a four-lane undivided roadway. Table 8 summarizes the study roadway segments on Chalan Pale Arnold and major characteristics along each of the segments.

There are eight signalized intersections along Chalan Pale Arnold. They are mainly located at major junctions, Lower Base Drive, Isa Drive, Industrial Drive, Micro Beach Road, Garapan Street/Sugar King Road, Gualo Rai Road, Quartermaster Road, and Chalan Monsignor Guerrero.

Well-striped pedestrian crosswalks are provided at multiple access locations (signalized and unsignalized) along the roadway segments especially between As Matius Road and Isa Drive. These pedestrian crosswalks provide a safer pedestrian access in and around hotel and resort areas. However, sidewalk facilities are in general not provided along Chalan Pale Arnold.

Table 8: Roadway Segments on Chalan Pale Arnold

Segment	Roadway Segment	# of lanes	Characteristics
S-9	North of As Matius Road	2	• Undivided • Rural with a few hotel resort areas
S-10	As Matius Road to Isa Drive	4	• Mostly undivided • Left-turn pockets and unsignalized crosswalks provided at major access locations • Low-density residential, industrial, and hotel resorts
S-11	Isa Drive to Industrial Drive	4	• Undivided • Left turn pockets provided at Isa Drive and Industrial Drive • Mainly industrial on the west-side of road
S-12	Industrial Drive to Gualo Rai Road	4	• Undivided • Exclusive turn lanes provided at signalized intersections • Unsignalized crosswalk provided north of CPL Derence Jack Road • High pedestrian activities area • Mainly commercial, retail business, and residential on sides of road
S-13	Gualo Rai Road to Quartermaster Road	4	• Undivided • Exclusive turn lanes and crosswalks provided at signalized intersections • Mainly mixed commercial and retail business along both sides of road
S-14	Quartermaster Road to Chalan Monsignor Guerrero	4	• Undivided • Exclusive turn lanes and crosswalks provided at signalized intersections • Low-density commercial and residential area

Completed Roadway Improvements

The previous highway master plan has identified a few operational deficiencies along Chalan Pale Arnold with corresponding mitigations or recommendations improvements. Since the completion of the previous master plan, a few of the roadway improvement projects have been completed, including those intended to enhance operation, vehicle access and safety of the roadway. The completed projects along with the added benefits are listed below.

1. Installation of four traffic signals at Lower Base Drive, Garapan Street, Gualo Rai Road, and Quartermaster Road – to improve traffic operation and vehicle access along Chalan Pale Arnold

2. Installation of new edge concrete barrier on Chalan Pale Arnold south of Capital Hill – to prevent vehicles running off the roadway

3. Repaving of Chalan Pale Arnold – to improve driving comfort on the road

Chalan Monsignor Guerrero

Chalan Monsignor Guerrero is an east-west street providing a connection between Beach Road in the west and Isa Drive in the east. The entire roadway is approximately 2.5 miles long. According to the existing roadway classification, Chalan Monsignor Guerrero is a secondary roadway. This corridor has been widened from 2 lanes to 4 lanes since the completion of the previous master plan. Table 9 summarizes the characteristics of all study roadway segments on Chalan Monsignor Guerrero.

The intersections at Beach Road, Chalan Pale Arnold, Chalan Tun Antonio, Chalan Monsignor Martinez, and Tun Herman Pan Road are signalized. At each of these intersections, exclusive turn lanes are provided for most turning movements.

Table 9: Roadway Segments on Chalan Monsignor Guerrero

Segment	Roadway Segment	# of lanes	Characteristics
S-15	Beach Road to Chalan Pale Arnold	4	• Undivided with striped median • Turn lanes provided at intersections of Beach Road and Chalan Pale Arnold • Mainly commercial and retail business
S-16	Chalan Pale Arnold to Tun Herman Pan Road	4	• Undivided • No turn lanes provided at unsignalized intersections • Low-density residential and mixed used development along both sides of road
S-17	Tun Herman Pan Road to Isa Drive	4/2	• Undivided • No turn lanes provided at unsignalized intersections • Mainly residential area

Completed Roadway Improvements

The major roadway improvement and upgrade completed since the previous highway master plan was the widening of the entire Chalan Monsignor Guerrero from a 2-lane facility to a 4-lane facility. In addition to the roadway widening, three new traffic signals were installed in the eastern end of the corridor located at Chalan Tun Antonio APA, Chalan Monsignor Martinez, and Tun Herman Pan Road.

Tun Herman Pan Road

Tun Herman Pan Road connects Saipan International Airport with Chalan Monsignor Guerrero and is a critical roadway providing mobility between the Saipan International Airport and the western and northern parts of Saipan. The entire roadway is approximately 2.5 miles long and is classified as a primary roadway. Roadway characteristics for the study segments on Tun Herman Pan Road are summarized in Table 10.

Tun Herman Pan Road is a two-lane undivided roadway with one signalized intersection at Chalan Monsignor Guerrero. Exclusive right-turn lanes are provided for the eastbound and northbound approaches at this intersection.

Table 10: Roadway Segments on Tun Herman Pan Road

Segment	Roadway Segment	# of lanes	Characteristics
S-18	Chalan Monsignor Guerrero to Isa Drive	2	• Undivided • Low-density residential area
S-19	Isa Drive to Airport	2	• Undivided • Airport access

Isa Drive

Isa Drive, previously known as Cross Island Road, provides east-west mobility for central Saipan and north-south circulation for part of east Saipan. The roadway is approximately 7.6 miles long and is classified as a secondary roadway. Roadway characteristics for the study segments on Isa Drive are summarized in Table 11.

Isa Drive is an undivided two-lane road traversing mountainous terrain in Saipan. In certain areas, the roadway alignment is especially winding with tight turns. Traffic signals were installed at the intersections at Chalan Pale Arnold and at Chalan Monsignor Guerrero. Exclusive turn lanes are provided at these locations for all turning movements.

Table 11: Roadway Segments on Isa Drive

Segment	Roadway Segment	# of lanes	Characteristics
S-20	Chalan Pale Arnold to Capital Hill Road	2	• Undivided
S-21	Capital Hill Road to Chalan Monsignor Guerrero	2	• Undivided
S-22	Chalan Monsignor Guerrero to Dan Dan Road	2	• Undivided
S-23	Dan Dan Road to Tun Herman Pan Road	2	• Undivided
S-24	Tun Herman Pan Road to Chalan Monsignor Martinez	2	• Undivided

Chalan Monsignor Martinez

Chalan Monsignor Martinez connects Kobleville and Chalan Monsignor Guerrero and provides north-south mobility in the southern part of Saipan. It is a two-lane undivided road and is classified as a secondary roadway. The entire roadway is approximately 3.3 miles long. The intersection of Chalan Monsignor Martinez and Chalan Monsignor Guerrero is signalized with exclusive turn lanes. Roadway characteristics for the study segments on Chalan Monsignor Martinez are summarized in Table 12.

Table 12: Roadway Segments on Chalan Monsignor Martinez

Segment	Roadway Segment	# of lanes	Characteristics
S-25	Chalan Monsignor Guerrero to Chalan Tun Joaquin Doi	2	• Undivided • Residential and light industrial
S-26	Chalan Tun Joaquin Doi to Beach Road	2	• Undivided • Mainly residential area on east-side of road

As Perdido Road

As Perdido Road is a two-lane undivided roadway which provides east-west mobility between Beach Road and the Saipan International Airport. It is classified as a secondary roadway. The entire roadway is approximately 2.2 miles long. There are two signalized intersections along As Perdido Road, located at Beach Road and Chalan Monsignor Martinez. Roadway characteristics for the study segments on As Perdido Road are summarized in Table 13.

Table 13: Roadway Segments on As Perdido Road

Segment	Roadway Segment	# of lanes	Characteristics
S-27	Beach Road to Chalan Monsignor Martinez	2	• Undivided • Low-density residential and light industrial
S-28	Chalan Monsignor Martinez to Tun Herman Pan Road	2	• Undivided • Scattered residential and other developments

Other Roadway Segments

In addition to the roadway segments presented, there are several other roadway segments included in the report. These roadway segments are summarized in Table 14 below.

Table 14: Other Study Roadway Segments

Segment	Roadway Segment	# of lanes	Characteristics
S-29	Gualo Rai Road	2	• Undivided

Segment	Roadway Segment	# of lanes	Characteristics
S-30	Quartermaster Road	2	• Undivided
S-31	Chalan Tun Joaquin Doi	2	• Undivided
S-32	Ropa Di Oru Street	2	• Undivided
S-33	Garapa Street	2	• Undivided
S-34	CPL Derence Jack Road	2	• Undivided
S-35	Micro Beach Road	2	• Undivided
S-36	Afetna Road	2	• Undivided
S-37	Navy Hill	2	• Undivided
S-38	Oleai Street	2	• Undivided
S-39	Tekken Street	2	• Undivided
S-40	Chalan Hagoi	2	• Undivided
S-41	Kagman Road	2	• Undivided

Figure 9: Saipan Roadway Map

5.1.2 Tinian

Figure 10 depicts all the study roadway segments on Tinian. Roadway characteristics for the study segments on the island of Tinian are summarized in Table 15.

Table 15: Roadway Segments on Tinian

Segment Number	Road	# of Lanes	Characteristics
T-1	Riverside Drive	2	• Undivided
T-2	Riverside Drive	2	• Undivided
T-3	NA	2	• Undivided
T-4	8th Avenue (north of 86th Ave.)	2	• Undivided
T-5	8th Avenue (south of 86th Ave.)	2	• Undivided
T-6	86th Avenue	2	• Undivided
T-7	Broadway Road (Route 21)	2	• Undivided
T-8	Broadway Road (north of 42nd Street)	2	• Undivided
T-9	Broadway Road (south of 42nd Street)	2	• Undivided
T-10	42nd Street	2	• Undivided
T-11	8th Avenue (north of 42nd Street)	2	• Undivided
T-12	NA	2	• Undivided
T-13	8th Avenue (north of Canal Street)	2	• Undivided
T-14	Route 202	2	• Undivided
T-15	Route 201	2	• Undivided
T-16	Broadway Road (south of Route 201)	2	• Undivided
T-17	Route 21	2	• Undivided
T-18	NA	2	• Undivided

Figure 10: Tinian Roadway Map

5.1.3 Rota

Figure 11 depicts all the study roadway segments on Rota. Roadway characteristics for the study segments on the island of Rota are summarized in Table 16.

Table 16: Roadway Segment on Rota

Segment Number	Road	# of Lanes	Characteristics
R-1	Route 10 (south of Route 101)	2	• Undivided
R-2	Route 10 (north of Route 101)	2	• Undivided
R-3	Route 100	2	• Undivided
R-4	Route 100	2	• Undivided
R-5	Route 11	2	• Undivided
R-6	San Jose Street	2	• Undivided
R-7	San Francisco De Borja Street	2	• Undivided
R-8	Santa Ana Street	2	• Undivided
R-9	San Ignacio Street	2	• Undivided
R-10	San Ignacio Street	2	• Undivided

Figure 11: Rota Roadway Map

5.2 Existing Traffic Volumes

In February 2008, 24-hour traffic counts were conducted, mainly covering key roadway segments on the islands of Saipan, Tinian, and Rota. As of this draft report, traffic counts are available only on Isa Drive, Kagman Road, Tun Herman Pan Road, and As Perdido Road, and one segment on Chalan Pale Arnold on Saipan.

In order to estimate the traffic volumes on roadways where existing volumes are not available, a growth rate was applied to the 1997 counts presented in the previous report to increase the traffic to estimate existing conditions. The growth rate was calculated by comparing the available traffic volumes on the aforementioned roadways to the 1997 counts presented in the previous Highway Master Plan. No comparison was performed for Tinian and Rota as historic count data was not available. The analysis indicated that the average traffic growth on Saipan from 1997 to 2008 was approximately 13.6% (1.2% per year). While the data is showing a 1.2% average annual growth rate in traffic volumes, the population on islands on average is growing at a higher rate of 2.8% per year from 1997 to 2008. In order to account for the growths in both population and traffic volume, an average growth rate of 2% per year was used to increase the historic traffic volumes to year 2008 condition, except for the segments S-9 and S-10 on Chalan Pale Arnold.

According to information from the Department of Public Works, traffic on Chalan Pale Arnold north of Capital Hill has significantly decreased since the 1997 study due to the closure of Lower Base port buildings, the garment shops, and a large hotel in the area. Therefore, an estimated decrease of 35% in traffic volumes was applied to the 1997 traffic counts on the northern segments of S-9 and S-10 on Chalan Pale Arnold. Figure 12 to Figure 14 display existing/estimated average daily traffic (ADT) on Saipan, Tinian, and Rota respectively.

5.2.1 Saipan

Beach Road

Beach Road currently carries approximately 27,000 vehicles per day ("average daily traffic" or ADT) in the north between Garapan Street and Micro Beach Road. Traffic gradually picks up south of Garapan Street to Chalan Hagoi, where average daily traffic reaches approximately 40,000 vehicles. Traffic volume then drops to 30,000 vehicles south of Chalan Hagoi and to 13,000 vehicles towards the end of the roadway.

Chalan Pale Arnold

The most northern 2-lane segment of Chalan Pale Arnold carries roughly 1,760 vehicles per an average day. The average daily traffic is roughly 8,130 vehicles north of Isa Drive. It begins to increase from 23,200 to 30,900 vehicles south of Isa Drive to Gualo Rai Road, south of the Garapan Area. The highest ADT of about 31,400 vehicles was estimated between Gualo Rai Road and Quartermaster Road.

Chalan Monsignor Guerrero

This 4-lane undivided roadway carries approximately 22,300 daily vehicles between Beach Road and Chalan Pale Arnold. Traffic volume increases to 29,000 vehicles east of Chalan Pale Arnold, and gradually decreases from there on to 16,600 at the end of the roadway where it intersects Isa Drive.

Tun Herman Pan Road

Average daily traffic on Tun Herman Pan Road, which connects Chalan Monsignor Guerrero and the airport, is relatively lower compare to the other study roadways. The traffic volumes vary from 7,000 to 7,600 vehicles per day.

Isa Drive

Isa Drive carries roughly 10,300 daily vehicles east of Chalan Pale Arnold. Traffic volume decreases from there to 5,400 vehicles and picks up again to 8,400 daily vehicles south of Chalan Monsignor Guerrero.

Chalan Monsignor Martinez

The roadway carries approximately 13,200 daily vehicles on the north end of the corridor. The traffic is generally lower in the south end of the roadway to about 7,900 daily vehicles.

As Perdido Road

Between Beach Road and Chalan Monsignor Martinez, the estimated daily traffic on the roadway is 12,100 vehicles. The traffic drops to half of that between Chalan Monsignor Martinez and Isa Drive.

5.2.2 Tinian

Existing average daily volumes on selected roadways in Tinian are relatively low compare to those in Saipan. Roadways that provide access around the island in general carry daily traffic range from 25 to 400 vehicles. The segment on Broadway Road south of 42nd Street carries roughly 1,470 vehicles per day. The two major routes, Routes 201 and 202, that provide access in and out of the San Jose Village area carry the highest amount of daily traffic on Tinian, with approximately 1,520 vehicles per day on Route 202 and 2,240 vehicles per day on Route 201.

5.2.3 Rota

Daily traffic volumes on Rota are the lowest among the three islands, with average daily traffic on study roadways ranging from 350 to 1,970 vehicles.

Figure 12: Existing ADT on Saipan

Figure 13: Existing ADT on Tinian

Figure 14: Existing ADT on Rota

5.3 Existing Roadway Conditions

Roadway segment Level of Service (LOS) standards and thresholds provide the basis for the analysis of roadway segment performance. The analysis of roadway segment LOS is based on the roadway functional classification, maximum capacity, geometrics, and existing or forecast Average Daily Traffic (ADT) volumes. The LOS standards used in this analysis of roadways are presented in Table 17. These standards define the roadway segment capacity thresholds and the corresponding LOS as a function of the roadway classification. The analysis was based upon the comparison of ADT to these roadway standards. Any roadway with LOS F is considered as over capacity with average daily volume higher than the capacity threshold of LOS E. A description of the levels of service for roadway segments is provided in Appendix C.

Since the CNMI currently has a different roadway classification system than that listed in Table 17, the study roadways in Saipan, Tinian, and Rota were assigned to one of the roadway classifications listed in the table that best matches the corresponding roadway characteristics. In general, the existing 4-lane primary arterials were considered as 4-lane major arterials, and existing secondary arterials as either minor arterials or collectors.

Table 17: Roadway Segment Level of Service Threshold

	LOS THRESHOLDS (Average Daily Volume)				
Roadway Classification	**A**	**B**	**C**	**D**	**E**
6-Lane Major Arterial	20,000	28,000	40,000	45,000	50,000
4-Lane Major Arterial	15,000	21,000	30,000	35,000	40,000
4-Lane Collector/Minor Arterial	10,000	14,000	20,000	25,000	30,000
2-Lane Collector (with left-turn lane)	5,000	7,000	10,000	13,000	15,000
2-Lane Collector/Rural Collector (no front Prop.)	4,000	5,500	7,500	9,000	10,000
2-Lane Collector (local)	2,500	3,500	5,000	6,500	8,000

5.3.1 Saipan

Table 18 to Table 25 summarize the existing roadway segment LOS on Beach Road, Chalan Pale Arnold, Chalan Monsignor Guerrero, Tun Herman Pan Road, Isa Drive, Chalan Monsignor Martinez, As Perdido Road, and a few other study roadway segments, respectively.

The roadway capacity and LOS analysis reveals some operational deficiency on most of Beach Road, between Micro Beach Road and As Perdido Road, where the daily volumes on the road were significantly higher than the capacity of a 2-lane or 4-lane collector. The high volumes on Beach Road resulted in an unacceptable LOS F for roadway segments S-1 to S-5, a LOS E for segment S-6, and a LOS D for segments S-7 and S-8.

Based, on the analysis, most of the other study corridors operate at an acceptable LOS E or better in the existing condition with the exception of two study segments that are currently operating at LOS F. These segments are S-20 on Isa Drive, S-25 on Chalan Monsignor

Martinez, and S-27 on As Perdido Road. Figure 15 provides a map of the roadway LOS on Saipan.

Beach Road

Table 18: Roadway Segment LOS on Beach Road

Segment Number	Segment	# of lanes	LOS E Capacity	2008 ADT	LOS	Over Capacity?
S-1	Mircro Beach to Garapan St.	2	15,000	27,080	***F***	***Y***
S-2	Garapan St. to Gualo Rai Rd.	2	15,000	27,080	***F***	***Y***
S-3	Gualo Rai Rd. to Quartermaster Rd.	2	15,000	26,350	***F***	***Y***
S-4	Quartermaster Rd. to Chalan Monsignor Guerrero	4	30,000	31,600	***F***	***Y***
S-5	Chalan Monsignor Guerrero to Chalan Hagoi	4	30,000	39,890	***F***	***Y***
S-6	Chalan Hagoi to As Perdido Rd.	4	30,000	29,890	E	N
S-7	As Perdido Rd. to Afetna Rd.	4	30,000	20,860	D	N
S-8	Afetna Rd. to Koblerville Rd.	2	15,000	12,690	D	N

Chalan Pale Arnold

Table 19: Roadway Segment LOS on Chalan Pale Arnold

Segment Number	Segment	# of lanes	LOS E Capacity	2008 ADT	LOS	Over Capacity?
S-9	North end to As Matius Road	2	10,000	1,760	A	N
S-10	As Matius Road to Isa Drive	4	40,000	8,130	A	N
S-11	Isa Drive to Industrial Drive	4	40,000	23,180	C	N
S-12	Industrial Drive. to Gualo Rai Road	4	40,000	30,870	D	N
S-13	Gualo Rai Road to Quartermaster Road	4	40,000	31,350	D	N
S-14	Quartermaster Road to Chalan Monsignor Guerrero	4	40,000	27,820	C	N

Chalan Monsignor Guerrero

Table 20: Roadway Segment LOS on Chalan Monsignor Guerrero

Segment Number	Segment	# of lanes	LOS E Capacity	2008 ADT	LOS	Over Capacity?
S-15	Beach Road to Chalan Pale Arnold	4	40,000	22,330	C	N
S-16	Chalan Pale Arnold to Capital Hill	4	40,000	29,040	C	N
S-17	Capital Hill Road to Chalan Monsignor Guerrero	4	40,000	16,590	B	N

Tun Herman Pan Road

Table 21: Roadway Segment LOS on Tun Herman Pan Road

Segment Number	Segment	# of lanes	LOS E Capacity	2008 ADT	LOS	Over Capacity?
S-18	Chalan Msgr Guerrero to Isa Drive	2	10,000	5,280	B	N
S-19	Isa Drive to Airport	2	10,000	6,950	C	N

Isa Drive

Table 22: Roadway Segment LOS on Isa Drive

Segment Number	Segment	# of lanes	LOS E Capacity	2008 ADT	LOS	Over Capacity?
S-20	Chalan Pale Arnold to Capital Hill Road	2	10,000	8,490	D	N
S-21	Capital Hill Road to Chalan Monsignor Guerrero	2	10,000	7,530	D	N
S-22	Chalan Monsignor Guerrero to Dan Dan Road	2	10,000	8,420	D	N
S-23	Dan Dan Road to Tun Herman Pan Rd.	2	10,000	4,760	B	N
S-24	Tun Herman Pan Road to Chalan Monsignor Martinez	2	10,000	2,930	A	N

Chalan Monsignor Martinez

Table 23: Roadway Segment LOS on Chalan Monsignor Martinez

Segment Number	Segment	# of lanes	LOS E Capacity	2008 ADT	LOS	Over Capacity?
S-25	Chalan Monsignor Guerrero to Chalan Tun Joaquin Doi	2	10,000	13,180	***F***	***Y***
S-26	Chalan Tun Joaquin Doi to Beach Road	2	10,000	7,930	D	N

As Perdido Road

Table 24: Roadway Segment LOS on As Perdido Road

Segment Number	Segment	# of lanes	LOS E Capacity	2008 ADT	LOS	Over Capacity?
S-27	Beach Road to Chalan Monsignor Martinez	2	10,000	12,080	***F***	***Y***
S-28	Chalan Monsignor Martinez to Tun Herman Pan Road	2	10,000	5,100	B	N

Others

Table 25: Roadway Segment LOS on Other Roadways

Segment Number	Road	# of lanes	LOS E Capacity	2008 ADT	LOS	Over Capacity?
S-29	Gualo Rai Road	2	10,000	980	A	N
S-30	Quartermaster Road	2	10,000	4,150	B	N
S-31	Chalan Tun Antonio APA	2	10,000	6,590	C	N
S-32	Ropa Di Oru Street	2	10,000	4,030	B	N
S-33	Garapan Street	2	10,000	8,300	D	N
S-34	CPL Derence Jack Road	2	10,000	4,270	B	N
S-35	Micro Beach Road	2	10,000	9,520	E	N
S-36	Afetna Road	2	10,000	3,050	A	N
S-37	Navy Hill Road	2	10,000	4,270	B	N
S-38	Oleai Street	2	10,000	3,540	A	N
S-39	Tekken Street	2	10,000	4,640	B	N
S-40	Chalan Hagoi	2	10,000	7,560	D	N
S-41	Kagman Road	2	10,000	6,750	C	N

Figure 15: Saipan Existing LOS

5.3.2 Tinian

All the 18 study roadway segments on Tinian are identified as a 2-lane local collector, with a roadway capacity of 5,000 vehicles per day as listed in Table 17. The operational analysis indicates that, as shown in Table 26, all roadways are operating at LOS A under the existing conditions. A roadway LOS summary map for Tinian is shown in Figure 16.

Table 26: Roadway Segment LOS on Tinian

Segment Number	Road	Roadway Type	LOS E Capacity	2008 ADT	LOS	Over Capacity?
T-1	Riverside Drive	2-Lane Collector (local)	5,000	25	A	N
T-2	Riverside Drive	2-Lane Collector (local)	5,000	25	A	N
T-3	No Name	2-Lane Collector (local)	5,000	50	A	N
T-4	8th Avenue (north of 86th Ave.)	2-Lane Collector (local)	5,000	50	A	N
T-5	8th Avenue (south of 86th Ave.)	2-Lane Collector (local)	5,000	90	A	N
T-6	86th Avenue	2-Lane Collector (local)	5,000	100	A	N
T-7	Broadway Road (Route 21)	2-Lane Collector (local)	5,000	180	A	N
T-8	Broadway Road (north of 42nd Street)	2-Lane Collector (local)	5,000	390	A	N
T-9	Broadway Road (south of 42nd Street)	2-Lane Collector (local)	5,000	1,470	A	N
T-10	42nd Street	2-Lane Collector (local)	5,000	150	A	N
T-11	8th Avenue (north of 42nd Street)	2-Lane Collector (local)	5,000	180	A	N
T-12	No Name	2-Lane Collector (local)	5,000	310	A	N
T-13	8th Avenue (north of Canal Street)	2-Lane Collector (local)	5,000	300	A	N
T-14	Route 202	2-Lane Collector (local)	5,000	1,520	A	N
T-15	Route 201	2-Lane Collector (local)	5,000	2,240	A	N
T-16	Broadway Road (south of Route 201)	2-Lane Collector (local)	5,000	300	A	N

Segment Number	Road	Roadway Type	LOS E Capacity	2008 ADT	LOS	Over Capacity?
T-17	Route 21	2-Lane Collector (local)	5,000	300	A	N
T-18	No Name	2-Lane Collector (local)	5,000	290	A	N

Figure 16: Tinian Existing LOS

5.3.3 Rota

All the 10 study roadway segments on Rota are identified as 2-lane local collector roadways. With a capacity of 5,000 vehicles per day (ADT) for a 2-lane local collector, all the roadways are currently operating at LOS A as shown in Table 27. A roadway LOS summary map for Rota is shown in Figure 17.

Table 27: Roadway Segment LOS on Rota

Segment Number	Road	Roadway Type	LOS E Capacity	2008 ADT	LOS	Over Capacity?
R-1	Route 10 (south of Route 101)	2-Lane Collector (local)	5,000	1,730	A	N
R-2	Route 10 (north of Route 101)	2-Lane Collector (local)	5,000	1,710	A	N
R-3	Route 100	2-Lane Collector (local)	5,000	900	A	N
R-4	Route 100	2-Lane Collector (local)	5,000	560	A	N
R-5	Route 11	2-Lane Collector (local)	5,000	970	A	N
R-6	San Jose Street	2-Lane Collector (local)	5,000	350	A	N
R-7	San Francisco De Borja Street	2-Lane Collector (local)	5,000	680	A	N
R-8	Santa Ana Street	2-Lane Collector (local)	5,000	400	A	N
R-9	San Ignacio Street	2-Lane Collector (local)	5,000	1,970	A	N
R-10	San Ignacio Street	2-Lane Collector (local)	5,000	1,290	A	N

Figure 17: Rota Existing LOS

5.4 Existing Intersection Conditions

In the previous Highway Master Plan study, some intersection operational deficiency was reported along Beach Road and Chalan Pale Arnold. Consistent with the analysis and improvements proposed from the previous plan, some of the signalized or unsignalized intersections have been upgraded with traffic signals or improvements to enhance safety and traffic operations along the intersections and the corridors. New traffic signals installed since the previous study include Beach Road/Garapan Street, Chalan Pale Arnold/Gualo Rai Road, and Chalan Pale Arnold/Quartermaster Road.

For this study, the operations of the major intersections and intersections indicated in the previous plan or identified by the CNMI officials as major areas of concern were analyzed. These intersections are mainly the key junctions of major roadways, busiest intersections on the island, intersections with safety issues, unsignalized intersections with significant minor approach delays, and potential candidates for traffic signal installations. Table 28 provides a list of the intersections analyzed in this study. Intersection turning movement counts were collected for either the AM or PM peak hour at each of these intersections. The peak hour turning movement counts collected for the seven study intersections, which were either AM or PM peak, are presented in Figure 18. The intersection operational analysis computer software SYNCHRO was used to analyze both signalized and unsignalized intersections. The analysis utilized the Highway Capacity Manual defined levels of service for unsignalized and signalized intersections. Level of Service ranges from A to F and provides an index to the operational qualities of an intersection. A description of the levels of service for intersections is provided in Appendix B.

Table 28: List of Study Intersections

Intersection #	Main Street	Cross Street	Control Type
1	Beach Road	Micro Beach Road	AWSC
2	Beach Road	CPL Derence Jack Road	TWSC
3	Beach Road	Gualo Rai Road	TWSC
4	Beach Road	Quartermaster Road	TWSC
5	Beach Road	Chalan Monsignor Guerrero	Signalized
6	Chalan Pale Arnold	Navy Hill Road	Signalized
7	Chalan Pale Arnold	Chalan Monsignor Guerrero	Signalized

Notes: AWSC = All-Way Stop-Controlled

TWSC = Two-Way Stop-Controlled

Figure 18: Saipan Existing Peak Hour Turning Movement Counts

The results of the analysis are summarized in Table 29 and Table 30 for signalized and unsignalized intersections, respectively. The intersection analysis revealed that the three signalized intersections are operating at a satisfactory condition of LOS D or better, while two of the three unsignalized intersections, Beach Road at CPL Derence Jack Road and Beach Road at Quartermaster Road, are failing, with significant delays on the minor street approaches. A summary of the existing intersection LOS results is provided Figure 19. Analysis result summaries from SYNCHRO are provided in Appendix D of the report.

Installation of traffic signals should be considered in order to improve operation and efficiency for the intersections of Beach Road at CPL Derence Jack Road and Beach Road at Quartermaster Road. The intersection of Beach Road at CPL Derence Jack Road is located near a school, and very high pedestrian (especially student) activities were observed at this junction. Providing a traffic signal at Beach Road and CPL Derence Jack Road could improve pedestrian safety. Recommendations to specific intersections are further discussed in the later section "Short-Range Highway Improvement Plans" of the report.

Table 29: Existing Signalized Intersection Level of Service (LOS)

Signalized Intersection	Delay (sec/veh)	LOS
Beach Road and Chalan Monsignor Guerrero	22.3	C
Chalan Pale Arnold and Navy Hill Road	38.5	D
Chalan Pale Arnold and Chalan Monsignor Guerrero	16.1	B

Table 30: Existing Unsignalized Intersection Level of Service (LOS)

Unsignalized Intersection	Delay (sec/veh)	LOS
Beach Road and Micro Beach Road		
EB Approach	11.2	B
WB Approach	14.4	B
NB Left Turn	10.3	B
NB Right Turn	10.7	B
Beach Road and CPL Derence Jack Road		
EB Approach	47.3	E
WB Approach	***127.0***	***F***
Beach Road and Gualo Rai Road		
WB Approach	19.4	C
Beach Road and Quartermaster Road		
WB Approach	***>500.0***	***F***

Figure 19: Saipan Existing Intersection LOS

5.5 Existing Pavement Conditions

Pavement condition on the roadway has been an issue on the three islands due to the use of the relatively endurable coral and acidic based pavement materials, and poor drainage on the roadways. Several pavement issues identified in the field include uneven areas, no paved shoulders, pot holes, cracks, and abruptly ended edge pavements. A few locations include Quartermaster Road, Gualo Rai Road, Capital Hill Road, Tun Herman Pan Road, and Kagman Road.

5.6 Existing Alternative Transportation Modes

Travel demand within the CNMI is primarily auto-oriented as in the past. With the relatively low population density, demand for public transportation is considered to be low; and therefore no public transit is currently provided on any of the three islands. Limited para-transit services are available for senior and disabled persons access within the islands. Tour bus and some hotel shuttles services are provided by private companies mainly for visitors and tourists.

5.7 Existing Bike and Pedestrian Facilities

There are currently limited designated bike paths on Saipan, Tinian, or Rota along major roadways and in main tourist attractions. Bike lanes are provided on both sides of Beach Road; however, the striping has faded and is hardly visible. For other roadways, bicyclists are usually required to either use the roadway shoulders or sidewalks where provided or share the road with the vehicles on existing travel lanes.

Continuous pedestrian sidewalks are provided on both sides of Beach Road in the Garapan area where pedestrian activities are the highest on Saipan. Isolated sidewalks can also be found along some short segments of roadways. But in general, continuous sidewalks do not exist in the majority of the roads on Saipan, Tinian, and Rota. It is observed that pedestrians are required to walk on the travel way or landscaped area off the roads.

A Pedestrian and Bike network system has been recommended in the previous 1997 study; however, few of these recommendations have to date yet been implemented. According to the comments given by the Department of Public Works, there is an increase in the number of people walking and riding bikes on the islands, therefore, pedestrian and bike facilities and a network system are of a strong need with the increased demand.

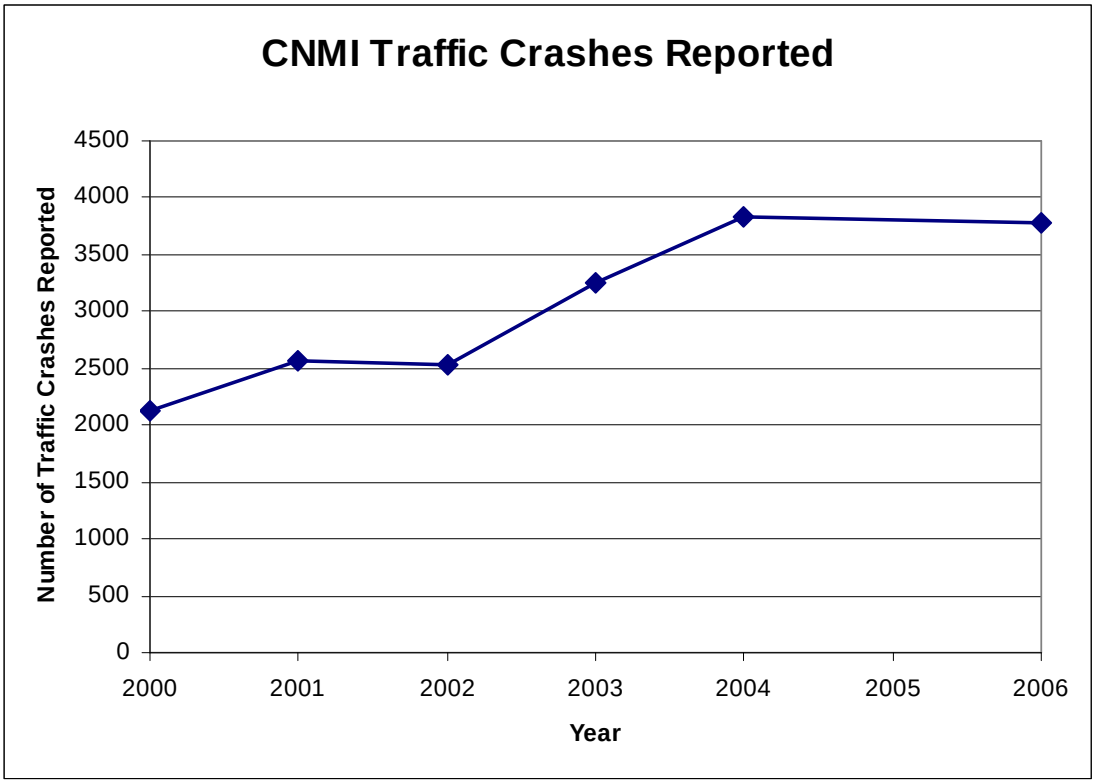
5.8 Accident Data

Accident data was collected from various sources for this highway master plan study. These data sources include the CNMI Highway Safety Programs Annual Report, raw accident data on Saipan provided by the Department of Public Safety (DPS) for the years 2003-2008, and information provided by the DPS during a project conference call in July 2008. The accident data reported in the previous master plan report was also re-evaluated in this study to check if any of the previously identified high frequency locations have been improved since the 1997 study.

5.8.1 CNMI Highway Safety Program Annual Report 2007

The number of auto related accidents reported on the CNMI islands has increased by approximately 77% from year 2000 to year 2006 according to the accident summary presented in the CNMI Highway Safety Programs Annual Report 2007. A plot of the number of traffic crashes reported on the CNMI islands between 2000 and 2006 is shown in Figure 20. The increasing number of accidents indicates that roadway safety should be a key concern on the islands, and is one of the focuses in this 2008 study.

Figure 20: CNMI Traffic Crashes Reported



5.8.2 Historic Accident Data 1992-1995

The historic accident data presented in the previous study was from years 1992-1995 and was compiled for roadway segments and intersections on Saipan. High accident frequency roadway segments and intersections were listed as major area of concerns. These segments or locations were reviewed and re-evaluated in this study, and the focus was to identify if any of these high frequency locations have been improved since the 1997 study. If no improvements have been made, similar problems on roadway segments and intersections are assumed to still exist and improvements are recommended in later sections of this report.

Roadway Segments

The 1997 study applied the frequency method to rank the high accident locations. The roadway segment with the highest number of accidents was ranked first, followed by the segment with the second highest number of accidents, and so on. This method did not take into account the differing amounts of traffic on and differing lengths of each roadway segment. Therefore, the

segments with high accident numbers were ranked high even if the segment had a relatively low number of accidents for the traffic volume that it carried. In order to have a more standardized comparison of the safety condition on these roadway segments, the accident rate was calculated instead for each of these segments with the available data provided. The roadway segments were then ranked in descending order by accident rate and the results are listed in Table 31. Figure 21 provides a map showing the locations of the high accident ranking roadway segments and intersections on Saipan.

The accident rate method compares the number of accidents on a segment with the number of vehicles or vehicle miles of travel along it. This accident rate is stated in terms of "accidents per million vehicle-miles traveled". The equation used for calculating the accident rate is show below.

$$\text{Accident Rate} = \frac{accidents * 1{,}000{,}000}{length * ADT * years * 365}$$

Table 31: Accident Rate for Roadway Segments

Ranking	Segment	Length (mile)	# of Accidents (1992-1995)	1997 ADT	Accident Rate	Improvements Completed?
1	Chalan Monsignor Guerrero - San Jose, Chalan Kiya	0.35	437	18,300	62	Widened roadway with new turn lanes
2	Chalan Monsignor Guerrero - Airport	0.22	139	19,300	30	None
3	Chalan Tun Road - As Terlaje	1.03	135	5,400	22	None
4	Beach Road - Garapan	0.95	461	22,200	20	Installed raised median and turn lanes
5	Chalan Pale Arnold - Garapan	0.8	333	23,000	17	None
6	Beach Road - Susupe	0.78	397	31,900	15	None
7	Beach Road - Chalan Kanoa	1.06	421	31,200	12	None
8	Beach Road - Chalan Piao	0.62	128	17,100	11	None
9	Chalan Pale Arnold - Gualo Rai	0.91	191	25,300	8	None
10	Chalan Pale Arnold - Puerto Pico	0.86	113	18,100	7	None
11	Beach Road - Oleai	0.78	146	32,700	5	None
12	Chalan Pale Arnold - Chalan Laulau	1.06	142	35,700	3	None

Note: Roadway segments are ranked by accident rate.

As summarized in the table, the highest accident rate in accidents per million vehicle-miles traveled is found along Chalan Monsignor Guerrero between Beach Road and Chalan Pale Arnold. The previous study addressed this roadway segment as one of the key areas of concern with problems of having relatively high volumes entering and exiting the driveways along the roadway with no turn pockets provided. Since the 1997 study, Chalan Monsignor Guerrero was widened from 2 to 4 lanes and turn lanes were added for accessing driveways along the segment. The roadway has been repaved and delineated as well. It is assumed that the safety condition has significantly improved on Chalan Monsignor Guerrero with these completed upgrades, and no further improvements are recommended at this time.

Improvements were also made to the listed segment on Beach Road between Micro Beach Road and Garapan Street in Garapan area after the 1997 study. This street located in the heart of Garapan was modified to be a more pleasant and safe roadway. Raised medians were installed with landscaping, and turn lanes were provided for selected driveway accesses.

The other roadway segments listed have not had any improvements made since the previous study and it was assumed that improvements are needed and are further discussed in the "Short-Range Roadway Improvements" section of the report.

Intersections

Due to the lack of daily traffic volumes at the study intersections, accident rates which require ADT were not calculated. The accident frequency ranking that was presented in the previous report was thus used in this report. The four highest accident frequency ranking intersections are listed in Table 32. They were taken straight from the analysis presented in the previous study. Among the four highest ranking unsignalized intersections, two have been upgraded with traffic signals which would effectively improve vehicle safety, particularly the access movements to and from the minor street. Improvement recommendations are provided for the other two locations where no improvements were made since the 1997 study, and they are presented later in the "Short-range Roadway Improvements" section of the report.

Table 32: Accident Frequency at Intersections

Ranking	Intersection	# of Accidents (1992-1995)	Improvement Completed?
1	Chalan Monsignor Guerrero / Chalan Monsignor Martinez	53	Signal Installed
2	Beach Road / Road to the Lake	29	Signal Installed
3	Beach Road / Quartermaster Rd.	25	None
4	Tun Herman Pan / Flame Tree Drive	23	None

Figure 21: Saipan Accident Ranking

5.8.3 Accident Data 2003-2008

Accident data for Saipan covers the 5-year period from 2003 to 2008 was provided by the DPS. This data provides the information of the type and location of the accidents. This information was summarized and analyzed to determine some key locations where auto accidents are frequent and therefore need improvements to mitigate the problem. Accident data used in the report is presented in Appendix F.

Table 33 summarizes the accidents reported on Saipan by accident type. As shown in the table, the majority of the accidents were auto-auto collisions which accounted for more than 50% of the total accidents.

Table 33: Accident Summary by Accident Type

Type of Accident	No. of Accident	Percentage
Traffic Accident Auto/Auto	4,695	52.61%
Traffic Accident Auto/Parked Veh.	1457	16.33%
Traffic Accident Auto/Hit Run	670	7.51%
Traffic Accident Auto/Runoff	667	7.47%
Traffic Accident Auto/Fixed Object	623	6.98%
Traffic Accident Auto/Object	167	1.87%
Traffic Accident Auto/Pedestrian	141	1.58%
Traffic Accident Auto/Bus	102	1.14%
Traffic Accident Auto/Truck	80	0.90%
Traffic Accident Auto/Bicycle	75	0.84%
Traffic Accident Auto Animal	59	0.66%
Traffic Accident Moped	51	0.57%
Traffic Accident Auto/Mcycle	46	0.52%
Traffic Accident Auto Overturn	39	0.44%
Traffic Enf D.U.I.	37	0.41%
Traffic Enf Reckless Driving	11	0.12%
Traffic Accident Bus/Object	2	0.02%
Traffic Enf No Insurance	2	0.02%
TOTAL	**8,924**	**100.00%**

In order to identify the high accident frequency locations, the accident data was summarized by street and location. The ranking based on the number of accidents occurring by street and location on Saipan is summarized in Table 34. Among all the roadways on Saipan, the majority of the accidents occurred on Beach Road. The three top-ranked accident sites are all located on Beach Road. Susupe was ranked first with 399 incidents, followed by Garapan with 379 and Chalan Kanoe with 266 cases reported.

Roadway improvements are recommended for some of the key locations or hot spots identified aimed at improving the roadway conditions and are summarized in the recommended improvement section of the report.

Table 34: Accident Summary by Site

Rank	High Accident sites		Accident Total 2003-2008
	Street	Location	
1	Beach Road	Susupe	399
2	Beach Road	Garapan	379
3	Beach Road	Chalan Kanoe	266
4	Parking Lot	Garapan	261
5	Beach Road	San Jose	193
6	Chalan Pale Arnold	Garapan	189
	Chalan Pale Arnold	Gualo Rai	189
7	Chalan Pale Arnold	Chalan Laulau	154
8	Blank	Garapan	131
9	Chalan Monsignor Martinez	As Lito	123
10	Beach Road	San Antonio	120
11	Beach Road	Chalan Laulau	117
12	Isa Drive	San Vicente	106
13	Isa Drive	San Jose	105
14	Chalan Pale Arnold	Puerto Rico	103
15	Parking	Chalan Kanoe	102
16	Parking	Susupe	96
17	Parking	Chalan Laulau	94
18	Parking	San Jose	93
19	Beach Road	Chalan Piao	91
20	Isa Drive	Capitol Hill	89
21	Isa Drive	PaPago	88
22	Isa Drive	Dan Dan	80
23	Parking	Gualo Rai	74
24	Isa Drive	Chalan Kiya	65
25	Chalan Pale Arnold	Tanapag	64
26	Dandan Road	Dan Dan	63
27	Isa Drive	As Terlaje	56
28	Parking	Koblerville	54
29	As Perdido Road	As Perdido	53
	Parking	Dan Dan	53
30	Kagman Road	Kagman	52

5.9 Planned Roadway Improvements

Based on the information provided by the Department of Public Works of the CNMI, there are several roadway improvement projects on the three islands that have started or have been planned with committed funding and would begin construction in the near future. These projects are summarized and listed below. Estimated project cost is provided if the information is available.

5.9.1 Saipan

1. Tun Herman Pan Road improvement project – Tun Herman Pan Road will be repaved, and improved from Dan Dan Driving Range to Chalan Monsignor Guerrero. There will be no road widening.

2. Gualo Rai Road improvement project – Gualo Rai Road will be realigned and repaved between Chalan Pale Arnold and Beach Road. The intersection of Beach Road and Gualo Rai Road would be upgraded to a signalized intersection if signal warrants are met.

3. Truck route improvement – This is to construct a truck climbing lane on Isa Drive northbound to Kagman.

4. Traffic Signal Installation at Kagman Road and Isa Drive – Kagman is one if the most rapidly growing areas on Saipan in terms of population and development. Kagman Road is currently the only principal route connecting the Kagman area to the rest of the island, and the intersection of Kagman Road and Isa Drive is the key intersection along the route. The installation of signals at this location will enhance the operation of the intersection as traffic increases due to the growth in Kagman and will improve mobility of the area.

5. Dan Dan Road Realignment and Traffic Signal Installation at Dan Dan Road and Isa Drive – Dan Dan Road will be realigned and the intersection of Isa Drive and Dan Dan Road will be signalized.

6. Route 31 Cross Island Road Reconstruction, Phase I ($7,600,000)

7. Route 31 Cross Island Road Reconstruction, Phase IIA

5.9.2 Tinian

1. Route 202 Road Reconstruction ($1,388,800)

2. Route 201 Road Reconstruction ($1,700,00)

5.9.3 Rota

1. Route 10/100 Emergency Repair ($900,000)
2. Route 101 Road Construction ($1,000,000)
3. Route 11 Road Construction ($5,000,000)
4. Route 102 Road Reconstruction ($20,000,000)

6 FUTURE TRANSPORTATION CONDITIONS

This section of the report documents the role of the study roadways on the islands in the future, the methodology for estimating future traffic volumes for the study roadways and intersections, and the future levels of service that would result if no improvements to the existing roadway system are made.

6.1 Future Traffic Volumes

To forecast the future traffic volumes on the study roadways, a growth rate was applied to factor up the existing traffic volumes to the 2022 condition. This growth rate was calculated based on the historic average daily traffic volumes and population data on the islands for the past 10 to 15 years. The same growth rate of 2%, which was used to increase the historic counts to the existing condition, was applied. It is based on the assumption that similar growth patterns will continue in the future. For the other two islands, Tinian and Rota, since there are no historic traffic counts available, the same growth rate of 2% per year was applied.

6.1.1 Saipan

The average daily traffic volumes on Beach Road are expected to increase from the highest of 40,450 vehicles between Chalan Monsignor Guerrero and Chalan Hagoi in year 2008 to 51,060 ADT by 2022. The majority of the roadway segments on Beach Road would reach over 33,000 vehicles on an average day. The other two primary roadways on Saipan, Chalan Pale Arnold and Chalan Monsignor Guerrero, would be expected to have over 35,000 daily vehicles on some of the segments. On Chalan Pale Arnold, average daily traffic volumes south of Isa Drive would increase to close to 30,000 vehicles in 2022, and segments south of Industrial Drive would reach almost to 40,000 vehicles. Likewise, the middle segment on Chalan Monsignor Guerrero from Chalan Pale Arnold to Tun Herman Pan Road would increase from 29,000 vehicles per day in 2008 to 37,000 by 2022. Table 35 provides a summary of the existing ADT and the forecast 2022 ADT for all study roadways on Saipan. Forecast future roadway ADTs are also presented in Figure 22.

Table 35: Roadway Segment Forecast ADT for Saipan

Segment Number	Road	Roadway Segment	Roadway Type	2008 ADT	2022 Forecast ADT
S-1	Beach Road	Mircro Beach Road to Garapan Street	2-Lane Collector	27,080	34,660
S-2		Garapan Street to Gualo Rai Road	2-Lane Collector	27,080	34,660
S-3		Gualo Rai Road to Quartermaster Road	2-Lane Collector	26,350	33,730
S-4		Quartermaster Road to Chalan Monsignor Guerrero	4-Lane Collector/Minor Arterial	31,600	40,450

Segment Number	Road	Roadway Segment	Roadway Type	2008 ADT	2022 Forecast ADT
S-5		Chalan Monsignor Guerrero to Chalan Hagoi	4-Lane Collector/Minor Arterial	39,890	51,060
S-6		Chalan Hagoi to As Perdido Road	4-Lane Collector/Minor Arterial	29,890	38,260
S-7		As Perdido Road to Afetna Road	4-Lane Collector/Minor Arterial	20,860	26,700
S-8		Afetna Road to Koblerville Road	2-Lane Collector	12,690	16,240
S-9	Chalan Pale Arnold	North end to As Matius Road	2-Lane Collector	*1,760*	2,250
S-10		As Matius Road to Isa Drive	4-Lane Major Arterial	*8,130*	10,410
S-11		Isa Drive to Industrial Drive	4-Lane Major Arterial	23,180	29,670
S-12		Industrial Drive to Gualo Rai Road	4-Lane Major Arterial	30,870	39,510
S-13		Gualo Rai Road to Quartermaster Road	4-Lane Major Arterial	31,350	40,130
S-14		Quartermaster Road to Chalan Monsignor Guerrero	4-Lane Major Arterial	27,820	35,610
S-15	Chalan Monsignor Guerrero	Beach Road to Chalan Pale Arnold	4-Lane Major Arterial	22,330	28,580
S-16		Chalan Pale Arnold to Tun Herman Pan Road	4-Lane Major Arterial	29,040	37,170
S-17		Tun Herman Pan Road to Isa Drive	4-Lane Major Arterial	16,590	21,240
S-18	Tun Herman Pan Road	Chalan Msgr Guerrero to Isa Drive	2-Lane Collector	5,280	6,760
S-19		Isa Drive to Airport	2-Lane Collector	6,950	8,900
S-20	Isa Drive	Chalan Pale Arnold to Capital Hill Road	2-Lane Collector	8,490	10,870
S-21		Capital Hill Road to Chalan Monsignor Guerrero	2-Lane Collector	7,530	9,640

Segment Number	Road	Roadway Segment	Roadway Type	2008 ADT	2022 Forecast ADT
S-22		Chalan Monsignor Guerrero to Dan Dan Road	2-Lane Collector	8,420	10,780
S-23		Dan Dan Road to Tun Herman Pan Road	2-Lane Collector	4,760	6,090
S-24		Tun Herman Pan Road to Chalan Monsignor Martinez	2-Lane Collector	2,930	3,750
S-25	Chalan Monsignor Martinez	Chalan Monsignor Guerrero to Chalan Tun Joaquin Doi	2-Lane Collector	13,180	16,870
S-26		Chalan Tun Joaquin Doi to As Perdido Road	2-Lane Collector	7,930	10,150
S-27	As Perdido Road	Beach Road to Chalan Monsignor Martinez	2-Lane Collector	12,080	15,460
S-28		Chalan Monsignor Martinez to Tun Herman Pan Road	2-Lane Collector	5,100	6,530
S-29	Gualo Rai Road	-	2-Lane Collector	980	1,250
S-30	Quartermaster Road	-	2-Lane Collector	4,150	5,310
S-31	Chalan Tun Joaquin Doi	-	2-Lane Collector	6,590	8,440
S-32	Ropa Di Oru Street	-	2-Lane Collector	4,030	5,160
S-33	Garapan Street	-	2-Lane Collector	8,300	10,620
S-34	CPL Derence Jack Road	-	2-Lane Collector	4,270	5,470
S-35	Micro Beach Road	-	2-Lane Collector	9,520	12,190
S-36	Afetna Road	-	2-Lane Collector	3,050	3,900
S-37	Navy Hill Road	-	2-Lane Collector	4,270	5,470
S-38	Oleai Street	-	2-Lane Collector	3,540	4,530
S-39	Tekken Street	-	2-Lane Collector	4,640	5,940
S-40	Chalan Hagoi	-	2-Lane Collector	7,560	9,680
S-41	Kagman Road	-	2-Lane Collector	6,750	8,640

Figure 22: Saipan Forecast ADT

6.1.2 Tinian

The future average daily traffic volumes in Tinian are expected to be low relative to that on Saipan. The highest ADT on Tinian would reach 2,840 vehicles per day on segment S-15 in year 2022. Table 36 summarizes the 2022 forecast ADT on study roadways in Tinian and Figure 23 shows the forecast ADT on a Tinian roadway map.

Table 36: Roadway Segment Forecast ADT for Tinian

Segment Number	Road	Roadway Type	2008 ADT	2022 Forecast ADT
T-1	Riverside Drive	2-Lane Collector (local)	25	30
T-2	Riverside Drive	2-Lane Collector (local)	25	30
T-3	NA	2-Lane Collector (local)	50	60
T-4	8th Avenue (north of 86th Ave.)	2-Lane Collector (local)	50	60
T-5	8th Avenue (south of 86th Ave.)	2-Lane Collector (local)	90	120
T-6	86th Avenue	2-Lane Collector (local)	100	130
T-7	Broadway Road (Route 21)	2-Lane Collector (local)	180	230
T-8	Broadway Road (north of 42nd Street)	2-Lane Collector (local)	390	500
T-9	Broadway Road (south of 42nd Street)	2-Lane Collector (local)	1,470	1,880
T-10	42nd Street	2-Lane Collector (local)	150	190
T-11	8th Avenue (north of 42nd Street)	2-Lane Collector (local)	180	230
T-12	NA	2-Lane Collector (local)	310	400
T-13	8th Avenue (north of Canal Street)	2-Lane Collector (local)	300	380
T-14	Route 202	2-Lane Collector (local)	1,520	1,950
T-15	Route 201	2-Lane Collector (local)	2,240	2,870
T-16	Broadway Road (south of Route 201)	2-Lane Collector (local)	300	380
T-17	Route 21	2-Lane Collector (local)	300	380
T-18	NA	2-Lane Collector (local)	290	370

Figure 23: Tinian Forecast ADT

6.1.3 Rota

Similar to Tinian, the traffic on Rota is expected to be low in year 2022 with the highest ADT of 2,250 vehicles on segment R-9. Figure 24 and Table 37 summarizes the year 2022 volume forecasts on Rota.

Table 37: Roadway Segment Forecast ADT for Rota

Segment Number	Road	Roadway Type	2008 ADT	2022 Forecast ADT
R-1	Route 10 (south of Route 101)	2-Lane Collector (local)	1,730	2,210
R-2	Route 10 (north of Route 101)	2-Lane Collector (local)	1,710	2,190
R-3	Route 100	2-Lane Collector (local)	900	1,150
R-4	Route 100	2-Lane Collector (local)	560	720
R-5	Route 11	2-Lane Collector (local)	970	1,240
R-6	San Jose Street	2-Lane Collector (local)	350	450
R-7	San Francisco De Borja Street	2-Lane Collector (local)	680	870
R-8	Santa Ana Street	2-Lane Collector (local)	400	510
R-9	San Ignacio Street	2-Lane Collector (local)	1,970	2,520
R-10	San Ignacio Street	2-Lane Collector (local)	1,290	1,650

Figure 24: Rota Forecast ADT

6.2 Future Roadway Conditions

Table 38 to Table 40 summarize and compare existing and future no-improvements roadway segment LOS for Saipan, Tinian, and Rota, respectively. Highlighted cells indicate locations where level of service falls below roadway capacity of LOS F. Figure 25 to Figure 27 show graphically the roadway LOS results for Saipan, Tinian, and Rota. The reported results were estimated based on the methodology and roadway LOS standard presented in Table 17 in the existing condition section of the report.

The traffic condition on Beach Road would continue to deteriorate in the future. By 2022, the entire length of Beach Road is expected to operate at LOS F except for the segment S-7 from As Perdido Road to Afetna Road (LOS E) if no improvements are made. The segment of Chalan Pale Arnold between Gualo Rai Road and Quartermaster Road would operate at an over-capacity condition by year 2022. For the other study corridors, two segments on Isa Drive, S-20 and S-22, are calculated to operate at LOS F; two segments on Chalan Monsignor Martinez; one segment on As Perdido Road; Garapa Street; and Micro Beach Road would operate at LOS F. Roadways on Tinian and Rota would continue to operate at an acceptable level of service based on the estimated amount of growth in 2022.

Table 38: 2022 Roadway Segment LOS for Saipan

Segment Number	Road	Segment	# of lanes (2008)	2008 LOS	2022 LOS	Over Capacity in 2022?
S-1	Beach Road	Mircro Beach Road to Garapan Street	2	***F***	***F***	***Y***
S-2		Garapan Street to Gualo Rai Road	2	***F***	***F***	***Y***
S-3		Gualo Rai Road to Quartermaster Road	2	***F***	***F***	***Y***
S-4		Quartermaster Road to Chalan Monsignor Guerrero	4	***F***	***F***	***Y***
S-5		Chalan Monsignor Guerrero to Chalan Hagoi	4	***F***	***F***	***Y***
S-6		Chalan Hagoi to As Perdido Road	4	E	***F***	***Y***
S-7		As Perdido Road to Afetna Road	4	D	E	N
S-8		Afetna Road to Koblerville Road	2	D	***F***	***Y***
S-9	Chalan Pale Arnold	North end to As Matius Road	2	A	A	N
S-10		As Matius Road to Isa Drive	4	A	A	N
S-11		Isa Drive to Industrial Drive	4	C	C	N
S-12		Industrial Drive to Gualo Rai Road	4	D	E	N

Segment Number	Road	Segment	# of lanes (2008)	2008 LOS	2022 LOS	Over Capacity in 2022?
S-13		Gualo Rai Road to Quartermaster Road	4	D	***F***	***Y***
S-14		Quartermaster Road to Chalan Monsignor Guerrero	4	C	E	N
S-15	Chalan Monsignor Guerrero	Beach Road to Chalan Pale Arnold	4	C	C	N
S-16		Chalan Pale Arnold to Tun Herman Pan Road	4	C	E	N
S-17		Tun Herman Pan Road to Isa Drive	4	B	C	N
S-18	Tun Herman Pan Road	Chalan Monsignor Guerrero to Isa Drive	2	B	C	N
S-19		Isa Drive to Airport	2	C	D	N
S-20	Isa Drive	Chalan Pale Arnold to Capital Hill Road	2	D	***F***	***Y***
S-21		Capital Hill Road to Chalan Monsignor Guerrero	2	D	E	N
S-22		Chalan Monsignor Guerrero to Dan Dan Road	2	D	***F***	***Y***
S-23		Dan Dan Road to Tun Herman Pan Road	2	B	C	N
S-24		Tun Herman Pan Road to Chalan Monsignor Martinez	2	A	A	N
S-25	Chalan Monsignor Martinez	Chalan Monsignor Guerrero to Chalan Tun Joaquin Doi	2	***F***	***F***	***Y***
S-26		Chalan Tun Joaquin Doi to As Perdido Road	2	D	***F***	***Y***
S-27	As Perdido Road	Beach Road to Chalan Monsignor Martinez	2	***F***	***F***	***Y***
S-28		Chalan Monsignor Martinez to Tun Herman Pan Road	2	B	C	N
S-29	Gualo Rai Road	-	2	A	A	N
S-30	Quartermaster Road	-	2	B	B	N
S-31	Chalan Tun Joaquin Doi	-	2	C	D	N
S-32	Ropa Di Oru Street	-	2	B	B	N
S-33	Garapan Street	-	2	D	***F***	***Y***

Segment Number	Road	Segment	# of lanes (2008)	2008 LOS	2022 LOS	Over Capacity in 2022?
S-34	CPL Derence Jack Road	-	2	B	B	N
S-35	Micro Beach Road	-	2	E	***F***	***Y***
S-36	Afetna Road	-	2	A	A	N
S-37	Navy Hill Road	-	2	B	B	N
S-38	Oleai Street	-	2	A	B	N
S-39	Tekken Street	-	2	B	C	N
S-40	Chalan Hagoi	-	2	D	E	N
S-41	Kagman Road	-	2	C	D	N

Table 39: 2022 Roadway Segment LOS for Tinian

Segment Number	Road	# of lanes (2008)	2008 LOS	2022 LOS	Over Capacity in 2022?
T-1	Riverside Drive	2	A	A	N
T-2	Riverside Drive	2	A	A	N
T-3	NA	2	A	A	N
T-4	8th Avenue (north of 86th Ave.)	2	A	A	N
T-5	8th Avenue (south of 86th Ave.)	2	A	A	N
T-6	86th Avenue	2	A	A	N
T-7	Broadway Road (Route 21)	2	A	A	N
T-8	Broadway Road (north of 42nd Street)	2	A	A	N
T-9	Broadway Road (south of 42nd Street)	2	A	A	N
T-10	42nd Street	2	A	A	N
T-11	8th Avenue (north of 42nd Street)	2	A	A	N
T-12	NA	2	A	A	N
T-13	8th Avenue (north of Canal Street)	2	A	A	N
T-14	Route 202	2	A	A	N

Segment Number	Road	# of lanes (2008)	2008 LOS	2022 LOS	Over Capacity in 2022?
T-15	Route 201	2	A	B	N
T-16	Broadway Road (south of Route 201)	2	A	A	N
T-17	Route 21	2	A	A	N
T-18	NA	2	A	A	N

Table 40: 2022 Roadway Segment LOS for Rota

Segment Number	Road	# of lanes (2008)	2008 LOS	2022 LOS	Over Capacity in 2022?
R-1	Route 10 (south of Route 101)	2	A	A	N
R-2	Route 10 (north of Route 101)	2	A	A	N
R-3	Route 100	2	A	A	N
R-4	Route 100	2	A	A	N
R-5	Route 11	2	A	A	N
R-6	San Jose Street	2	A	A	N
R-7	San Francisco De Borja Street	2	A	A	N
R-8	Santa Ana Street	2	A	A	N
R-9	San Ignacio Street	2	A	B	N
R-10	San Ignacio Street	2	A	A	N

Figure 25: Saipan Future LOS

Figure 26: Tinian Future LOS

Figure 27: Rota Future LOS

6.3 Future Intersection Conditions

Existing turning movement volumes at the selected intersections were also factored up to the year 2022 condition with the growth rate of 2% per year. The forecast turning movement volumes at the study intersections are presented in Figure 28. Assuming no improvements are made to these study locations, the operation at the two unsignalized intersections of Beach Road and CPL Derence Jack Road, and Beach Road and Quartermaster Road would continue to deteriorate to an unacceptable level by 2022 that the side street movements would fail. Signalization of these two locations was considered in order to reduce vehicle delays. In addition, the signalized intersection at Chalan Pale Arnold and Navy Hill Road would fail with the growth in traffic volumes in the future if no improvements are made. Modifications to increase capacity and enhance operations at this signal location were also considered for the near future.

The other signalized and unsignalized intersections are expected to operate satisfactorily at LOS D or better in 2022. Figure 29 provides a summary of the future intersection LOS on Saipan. Table 41 and Table 42 provide a comparison of existing and future analysis results for the signalized and unsignalized intersections respectively.

Traffic signal warrants are the criteria in the Manual on Uniform Traffic Control Devices (MUTCD, 2003 edition) that should be met before installing a traffic signal at an intersection. In this analysis, traffic signal warrants based on traffic volumes over the peak hour period and the presence of school zones were checked for the intersections of Beach Road and CPL Derence Jack Road, and Beach Road and Quartermaster Road. Based on the 2008 volumes and 2022 peak hour volume projections, the intersection at Beach Road and Quartermaster Road will meet the peak hour warrant for traffic signal installation in the existing condition. For Beach Road and CPL Derence Jack Road, the peak hour warrant was not met in either the existing or the future conditions; however, the school crossing warrant 5 for signal installation was met because of the school nearby and the high levels of pedestrians and student activities at the intersection.

Table 41: 2022 Signalized Intersection Level of Service (LOS)

Signalized Intersection	2008		2022	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Beach Road and Chalan Monsignor Guerrero	22.3	C	54.2	D
Chalan Pale Arnold and Navy Hill	38.5	D	***84.1***	***F***
Chalan Pale Arnold and Chalan Monsignor Guerrero	16.1	B	22.8	C

Table 42: 2022 Unsignalized Intersection Level of Service (LOS)

Unsignlized Intersection	2008		2022	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Beach Road and Micro Beach Road				
EB Approach	11.2	B	15.1	C
WB Approach	14.4	B	23.8	C
NB Left Turn	10.3	B	12.1	B
NB Right Turn	10.7	B	15.0	C
Beach Road and CPL Derence Jack Road				
EB Approach	47.3	E	***>300***	***F***
WB Approach	***127***	***F***	***>300***	***F***
Beach Road and Gualo Rai Road				
WB Approach	19.4	C	32.1	D
Beach Road and Quartermaster Road				
WB Approach	***>300***	***F***	***>300***	***F***

Figure 28: Saipan Forecast Intersection Turning Movement Counts

Figure 29: Saipan Future Intersection LOS

7 ROADWAY IMPROVEMENT PLANS

7.1 Goals and Objectives

The circulation and mobility on the three islands of CNMI is constrained and impacted by various issues and facilities. Information was gathered which included discussions with Department of Public Works staff on congested areas, safety issues and operations, constraints to circulation, and potential impacts to the mobility of the island. The recommendations presented in this report are intended to improve circulation, increase safety for pedestrians, bicyclists and motorists, reduce congestion resulting in less resource consumption and pollution, maintain the local natural environment, and accommodate the increased traffic demand for future conditions.

To maintain the mobility on the islands, the identified improvements are divided into long range and short range recommendations. The designated timeframe for long range improvements would be from 5 to 10 years whereas the designated timeframe for short range recommendations would be from 1 to 4 years. Long range recommendations are improvements or upgrades that may be on a larger scale and take a longer time period to implement or modifications that are not immediately necessary but should be implemented to maintain the mobility on the islands. Short range improvements, modifications and upgrades that should be implemented due to their critical nature or are on a smaller scale and could be implemented in a shorter timeframe.

Recommended improvements are provided both on a project-wide basis for all three CNMI islands and specific roadway improvement projects for each of the three islands. Proposed short range and long range improvements and detailed discussions of each short range and long range recommendation are presented in this section.

7.2 Project-wide, Short-range Improvements

Short-range improvements recommended for project-wide implementation for all three CNMI islands are listed below. Details descriptions of the improvements follow.

PS-1 Roadway Pavement and Delineation Maintenance and Improvement Program

PS-2 Roadway Classifications

PS-1 Roadway Pavement and Delineation Maintenance and Improvement Program

A significant amount of roadway pavement and markings on the CNMI islands are identified to be in average to poor conditions. As mentioned in the existing condition section, roadways with pot holes, cracks, unpaved shoulders and abrupt edges, are not uncommon on the islands. Some of the roadways located in rural areas are even unpaved gravel or dirt roads. For the roadway striping, except those roadways and intersections that have been recently modified, the striping on the road is mostly faded or hardly visible due to the lack of contrast between the pavement and the painted strips. Figure 30 show locations on the islands where striping is faded or hardly visible to drivers.

Figure 30: Faded Crosswalk Markings and Poor Pavement Conditions

Having a smoother roadway surface and clear roadway markings, not only could the riding quality be greatly enhanced, but roadway safety and traffic flow could also be improved. This study, therefore, recommends the implementation of a roadway pavement and delineation maintenance and improvement program for the three CNMI islands to inspect, install, maintain, and repair roadway pavement and pavement markings in a programmatic basis. The goal of this program is to enhance the physical roadway environment and provide a safe and secure pavement system for motorists and tourists on the CNMI islands.

The improvement program would require regular inspection and inventory of roadway pavement and markings conditions on the islands. This could be done by performing regular drive through and visual inspection on the roadways. Information collected on pavement conditions of the roadways could then be used to prioritize the needs for repaving, rehabilitation, reconstruction, and installation of roadway surface and restriping faded pavement markings.

To increase the visibility of the pavement markings, it is also recommended to overlay the roadway surface with a layer of slurry seal before laying on the roadway pavement markings or delineators. The black slurry seal would provide a better contrast with the white or yellow pavement delineation devices. Figure 31 shows a picture of Chalan Pale Arnold which has been recently repaved with smooth roadway surface and with visible pavement delineators.

Figure 31: Recently Paved Chalan Pale Arnold

PS-2 Roadway Classifications

The CNMI Department of Public Works (DPW) uses a roadway classification system that only identifies principal and secondary roadways. This study recommends that DPW implement a more detailed classification system that better reflects the functionality of the roadways and also provide a guide for highway right-of-way (ROW) needs and implementation of non-vehicular improvements. Four roadway types were developed to reflect the desired functionality of the CNMI roadway network, and the recommended roadway classification scheme is shown in Table 43. The minimum and enhanced ROW widths serve as goals for each respective class of roadway. It may not be possible to implement the recommended ROW widths due to physical constraints, but it is highly advantageous to do so if possible. Figure 32 to Figure 34 show the desired roadway classification for roadway network on Saipan, Tinian, and Rota, respectively.

Table 43: Recommended Roadway Classification

Facility Type	Minimum ROW	Enhanced ROW	Maximum Lane
Principal Arterial	110 feet	140 feet	6
Minor Arterial	76 feet	96 feet	4
Collector	60 feet	80 feet	4
Local	40 feet	55 feet	2

Principal arterials are roadways that are the key to mobility on each island. It is important that the ability to move traffic on these facilities is maintained and that expandability is provided. Chalan Pale Arnold and Chalan Monsignor Guerrero are classified as principal arterials on Saipan. On Rota, Route 10 is an arterial (principal or minor) and serves the islands principal circulation needs but may not meet minimum requirements. Broadway is a principal arterial for Tinian serving as the most used travel corridor on the island. Minor arterials provide accessibility to the principal arterials and provide mobility within a sub-area. Beach Road is an example of a minor arterial on Saipan. It is recommended that heavy truck traffic except vehicle servicing existing business on Beach Road be restricted on this minor arterial between Chalan Monsignor Guerrero and Garapan Street on Saipan. Route 100 would be minor arterial on Rota, and Routes 201 or 202 are minor arterials on Tinian.

Collectors serve to balance mobility and land access. Usually spaced more frequently than the arterials, collectors carry less traffic volume but provide for more direct land access for vehicles. Collectors typically funnel all local traffic onto arterials for longer trips and disperse arterial traffic onto local streets for local traffic. Local roadways provide individual local access. Accessibility is the primary function of these roadways. The recommended roadway classifications for roadways on the three islands are shown in Figure 32 to Figure 34.

Figure 32: Saipan Recommended Roadway Classifications

Figure 33: Tinian Recommended Roadway Classifications

Figure 34: Rota Recommended Roadway Classifications

7.3 Saipan Roadway Improvements

7.3.1 Short Range Improvements

The short range improvements for Saipan are listed below and shown in Figure 35.

SS - 1. Intersection Modifications at the following intersections

a. Chalan Monsignor Guerrero and Chalan Pale Arnold
b. Chalan Monsignor Guerrero and Beach Road
c. Chalan Pale Arnold and Navy Hill Road
d. Beach Road and Garapan Street
e. Tun Herman Pan and Flame Tree Drive
f. Beach Road and Chalan Monsignor Martinez

SS - 2. Install new traffic signal or roundabout at the following intersections:

a. Beach Road and Quartermaster Road
b. Beach Road and Gualo Rai Road
c. Beach Road and CPL Derence Jack Road
d. Beach Road and Micro Beach Road
e. Beach Road and Tun Segundo Street

SS - 3. Add vehicle turnout along Isa Drive in Capital Hill

SS - 4. Relocate existing pedestrian crossing on Chalan Pale Arnold near Commonwealth Drive where a new museum and skate park is under construction, and signalize the intersection of Commonwealth Drive and Chalan Pale Arnold.

SS - 5. Improve signage and relocate driveway on Chalan Tun Road in As Terlaje

SS - 6. Add pedestrian pathway on Micro Beach Road

SS - 7. Improve signage on Isa Drive (Route 31) near Kagman Road

SS - 8. Improve signage on As Perdido Road (Route 32)

SS - 9. Add mid-block or signalized crosswalks on Beach Road

SS - 10. Speed enforcement on Chalan Monsignor Guerrero and Chalan Pale Arnold

Figure 35: Saipan Short and Long Range Improvements

SS - 11. Parking enforcement in Garapan

SS - 12. Vehicle Circulation in Garapan

SS - 13. Hazard Elimination along Route 30 (Chalan Pale Arnold)

SS-1 Existing Intersection or Traffic Signal Modifications

a. Chalan Monsignor Guerrero and Chalan Pale Arnold

The intersection of Chalan Monsignor Guerrero and Chalan Pale Arnold is one of the major intersections on Saipan. It receives traffic from Beach Road to the west and from Chalan Monsignor Guerrero to the east onto Chalan Pale Arnold. As this intersection is a junction between two major arterials and is the main entry into Chalan Pale Arnold, it is important to ensure that the intersection provides efficient traffic flow in all directions.

The current signal operation provides protected left-turn phases for eastbound and southbound left-turn movements. Right turn movements are permitted on red. Field observations and traffic counts show that there is a significant amount of turning traffic on all approaches and there is some queuing on the southbound and westbound right-turn lanes. To improve the flow of the right-turns, it is recommended to provide a free right-turn movement on the westbound approach, and an overlap right-turn phase for the southbound right-turn movements.

There is a small channelization island that allows the eastbound to northbound left-turn and westbound to northbound right turn movements to run simultaneously. However, the right-turn vehicles were observed to stop before executing the turn without realizing that it is a free right turn movement. Providing a continuous lane strip for the westbound right-turn movements or a more visible channelization island could significantly improve the westbound right-turn efficiency. Figure 36 presents an aerial photo with the recommended improvements at the intersection.

Figure 36: Recommended Improvements at Chalan Pale Arnold and Chalan Monsignor Guerrero

b. Chalan Monsignor Guerrero and Beach Road

This location is another key intersection that connects two major corridors on the island. Despite that it is currently running in a satisfactory condition, vehicle and pedestrian safety is the key area of concern at this location. There is currently a potential conflict between the northbound right-turn vehicles and the pedestrians crossing between the southeast corner and the channelization island, and a potential conflict between the northbound free right-turn and the southbound left-turn vehicles.

Due to the skewed alignment of Chalan Monsignor Guerrero, the sight distance for the northbound right-turn vehicles entering Chalan Monsignor Guerrero is limited. In addition, the crosswalk located between the sidewalk and the channelization island, as shown in Figure 38, is at a location that is not clearly visible to the right-turn vehicles. Pedestrian safety is an issue at this location with the lacking of pedestrian advance warning signs, the tendency of vehicles not stopping at a free right-turn movement, and a poor sight distance for the right-turn vehicles.

In addition, there is currently a driveway on the south side of Chalan Monsignor Guerrero approximately 100 ft away from the intersection as shown in Figure 37. To access the driveway, the southbound left-turning vehicles are required to weave over to the adjacent lane, the receiving lane for the northbound free right-turn vehicles, immediately after executing the turn within a short distance of 100 ft. This lane change is sometimes difficult because of the high volume of free northbound right-turn movements.

Figure 37: Driveway close to Beach Road and Chalan Monsignor Guerrero

Figure 38: Crosswalk at Beach Road and Chalan Monsignor Guerrero

Because of the above reasons, it is recommended to provide a dedicated right-turn signal for the northbound right-turn movement and a pedestrian signal for crossing the northbound right-turn lane in order to eliminate any conflicts between vehicles and pedestrians at that location. With the protected right-turn signal, the right-turn vehicles would be served concurrently with the northbound through and the westbound movements but not with the southbound left-turn movement. The new pedestrian signal crossing would be served simultaneously with the southbound left-turn movements. Figure 39 provides a layout of the recommended lane configuration and signal phasing of the intersection. The signal analysis results indicate that the intersection would continue to operate at an acceptable level with the recommended improvements in both existing and future conditions.

Figure 39: Recommended Signal Operation: Beach Road and Chalan Monsignor Guerrero

c. Chalan Pale Arnold and Navy Hill Road

Chalan Pale Arnold and Navy Hill Road is currently a signalized intersection. It is a major junction connecting the Garapan Area and Chalan Pale Arnold. During the peak periods, traffic volumes on Chalan Pale Arnold reaches 1000 vehicles in each direction. Left-turn traffic from Micro Beach Road onto Chalan Pale Arnold is significant and is the dominating movement at each of the eastbound and westbound approaches. Northbound and southbound right-turn traffic was observed to be heavy. This intersection current utilizes the "split phase" operation on the Micro Beach Road approaches with protected left-turn phases on Chalan Pale Arnold.

Intersection analysis shows that the signal is functioning satisfactorily without major delay and queuing issues under the existing condition; however, the signal is analyzed would operate at an unacceptable LOS by the year 2022. Therefore, signal modification is recommended in the near future in order to accommodate the increase in future traffic demand at this location.

It is recommended to introduce an overlap right turn phase for the northbound and southbound right-turn movements. An overlap right turn phase is a phase that allows a right turn movement to run concurrently with a left-turn movement on the intersecting street. In this case, the northbound right turn movement will be served at the same time as the westbound left turns; likewise, the southbound right turn movement will be served together with eastbound lefts. Overlap phase operations would greatly enhance the efficiency of the right turn movements and is extremely beneficial at locations where there are heavy right turns.

In addition to the right-turn signal phase modification, the potential increase in traffic volumes on Micro Beach Road and heavy left-turn volumes from the east and the west approaches suggest that a leading protected left-turn phase scheme on Micro Beach Road would yield a more efficient operation of the signal in the future.

Implementation of the recommended signal phasing scheme would require modifications to the existing lane configuration at some of the approaches. To allow the overlap right-turn feature, separate turn lanes of adequate storage length should be provided. An exclusive right-turn lane is provided in the southbound but not the northbound direction, and therefore, adding a right-turn pocket is required in the northbound approach. The switch from "split phasing" to protected left-turn phasing requires separation of through and left-turn movements. It is recommended to provide two exclusive left-turn lanes, one through, and one exclusive right-turn lane for each of the eastbound and westbound directions with the recommended signal phase scheme. The recommended lane configuration and signal phasing at Chalan Pale Arnold and Navy Hill Road are illustrated in Figure 40.

The performance of the intersection under the existing signal and the recommended signal phasing schemes and lane configurations are analyzed and compared. The results of the respective signal operations are summarized in Table 44. As shown in the table, the recommended improvements are expected to greatly reduce the average intersection delay in both the existing and future conditions.

Table 44: Delay and Queue Length Comparison for Chalan Pale Arnold and Navy Hill Road

Chalan Pale Arnold and Navy Hill Road	No Improvements		With Improvements	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Existing 2008	38.5	D	25.4	C
Future 2022	***84.1***	***F***	37.5	D

Figure 40: Recommended Signal Operation: Chalan Pale Arnold and Navy Hill Road

d. Beach Road and Garapan Street

The signalized T-intersection at Beach Road and Garapan Street is located in Garapan. Garapan Street is one of the key streets connecting Chalan Pale Arnold and Beach Road. The northbound right-turn traffic and westbound traffic are substantially high at this intersection based on field observations. To facilitate the northbound right-turn and westbound right-turn movements at the intersection, it is recommended to provide overlap right-turn phases for these movements. With the overlap phases, the northbound right-turn movement will run concurrently with the westbound left-turn movement, and the westbound right-turn will run simultaneously with southbound left-turn movement.

In addition to the signal operation, much of the striping at this intersection including the crosswalks have faded and are not clearly visible to drivers and pedestrians. New striping on top of slurry seal or a black painted background beneath the stripes that could greatly enhance the visibility of the pavement markings at the intersection is recommended.

e. Tun Herman Pan Road and Flame Tree Drive

The intersection of Tun Herman Pan Road and Flame Tree Drive was listed as one of the high accident frequency locations in the previous master plan study. Tun Herman Pan Road is a key roadway providing access to the airport and Flame Tree Drive connects to a residential area and is also a back road to the airport. This location is currently unsignalized with stop-sign control on Flame Tree Drive. The Department of Public Safety identified that the problem at the location is that drivers from the stop-controlled Flame Tree Drive have difficulty finding gaps in the traffic to turn onto the uncontrolled Tun Herman Pan Road. Based on the levels of existing daily traffic, a feasible short-range solution is to modify the two-way stop-controlled intersection to a four-way stop-control. Installation of a traffic signal is not recommended at this time as signal warrants could not be met under the existing condition; however, traffic signal should be considered in the future when traffic volumes increase and the signal warrants are met. Figure 41 below shows an aerial photograph and recommended improvements of the intersection.

Figure 41: Recommended Improvements at Tun Herman Pan Road and Flame Tree Drive

f. Beach Road and Chalan Monsignor Martinez

The T-intersection at Beach Road and Chalan Monsignor Martinez is currently yield-sign controlled on Chalan Monsignor Martinez. According to the information provided by Department of Public Safety, vehicles from Chalan Monsignor Martinez usually exit the roadway without stopping usually create a hazardous condition to vehicles on Beach Road. In order to improve the safety to vehicles on Beach Road, introducing stop control on Chalan Monsignor Martinez and improving roadway delineation at the intersection are recommended. These proposed improvements could prevent vehicles from entering Beach Road without stopping and could provide a better guidance to traffic accessing the intersection. Figure 42 shows the intersection of Chalan Monsignor Martinez and Beach Road and the proposed improvements.

Figure 42: Intersection of Beach Road and Chalan Monsignor Martinez

SS-2 Installation of New Traffic Signals or Roundabouts

a. Beach Road and CPL Derence Jack Road

The intersection of Beach Road and CPL Derence Jack Road is in the heart of Garapan. On the northeast corner of this intersection are the Garapan Elementary School and other commercial and retail businesses. CPL Derence Jack Road (previously called Orchard Street) is the primary access to the Fiesta and Hyatt Regency Hotels. Pedestrian activities are very high with the majority of pedestrian being tourists.

This intersection is currently unsignalized with stop-sign control on the eastbound and westbound approaches on CPL Derence Jack Road. Vehicle turning movements were observed to be high at this location, especially the left turn movements. Due to the high volumes on Beach Road and high pedestrian activities at this intersection, vehicles on CPL Derence Jack Road are queued during the peak hours. Intersection analysis results revealed that both eastbound movement and the westbound movement are currently operating at an unacceptable LOS E and LOS F, respectively.

Signalization of this intersection would provide signalized pedestrian crossings in all directions, which would enhance traffic safety for students, tourists, and reduce vehicle delays. As mentioned in the previous section, this intersection could potentially meet the school area and pedestrian warrants for installation of a traffic signal in the existing condition. It is recommended that a signal warrant analysis to be completed to justify signal installation.

Based on the signal operation analysis, with the existing turning movement patterns, it is recommended to provide a protected left-turn phase on Beach Road and a shared signal phase for the approaches on CPL Derence Jack Road. The leading phases would serve the northbound and southbound left-turn movements on Beach Road. During this phase, the eastbound and westbound right-turn movements could also move without any conflicts. The second phase serves the through movements on Beach Road. The pedestrian crossing on CPL Derence Jack Road would be served at the same time. The final phase would serve all movements on CPL Derence Jack Road. Left-turn movements would yield to the through and right-turn movement in the opposite directions until an adequate gap is available.

In conjunction with the recommended signal phasing, the lane configuration on CPL Derence Jack Road would require modification. Currently, there is one shared left-turn, through, and right turn lane on the eastbound approach, and one shared left-turn and through lane, and an exclusive right-turn lane on the westbound approach. With the permitted phase operation, an exclusive left-turn lane would be required on both eastbound and westbound approaches on CPL Derence Jack Road. Figure 43 provides the layout of the recommended lane configuration and phase diagram for the new signal at Beach Road and CPL Derence Jack Road. The intersection would operate at LOS B in both existing and future years with this phase scheme operation.

An alternative option of constructing a roundabout at this location was also evaluated for both the existing and future year condition. The analysis revealed that a single-lane roundabout would be adequate to accommodate both the existing and forecast future year volumes on Beach Road at CPL Derence Jack Road. The corresponding volume to capacity (V/C) ratios at the roundabout for the existing and future year conditions are 0.56 and 0.77, respectively. Although a roundabout is analyzed to be operationally feasible, constructing a single-lane roundabout could be challenging and expensive due to existing right-of-way constraints. Constructing a roundabout at this location is therefore not recommended. Figure 44 depicts a

conceptual layout of a single-lane roundabout with a 100-foot diameter inscribed circle and a 15-foot circulating lane. The figure shows that right-of-way acquisition would be required at the northwest and southeast corners.

Figure 43: Recommended Signal Operation: Beach Road and Derence Jack Road

Figure 44: Conceptual Layout of Roundabout at Beach Road and CPL Derence Jack Road

b. Beach Road and Quartermaster Road

The intersection of Beach Road and Quartermaster Road is a key location and serves traffic between Beach Road and Chalan Pale Arnold via Quartermaster Road. It is currently unsignalized with stop-sign control for the westbound approach on Quartermaster Road. During the peak hours, westbound traffic on Quartermaster Road experiences long queues and delays accessing Beach Road. The westbound left-turn to southbound Beach Road movement is especially critical since it creates the longest delays and is a potentially hazardous movement due to the high conflicting traffic volumes on Beach Road. Drivers performing this movement could hardly find a gap between vehicles on the main street for making a turn. Signalizing this intersection would significantly reduce delays without unduly imposing much of an impact on Beach Road traffic.

The amount of traffic and the simple T-intersection configuration suggests that a simple two-phase signal operation would be appropriate. The first signal phase would serve all the movements on Beach Road and the second phase the movements on Quartermaster Road. The southbound left-turn movement would require yielding to the northbound through movement during the green signal indication.

For the lane configuration, it is recommended to provide an exclusive turn lane for each of the turn movements on Quartermaster Road. Introduction of these turn lanes would further enhance the movements from the cross street. Figure 45 presents the layout of the recommended roadway lane configuration and phase diagram for the installation of traffic signal at Beach Road and Quartermaster Road. The intersection was calculated to operate at LOS B and LOS D for the existing and future traffic condition, respectively, with this recommended phase operation.

An alternative option of constructing a roundabout at this location was also evaluated for both the existing and future year conditions. The analysis results revealed that a single-lane roundabout would not be adequate to accommodate the existing traffic volume at the intersections of Beach Road and Quartermaster Road. A partial two-lane roundabout would be required. Figure 46 shows a conceptual layout of the partial two-lane roundabout with a 100-foot diameter inscribed circle and 15-foot circulating lane at the location. The figure shows that constructing the roundabout at this location would require acquiring the landscaped area on the west side of Beach Road and both the northeast and southeast corners. Analysis was also performed for the future year condition, and the results indicate that both a partial two-lane and a full two-lane roundabout would fail under the future traffic condition. The roundabout alternative is therefore not recommended at this location.

Figure 45: Recommended Signal Operation: Beach Road and Quartermaster Road

Figure 46: Conceptual Layout of Roundabout at Beach Road and Quartermaster Road

c. Beach Road and Gualo Rai Road

The intersection of Beach Road and Gualo Rai Road is currently an unsignalized intersection with stop-sign control at the westbound approach on Gualo Rai Road. There is one travel lane on Beach Road in each direction, but there is no turn lane.

A project to pave, realign, and improve Gualo Rai Road is proposed by the Department of Public Works. This project is expected to be implemented in the next five years. Once this substantial roadway, Gualo Rai Road, is improved, it is expected that more traffic will use this intersection to travel between Beach Road and Chalan Pale Arnold. Signalization of this intersection should be considered after the improvements are implemented. Although the existing traffic demands do not meet traffic signal warrants (this is probably due to the existing conditions of Gualo Rai Road), it is recommended that turning movement counts to be redone and traffic signal warrants to be re-evaluated after the improvements have been implemented on Gualo Rai Road. Figure 47 presents the layout of the recommended roadway lane configuration and phase diagram for the installation of traffic signal at Beach Road and Gualo Rai Road. The intersection was calculated to operate at LOS A in both existing and future conditions with this recommended phase operation.

An alternative option of constructing a roundabout at this location was also evaluated for both the existing and future year conditions. The analysis results revealed that a single-lane roundabout would be adequate to accommodate both the existing and future forecast traffic volume at Beach Road and Gualo Rai Road. The corresponding volume to capacity (V/C) ratios at the roundabout for the existing and future year conditions are 0.65 and 0.83, respectively. Figure 48 shows a conceptual layout of a single lane roundabout with a 100-foot diameter inscribed circle and a 15-foot circulating lane at the location. The figure shows that constructing a roundabout at this location would require acquiring the landscaped area on the west side of Beach Road, the northeast corner, and the parcel on the southeast corner of the intersection. The construction cost of a roundabout, excluding the right-of-way cost is comparable to that of a traffic signal. A roundabout would be a viable alternative to a signal at the intersection if the right-of-way cost is minimal. In this case, however, a roundabout may not be a cost-effective solution for this intersection in the short term due to the substantial right-of-way acquisition required.

Figure 47: Recommended Signal Operation: Beach Road and Gualo Rai Road

Figure 48: Conceptual Layout of Roundabout at Beach Road and Gualo Rai Road

d. Beach Road and Micro Beach Road

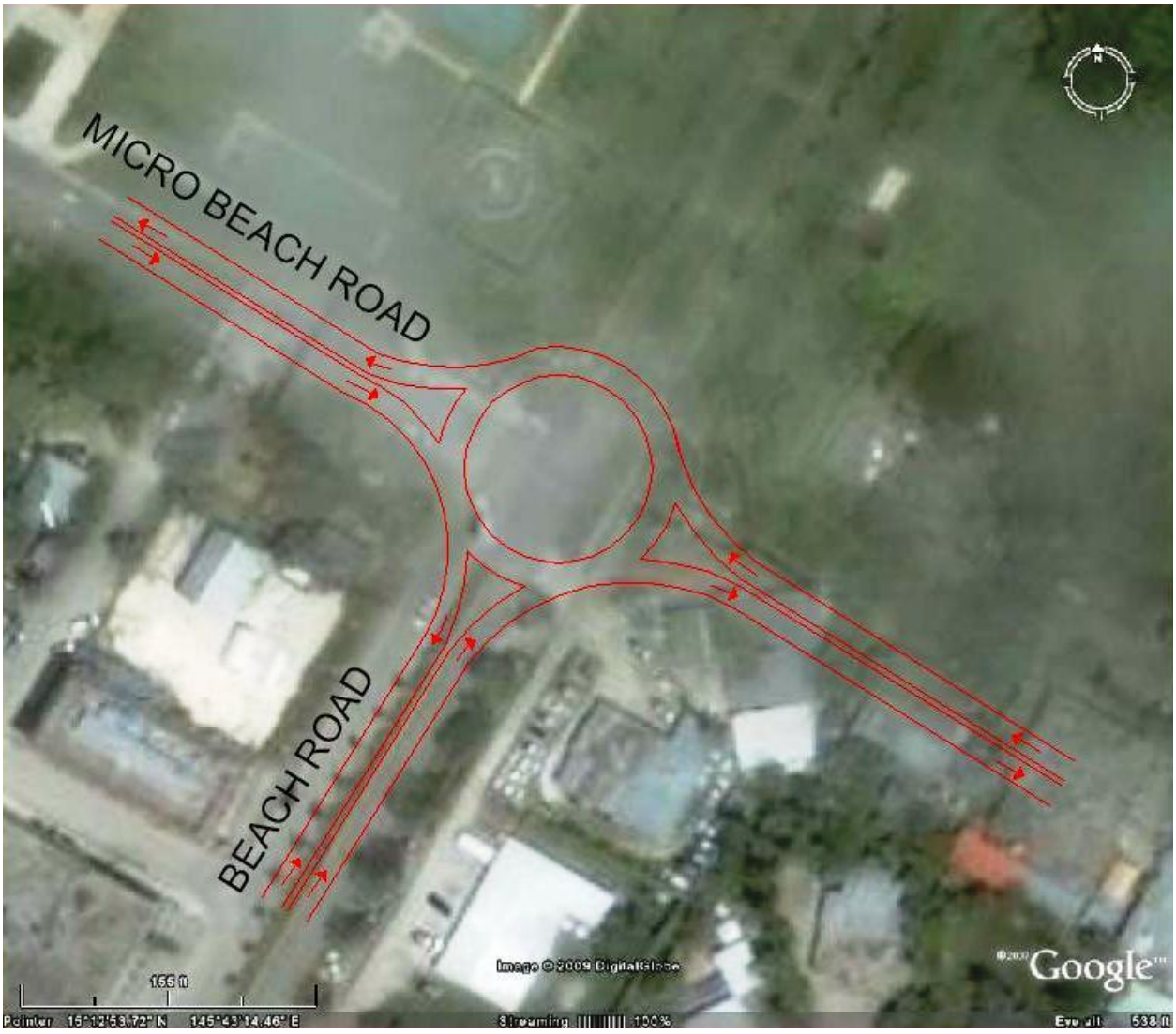
Beach Road terminates in the north at Micro Beach Road. The westbound volumes, vehicles coming from the intersection of Chalan Pale Arnold and Micro Beach Road, are high as this is the principal route for the motorists to access Garapan from the northern areas of the island (north of Navy Hill Road). The surrounding land uses include open spaces (American Memorial Park), a fire station, commercial and retail resulting in moderate pedestrian activity. The existing traffic conditions at this location do not meet signal warrants; however, it is recommended to collect turning movement volumes and re-evaulate the signal warrant analysis regularly in the future. A traffic signal could be considered for installation when signal warrant conditions are met. If a traffic signal is installed, emergency pre-emption must be also be included and connected to the fire station located on Beach Road. Figure 49 presents the layout of the recommended roadway lane configuration and phase diagram for the installation of traffic signal at Beach Road and Micro Beach Road. The intersection was calculated to operate at LOS A in both existing and future year conditions with this recommended phase operation.

An alternative option of constructing a roundabout at this location was also considered for both the existing and future year conditions. The analysis results revealed that a single-lane roundabout would be adequate to accommodate both the existing and future forecast traffic volumes at Beach Road and Gualo Rai Road. The corresponding volume to capacity (V/C) ratios at the roundabout for the existing and future year conditions are 0.35 and 0.46, respectively.

However, due to the existing right-of-way constraints, constructing a roundabout at this location is not recommended. Figure 50 shows a conceptual layout of the partial two-lane roundabout with a 100-foot diameter inscribed circle and a 15-foot circulating lane at the location. The American Memorial Park is located at the north end of Beach Road. Constructing a roundabout at this location would require acquiring a substantial amount of the landscaped area in the park at the north end of Beach Road and reconstructing a new entrance to the park. In addition, the access and layout of the fire station at one corner of the intersection would also require modifications if a roundabout is to be built.

Figure 49: Recommended Signal Operation: Beach Road and Micro Beach Road

Figure 50: Conceptual Layout of Roundabout at Beach Road and Micro Beach Road



e. Beach Road and Tun Segundo Street

Tun Segundo Street terminates in the west at Beach Road and leads to the main U.S. Post Office on Saipan in the east. The intersection of Beach Road and Tun Segundo Street is currently a one-way stop-control intersection with stop sign on Tun Segundo Street. Substantial amount of traffic including post office delivery trucks and vehicles heading or leaving the post office accessing this roadway from Beach Road is expected on a typical weekday; however, there is no turn facility, turn pocket or two-way-left-turn lane, provided at any of the approaches. Southbound left-turn vehicles on Beach Road are therefore required to stop on the through travel lane and wait for a traffic gap in the northbound direction before executing a turn onto Tun Segundo Street. Not only does the stopped vehicle interrupt the southbound traffic flow on Beach Road, it also increase the risk of rear-end auto to auto accident on the roadway.

As the turning volumes in and out of Tun Segundo Street are expected to increase in the future, upgrades at this intersection should be considered. It is recommended that signal warrant analysis to be conducted to confirm if signal installation is justified at this location. If so, traffic signal with protected/permitted left-turn phase with turn pocket should be provided. If signal is not warranted under the existing condition, it is recommended, as a short-term improvement, that a left-turn pocket on Beach Road in the southbound direction and a right-turn pocket in the northbound direction for vehicles turning in Tun Segundo Street be installed. Figure 51 presents the layout of the recommended roadway lane configuration and phase diagram for the installation of traffic signal at Beach Road and Tun Segundo Road. Since no existing turning movement volumes are available, no intersection analysis was performed for this intersection. The construction of a new traffic signal at this intersection will include new pavement markings for all approaches and minor pavement restoration along Tun Segundo Road.

An alternative option of constructing a roundabout at this location was also evaluated. However, constructing a roundabout at this location is not recommended due to the potentially high cost for right-of-way acquisition. Along Beach Road near Tun Segundo Street are concentrated commercial and retail properties. Figure 52 shows a conceptual layout of the partial two-lane roundabout with a 100-foot diameter inscribed circle and a 15-foot circulating lane at the location. According to the conceptual layout, parking areas and possibly the buildings located adjacent to the intersection would need to be partially removed for constructing a roundabout at this location. The construction cost of a roundabout plus the potential right-of-way cost is expected to be high compared to that of installing a traffic signal.

Figure 51: Recommended Signal Operation: Beach Road and Tun Segundo Street

Figure 52: Conceptual Layout of Roundabout at Beach Road and Tun Segundo Street

SS-3 Add Vehicle Turnout along Isa Drive in Capital Hill

Isa Drive is a two-lane undivided roadway providing mobility for the Capital Hill area. This roadway traverses mountainous terrain and the roadway alignment is especially winding with significant grades and tight turns in Capital Hill area. The speed differential among vehicles on this roadway is significant because of the considerable amount of heavy commercial traffic utilize this roadway. There are currently no designated turnouts along the winding road for slow-moving vehicles to turn off. As a result, traffic flow is highly inefficient as faster-moving vehicles are often required to follow the slower-moving vehicles along the route.

One cost-effective mitigation measure to improve the operation and traffic flow on Isa Drive is to introduce vehicle turnouts at various locations along the route to allow slow-moving vehicles to turn off and give passing opportunities to following vehicles. Due to the mountainous terrain and right-of-way constraints, turnouts are recommended to be located downstream of the horse-shoe shaped curve in Capital Hill area for both the eastbound and westbound approaches. Figure 53 illustrates these potential locations for the vehicle turnouts. According to the American Association of State Highway and Transportation Officials (AASHTO) design guidelines, turnouts should be 300 ft long at a minimum for a highway with an approach speed of 35 mph. The Turnout width should be at least 12 ft, however with widths of 16 ft are desirable. These guidelines together with other design guidelines in AASHTO should be followed in the design.

Figure 53: Recommended Vehicle Turnouts on Isa Drive

SS-4 Relocate Pedestrian Crosswalk on Chalan Pale Arnold near Commonwealth Drive

A pedestrian crosswalk is currently located on Chalan Pale Arnold between Sugar King Road and Commonwealth Drive, outside the Central Park on the east side of Chalan Pale Arnold. The current crosswalk serves as the main pedestrian access from the west side of Chalan Pale Arnold to and from the Central Park. A new skate park and new museum located adjacent to the park are currently under construction, and more pedestrian activity is expected in the area once these facilities are open. Pedestrian safety is therefore a major concern in the area as the current midblock crossing is the only crossing facility provided in the vicinity of the park; it is not signalized and is located on a four-lane roadway with many vehicles traveling at speeds over 40 mph. In addition, no advanced pedestrian crossing warning signs are installed on Chalan Pale Arnold.

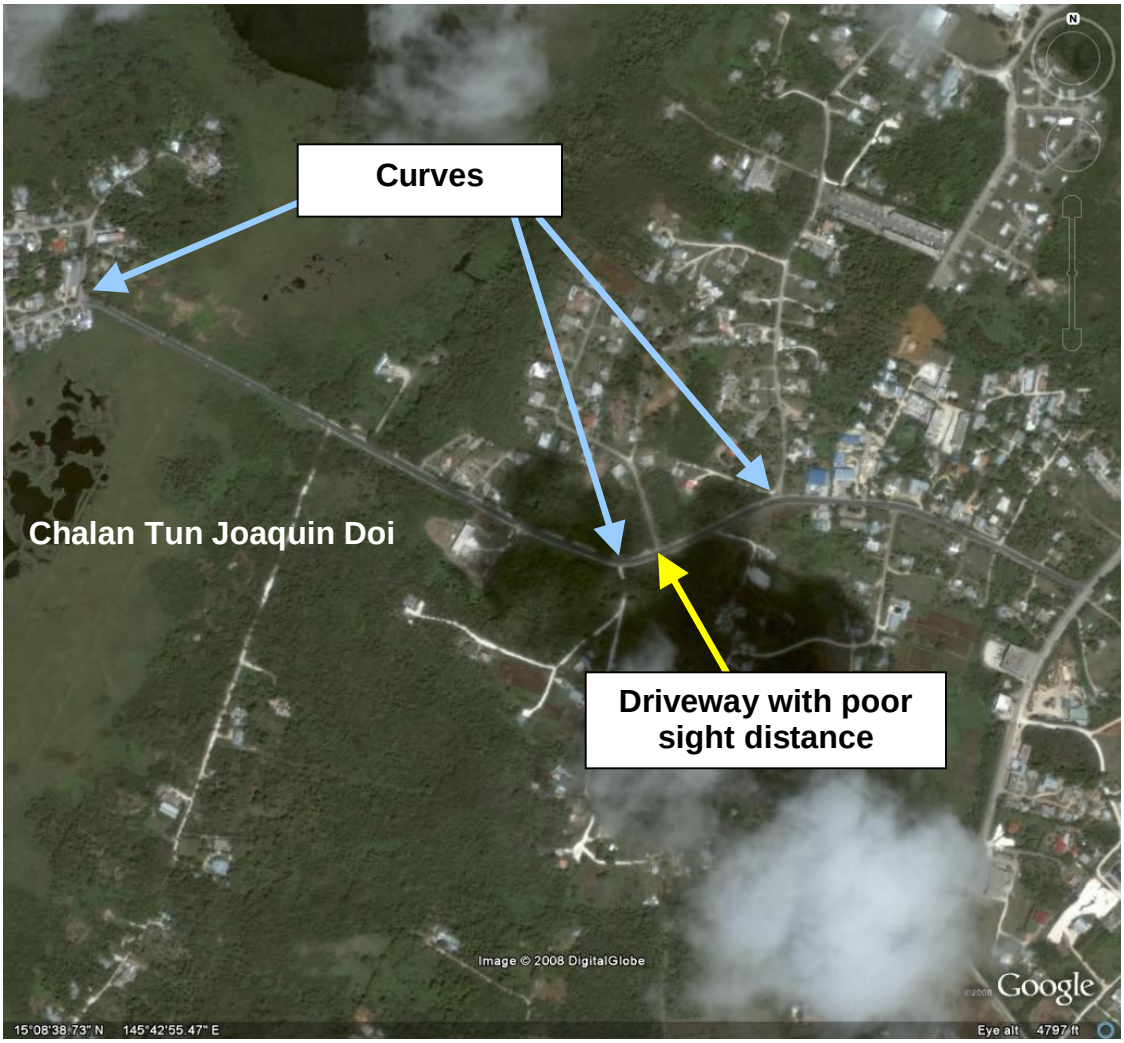
To provide a safer pedestrian crossing environment, as a short range improvement, it is recommended installing pedestrian-activated flashing beacons and adequate advance pedestrian crossing warning signs on Chalan Pale Arnold to provide warning to drivers of pedestrian crossing ahead. If budget is allowed, it is preferable to relocate the crosswalk to the south leg of the intersection of Chalan Pale Arnold and Sugar King Road to the north and signalize the intersection. Figure 54 depicts the proposed location of the pedestrian crosswalk.

Figure 54: Recommended Crosswalk Relocation on Chalan Pale Arnold

SS-5 Improve signage and Relocate driveway on Chalan Tun Joaquin Doi As Terlaje

Chalan Tun Joaquin Doi is a two-lane east-west collector connecting Chalan Monsignor Martinez and Beach Road, with daily traffic of roughly 6,000 vehicles. The central and eastern segment of this roadway is listed as the third highest accident rate roadway segment on Saipan. Although detailed accident data is not readily available, some safety issues along the roadway were identified. The roadway has sharp curves, and the access driveway has poor sight distance. The locations of the curves and driveways on Chalan Tun Joaquin Doi are illustrated on Figure 55.

Figure 55: Roadway Deficiencies on Chalan Tun Joaquin Doi

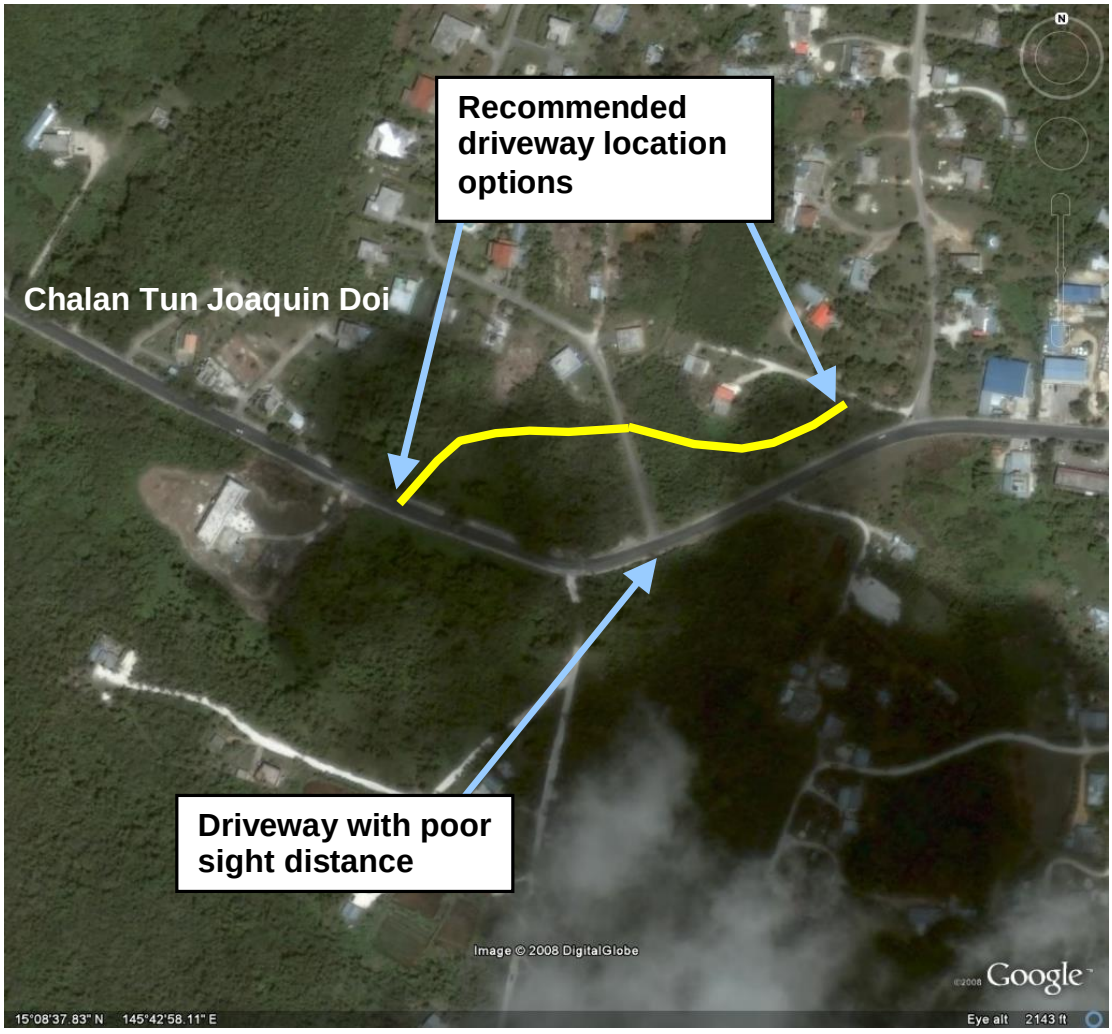


Providing adequate warning signs upstream of the curves or turns is a cost-effective short-term improvement to decrease the number of accidents due to vehicles entering curves with excessive speed. The Manual on Uniform Traffic Control Devices (MUTCD) guidelines on the placement of warning signs together with advisory speed signs for curves and turns should be followed.

The driveway identified to have poor sight distance is located roughly 180 feet east of a sharp curve as shown in Figure 55. The sight distance to the eastbound vehicles on Chalan Tun

Joaquin Doi is therefore only approximately 180 feet, which is much shorter than the American Association of State Highway and Transportation Officials (AASHTO) guideline of 390 feet for a 35 mph two-lane highway. Relocating the driveway to the west or connecting to the driveway to the east would is therefore recommended to imprive safety of vehicles using the driveway. The proposed relocations of the driveway are illustrated in Figure 56 .

Figure 56: Recommended Relocation of Driveway on Chalan Tun Joaquin Doi



SS-6 Add pedestrian pathway on Micro Beach Road

Micro Beach Road links Beach Road with Chalan Pale Arnold and provides a vital transportation connection between two of the most important roads on Saipan. It is recommended that pedestrian paths be provided to enhance the walkability of both Micro Beach Road and Garapan. An existing pedestrian pathway is located on the west side of Chalan Pale Arnold between Industrial Drive and Micro Beach Road. Extending this existing pedestrian pathway to connect to Beach Road would improve pedestrian safety and attract more usage of these alternatives to driving. Figure 57 illustrates the extension of the pedestrian pathway.

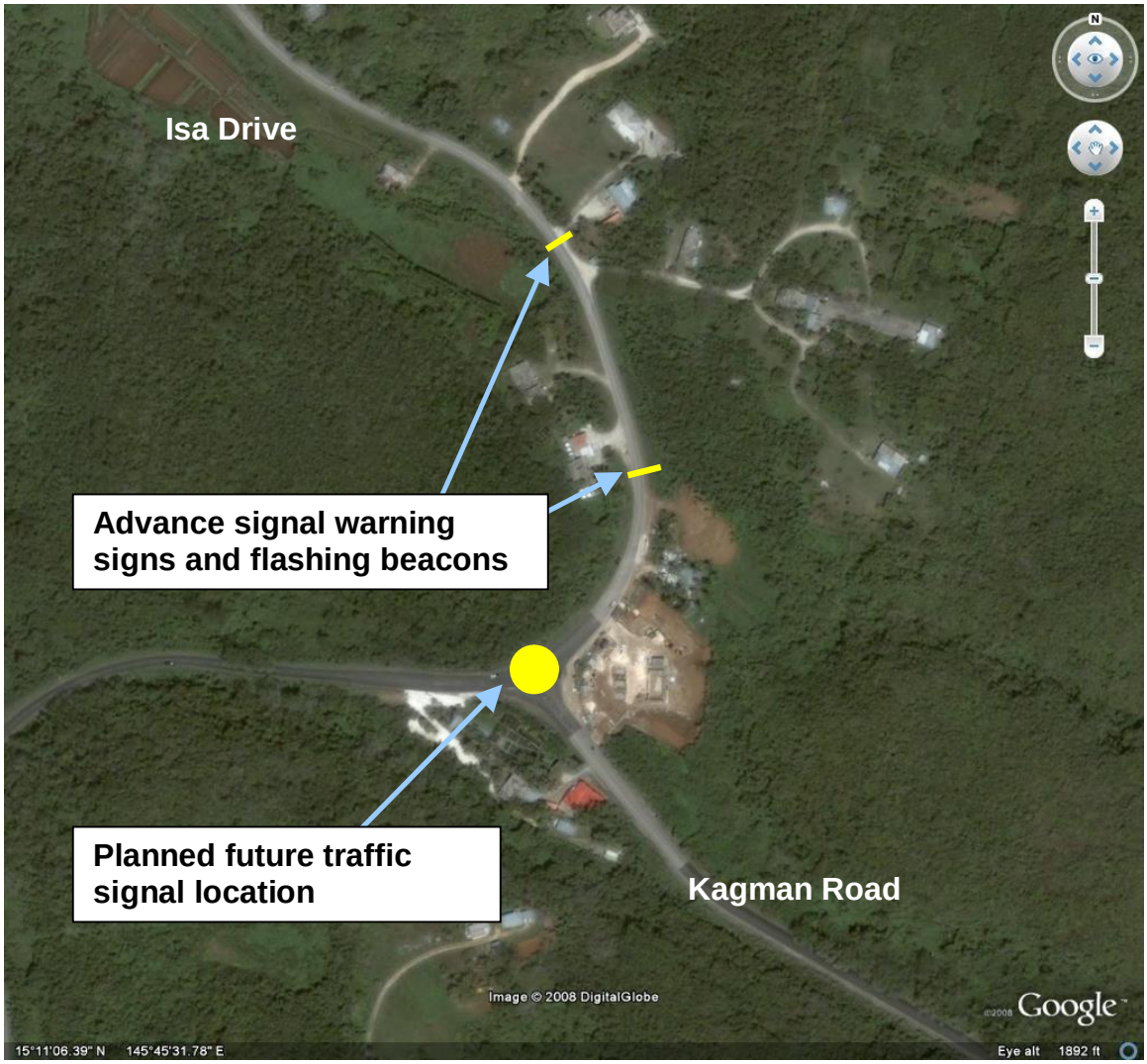
Figure 57: Recommended Extension of Existing Pedestrian Pathway on Micro Beach Road

SS-7 Improve signage on Isa Drive (Route 31) near Kagman Road

The Department of Public Safety identified accidents involving vehicles running off the roadway on the curved segment of Isa Road near Kagman Drive. According to the accident data collected, 33% of the total vehicle runoffs on Isa Drive occurred around the Papago area. The major cause of the accidents could be the lack of advance warning signs to drivers of sharp curves ahead. Improvement of signage on Isa Drive would raise awareness of road condition change and therefore would potentially reduce the number of vehicle runoffs in this area.

A project has been planned to pave and improve the segment of Isa Drive as shown in Figure 58. A traffic signal will be installed at the intersection of Isa Drive and Kagman Road along with this planned project. Due to the sharp curves and existing alignment of Isa Drive, the future traffic signal will have substandard stopping sight distance for drivers heading south on Isa Drive. It is recommended that advance flashing beacons together with signal ahead warning signs and curve ahead signs be installed for the southbound traffic on Isa Drive to provide advance warning to drivers to slow down and prepare to stop at the intersection. Near-side and far-side signal heads should also be provided for both northbound and southbound traffic on Isa Drive to increase visibility of the signal.

Figure 58: Recommended Improvements along Isa Drive



SS-8 Improve signage on As Perdido Road (Route 32)

Similar to Isa Drive, a segment of As Perdido Road is winding and frequent accidents with vehicles running off the roadway were reported, approximately 16% of the total accidents on As Perdido Road, according to the information provided by Department of Public Safety. Field observations confirmed that a lack of signage and faded or poorly visible pavement delineation on As Perdido Road might be a cause of the hazardous condition. Due to the physical constraint, realignment of the roadway would be costly. Rather, a cost effective remedy to this issue is to provide adequate advance warning signs to drivers of sharp curves and to reduce speed ahead. Clear pavement delineation especially the center lines and edge of travel way strips could also provide guidance to drivers of the change in roadway alignment.

SS-9 Add mid-block or signalized crosswalks on Beach Road

Several roadway segments on Beach Road have been identified as high pedestrian activity locations where no or inadequate pedestrian crosswalks are currently available. These locations include Gualo Rai Road and Quartermaster Road, and south of Chalan Monsignor Guerrero near the high school and the sports field. Pedestrians were often observed crossing the road outside the designated pedestrian crossing area because crosswalks are not available within a reasonably short walking distance. It is suggested evaluating safe and suitable locations for either mid-block crossings or signalized crosswalks on Beach Road to enhance pedestrian and vehicle safety. Advance pedestrian crossing warning signs should be installed on the roadway in conjunction of the crosswalk installation to alert drivers of the pedestrian crossing ahead.

SS-10 Speed enforcement on Chalan Monsignor Guerrero and Chalan Pale Arnold

It was discussed during the conference call with the Department of Public Safety that two roadway segments on Saipan have vehicles traveling at high and unsafe speed. These roadway segments are Chalan Monsignor Guerrero between Chalan Pale Arnold and Chalan Monsignor Martinez, and Chalan Pale Arnold north of Lower Base. The respective speed limit on Chalan Monsignor Guerrero is 40 mph and 35 mph. Vehicles traveling at an unsafe high speed on these segments could be hazardous to other drivers and also pedestrians.

One of the solutions to minimize the number of vehicles speeding on roadways is to increase the police coverage and enforcement in the particular speeding areas and giving out citations to speeding drivers. More frequent and regular police coverage is needed for more effective result.

In addition, installing speed limit signs together with radar speed signs could help alert drivers if their driving speed is over speed limit Figure 59 provides an example of a solar-powered radar speed sign system that has been widely used on roadways. This device detects the speed of an approaching vehicle by radar and displays the vehicle speed on the digital display. The vehicle speed display would flash if is the approaching vehicle is speeding.

Figure 59: Example of Solar-Powered Radar Speed Sign

SS – 11 Parking enforcement in Garapan

Beach Road in Garapan area is a roadway segment on Saipan where on-street parking is allowed because of the high density of commercial and retail businesses located on both sides of the road. The parking issue in the area; however, was raised by the Department of Public Safety during the conference call. It was discussed that vehicles were parking too close to the intersections or driveways and thus blocking the sight of vehicles trying to exit onto Beach Road. The 2007 Highway Safety Programs Annual Report also indicated that the accidents involving auto and parked vehicle was the second highest type of traffic crashes in 2007. According to the accident data report between 2003 and 2008, accidents involving parked vehicles ranked second highest in Garapan. Although not specifically located, there were 1,354 cases of parking accidents reported from 2003 to 2008. The majority of these are auto hitting parked vehicles.

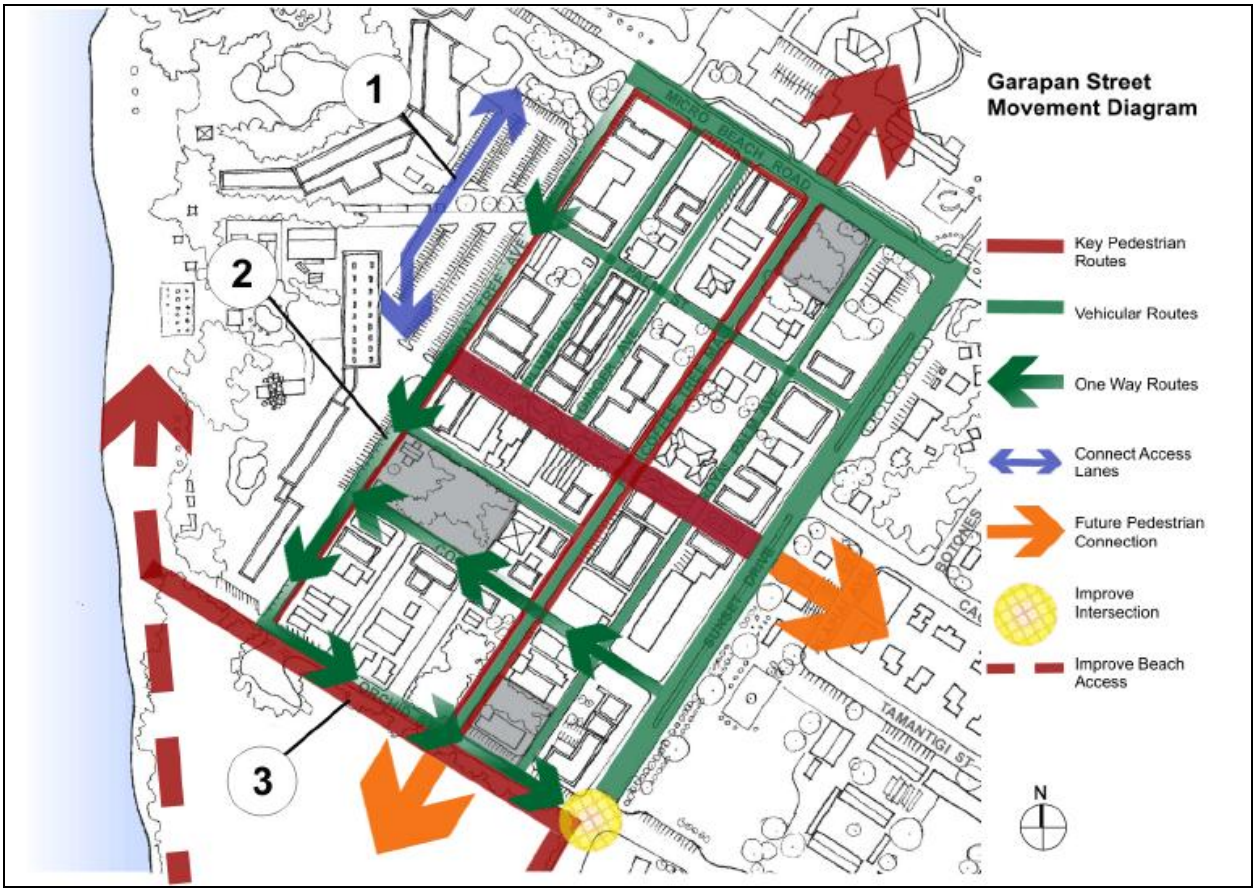
One potential solution to the parking issue is to establish a parking enforcement program in the area of Garapan. Improving the parking enforcement in Garapan would reduce the amount of illegal or improper parking, thus providing more clearance and better sight distance for passing or maneuvering vehicles. Activities needed to be performed by parking enforcement include having officers patrolling the designated area regularly and issuing citations to vehicles parked illegally, outside a designated parking space, double parking, blocking traffic, and etc. Public relations and education regarding the parking enforcement is essential to ensure that the public understand the program policy and procedures if the program is implemented.

Prior to establishing the parking enforcement program, it is also important to ensure that all the existing painted curbs and striping of on-street parking spaces are clearly visible and parking meters are functioning properly. Faded striping or painted curbs should be re-painted and malfunction parking meters should be repaired or replaced.

SS – 12 Traffic Circulation in Garapan

Reconfiguring vehicle circulation in Garapan was recommended in the Garapan and Beach Road Revitalization Plan dated September 6, 2007 as a short term improvement to the area. Some of the recommendations include changing direction of Coral Tree Avenue from one-way northbound to one-way southbound; making CPL Derence Jack Road Street one-way to reduce congestion at the CPL Derence Jack/Beach Road intersection; and making other internal streets one-way, as shown in Figure 60. As part of this study, the impacts and benefits to traffic conditions in Garapan due to the modification to vehicle circulation, especially on Beach Road and at the intersections of Beach/Micro Beach Road and Beach/CPL Derence Jack Road, were evaluated.

Figure 60: Traffic Circulation Changes in Garapan



Source: Garapan and Beach Road Revitalization Plan, September 6, 2007

With Coral Tree Avenue converted to one-way northbound and CPL Derence Jack Road to one-way eastbound, changes to the traffic flow pattern in Garapan is expected. Northbound vehicles on Beach Road heading to Coral Tree would require making a left-turn at the Beach/Micro Beach Road intersection instead of a left turn at the Beach CPL Derence Jack Road intersection. Vehicles from the east would turn at the Beach /Micro Beach Road intersection instead of at the Beach/CPL Derence Jack Road intersection.

Intersection analysis was performed with the assumption that both intersections will be signalized in the near future. Based on the analysis results, these redistributions of traffic in Garapan would slightly reduce delay at the intersection of Beach Road/CPL Derence Jack Road. Table 45 below presents the intersection delay at the two locations before and after the reconfiguration. According to the results presented, the intersection of Beach Road/CPL: Derence Jack Road would improve from LOS B to LOS A under the existing traffic condition, and the intersection of Beach Road/Micro Beach Road would operate at the same LOS A before and after the reconfiguration. The intersection operations in the future condition are expected to be similar with and without the reconfiguration.

Table 45: Intersection Delay Comparison in Garapan

Year	No Improvement		New configuration	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Beach Road/CPL Derence Jack				
Existing 2008	13.8	B	8.0	A
Future 2022	19.0	B	13.8	B
Beach Road/Micro Beach Road				
Existing 2008	5.3	A	7.5	A
Future 2022	6.6	A	8.3	A

Changing the street configuration would require some minor improvements on roadways in Garapan, including removing all roadside signs for two-way roads and installing new signs for one-way roads; installing new pavement delineation and striping along Coral Tree Avenue, CPL Derence Jack Road, and other minor streets to be converted to one-way roads; and new signage and modification to the intersections due to the new street configurations. A phased implementation and public involvement program should be established so that the public would be aware of the street reconfiguration.

SS – 13 Hazard Elimination along Route 30 (Chalan Pale Arnold)

According to the accident data between 2003 and 2008 provided by DPS, there are approximately 900 accidents reported on Chalan Pale Arnold in the 5-year period, the second highest among all the roadways on Saipan. As Chalan Pale Arnold is one of the busiest major corridors on the island, it is very important that a well maintained and safe roadway is provided to the users. Therefore, as a goal to enhance safety of this corridor, it is recommended that, as one of the short-term improvements on Saipan, a hazard elimination program be established for Chalan Pale Arnold.

Through reviewing the accidents reported on Chalan Pale Arnold in this 5-year period, it was revealed that over half of them were mainly concentrated in four different areas along the corridor and that the majority of them were auto to auto collisions. These four areas are Garapan, Gualo Rai, Chalan Laulau, and Puerto Rico. Since details of the accidents were not available for this study, the causes of these accidents were analyzed. However, based on the fact that these four areas are high vehicle and pedestrian activity locations with concentrated commercial, business and retail use along the corridor, it is expected that one of the major causes of the auto-auto collisions was conflicts between different vehicle movements; especially vehicles stopping and turning in and out of the side streets and vehicles traveling on the roadway. Improving signage along the corridor to raise drivers' awareness of vehicles entering and exiting driveways or side-streets and introducing turn pockets or Two-Way-Left-Turn lanes at major unsignalized intersections are recommended as a short-term improvements to reduce the likelihood of rear-end, head-on, or sideswipe collisions.

In addition, the pavement condition, pavement markings, crosswalk striping and signage along the entire corridor should be maintained and repaired regularly. Visible warning and regulatory

signs including speed enforcement signs should be installed upstream of pedestrian crosswalks, curves, and lane-drop areas to give advance warning to drivers of any changes in roadway conditions. It is also recommended to improve and repair collector road connections to Chalan Pale Arnold, improve and construct drainage structures at flooded areas, and improve street lighting at major intersections along the corridor.

7.3.2 Long Range Improvements

The long range improvements for Saipan are listed below and shown in Figure 35.

SL - 1. Construct new bridge and connection along Route 36

SL - 2. Upgrade and pave Lau Lau Road to Kagman

SL - 3. Realign Texas Road and modify Chalan Pale Arnold and Monsignor Guerrero to a four leg intersection

SL - 4. Realign Micro Beach Road between Beach Road and Chalan Pale Arnold. Widen roadway to provide a third lane that would become a WB left-turn lane, and add bike lanes. Add pedestrian pathway on Micro Beach Road**.**

SL - 5. Construct pedestrian facilities and bike lanes along Chalan Pale Arnold

SL - 6. Drainage upgrade along Chalan Monsignor Guerrero near Chalan Tun Herman Pan Road

SL - 7. Widen Beach Road from Chalan Monsignor Guerrero to Afetna to install two-way left-turn lane

SL - 8. Widen and improve Route 31

a. Widen and improve Route 31 from Kagman Road to Talofofo Road (Reconstruction Project Phase IIB)

b. Widen and improve Route 31 from Talofofo Road to Chalan Pale Arnold (Reconstruction Project Phase III)

SL - 9. Upgrade and improve Route 35 (Chalan Tun Herman Pan)

SL - 10. Widen and pave Route 316 (Chalan Savanna)

SL - 11. Upgrade and improve Route 310 towards Mt. Tapochao

SL-1 Reconstruct New Bridge and Connection along Route 36

As discussed in the LR-1 Roadway Classification improvements above, the continuing connection of a roadway loop for the southeast part of Saipan is of strategic importance. The connectivity of Route 36 is provided by reconstructing a new bridge on Talofofo Road immediately south of its joining Windward Road at a sharp 90 degree curve.

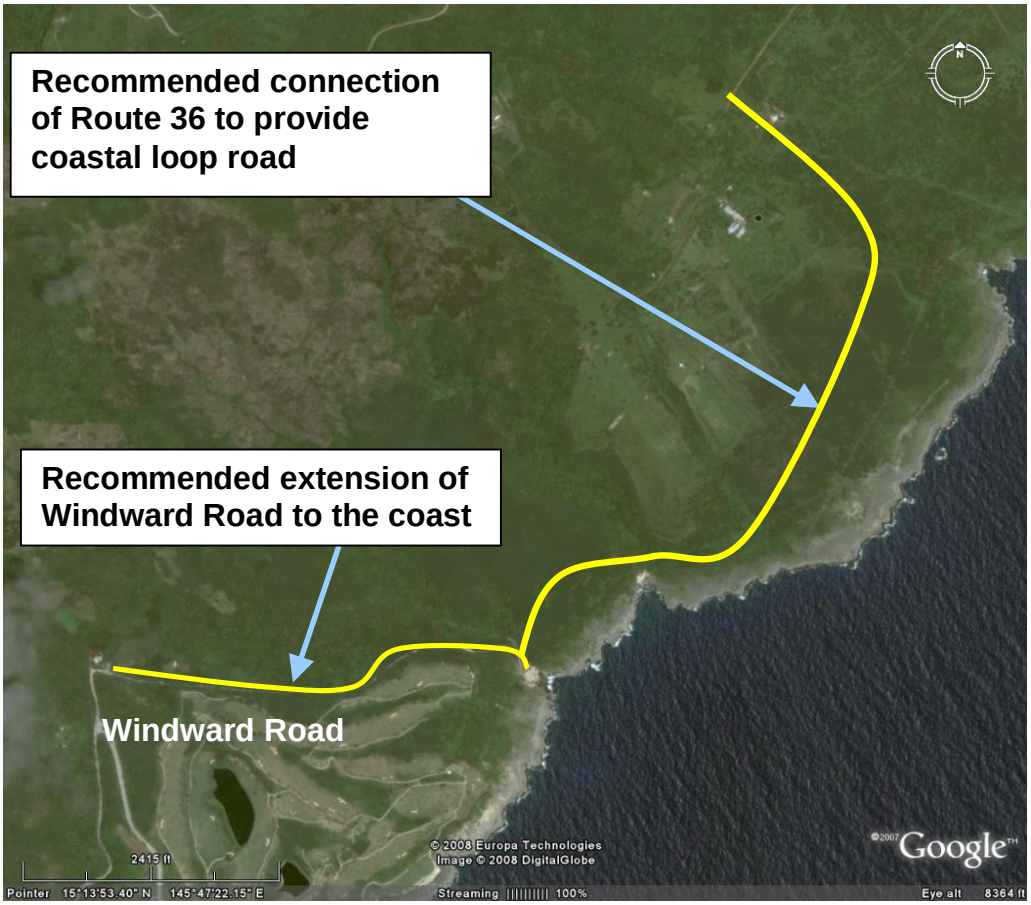
The extension of Windward Road to the east by approximately 0.8 miles will provide vehicular access to the coast. The increased connectivity will improve accessibility for that part of the island, and will also provide a transportation link for emergencies.

The remaining connection to complete the Route 36 loop is also recommended for implementation in the future. This new connection would provide a complete transportation loop around the island, with benefits of increased tourism through accessibility from both sides of the island, and connectivity for emergency purposes. Because of the relatively high construction

cost of providing a full-standard road, it is recommended that the link be initially unpaved. This would at least provide the connectivity, albeit at the lower standard than ideal. As funds become available in future years, the road should later be widened and paved. Figure 61 shows a picture of the existing Route 36 and Figure 62 illustrates the recommended improvements to the roadway.

Figure 61: Existing Route 36 (Windward Road)

Figure 62: Recommended Improvements on Route 36



SL-2 Upgrade and pave Lau Lau Bay Drive to Kagman

The Kagman area is one of the largest developing areas on Saipan with both residential and commercial developments occurring. Currently the area only has one main road, Kagman Road, connecting the neighborhood to the rest of the island. For emergencies or when there are traffic accidents of unforeseen congestion on Kagman Road, an alternative connecting road would provide relief. Upgrading Lau Lau Road to Kagman would provide such a connection. The road currently connects to Kagman but is of a poor surface standard, being unpaved for several hundred yards. This recommendation would provide traffic relief when incidents or emergency situations occur. Figure 63 provides an aerial photo that shows the existing alignment of Lau Lau Bay Drive and Figure 64 shows the existing condition of roadway. The recommended roadway cross-section of Lau Lau Bay Drive is shown in Figure 65.

Figure 63: Aerial of Existing Lau Lau Bay Drive

Figure 64: Existing Lau Lau Bay Drive

Figure 65: Recommended Roadway Cross-Section of Lau Lau Bay Drive

SL-3 Realign Texas Road and modify Chalan Pale Arnold and Monsignor Guerrero to a four leg intersection

Beach Road currently is the main access to areas in southwest Saipan and is expected to serve forecasted traffic demand increases. Alternatives to Beach Road are limited especially in the southern section of Saipan near Susupe, Chalan Kanoa and San Antonio. An alternative to provide an alternative route to Beach Road in the Susupe and Oleai areas would be to upgrade and extend Texas Road and create a new four leg intersection at Chalan Monsignor Guerrero and Chalan Pale Arnold. If implemented, this circulation upgrade would relieve the traffic demands along Beach Road south of Chalan Monsignor Guerrero and reduce the turning demands at the Beach Road and Monsignor Guerrero intersection.

This recommendation requires the realignment and upgrade of the existing Texas Road resulting in some right-of-acquisition and the modification of the existing Chalan Monsignor Guerrero and Chalan Pale Arnold intersection to a four-legged intersection. The existing Chalan Monsignor Guerrero and Chalan Pale Arnold intersection would be modified to include a south leg (for northbound traffic movements). With these improvements traffic signal phasing would be revised to include additional phases for the northbound movements. Traffic signal operations at Chalan Monsignor Guerrero and Chalan Pale Arnold are expected to remain at acceptable service levels. Texas Road would be upgraded to include a minimum of two 12-foot lanes (one in each direction) with 6-foot shoulders that could be used as bike lanes. A sidewalk or pedestrian pathway should also be included as the current land uses along Texas Road are residential which would generate pedestrian and bicycle activity.

This additional north-south roadway would be used as an extension of Chalan Pale Arnold south of Chalan Monsignor Guerrero reducing the traffic demands along Beach Road and the segment of Chalan Monsignor Guerrero between Beach Road and Chalan Pale Arnold. Improved traffic operations along Beach Road would result and an additional access route to the areas of Susupe, Chalan Kanoa, and San Antonio would be available. Figure 66 and Figure 67 illustrate the conceptual realignment and modifications to Texas Road.

Figure 66: Recommended Improvement of Texas Road

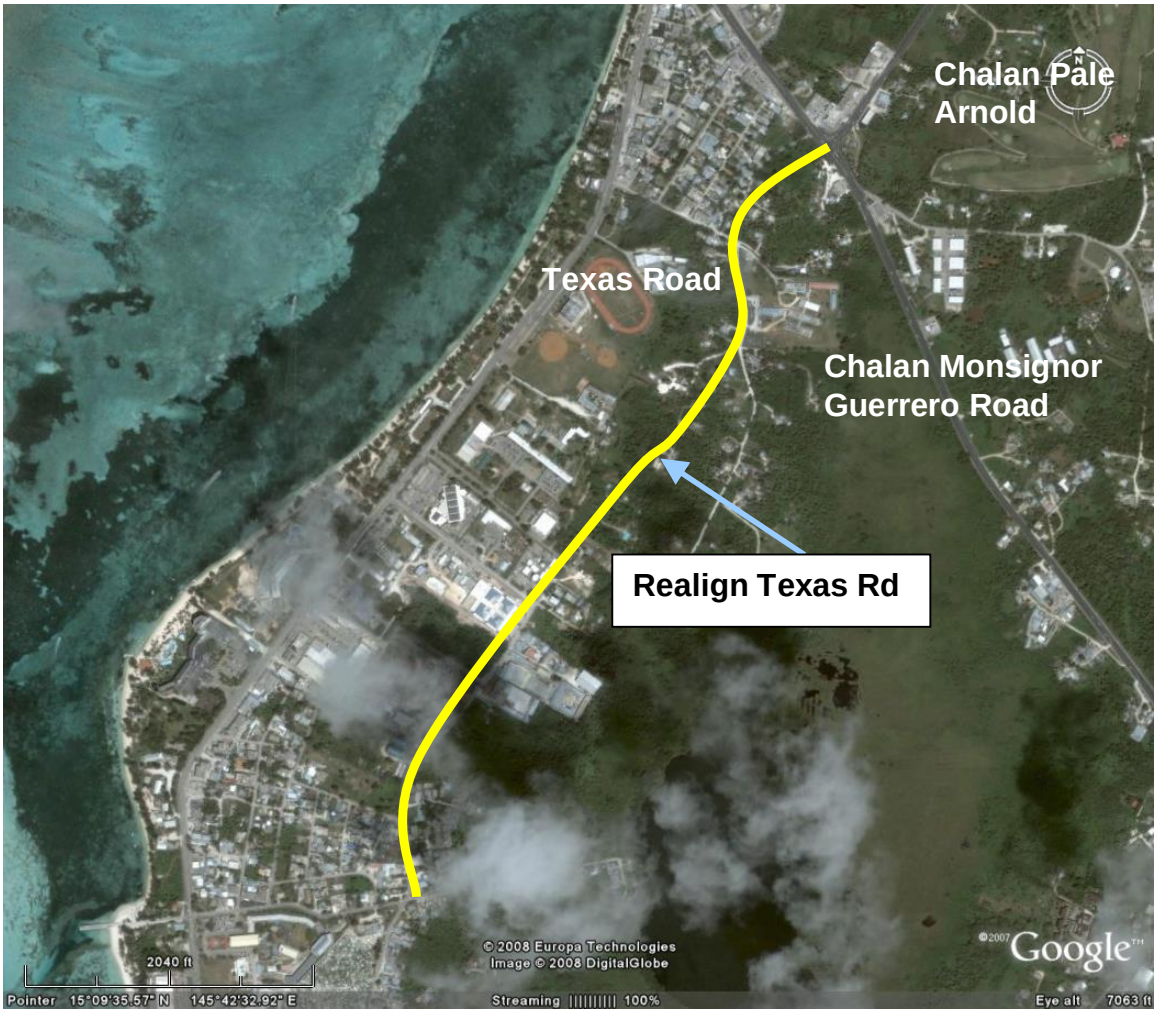


Figure 67: Recommended Realignment of Texas Road

SL-4 Realign Micro Beach Road between Beach Road and Chalan Pale Arnold. Widen roadway to provide a third lane that would become a WB left-turn lane, and add bike lanes. Add pedestrian pathway on Micro Beach Road

Micro Beach Road links Beach Road with Chalan Pale Arnold and provides a vital transportation connection between two of the most important roads on Saipan. Given the high levels of traffic on Micro Beach Road, the addition of a third lane that also functions as a WB left turn lane at the intersection with Beach Road, would add capacity on the road and at the intersection. Given the current pavement width is approximately 26 feet, the third lane could be provided with the addition of approximately 12 feet of pavement.

Micro Beach Road links Beach Road with Chalan Pale Arnold and provides a vital transportation connection between two of the most important roads on Saipan. The addition of bicycle lanes on Micro Beach Road would connect those already provided or being recommended on Beach and Chalan Pale Arnold, enhancing the usability of those lanes and the island's cycle network. It is recommended that pedestrian paths be provided to enhance the walkability of both Micro Beach Road and Garapan. Six-foot bike lanes on both sides of Micro Beach Road would provide a safer facility for bicyclists. Providing pedestrian facilities and bike lanes along Micro Beach Road would improve pedestrian and bicycle safety and attract more usage of these alternatives to driving.

Figure 68 shows the lack of pedestrian facilities and relatively scarce amount of roadway side development along Micro Beach Road. Figure 69 illustrates the recommended roadway improvements on Micro Beach Road.

Figure 68: Existing Micro Beach Road

Figure 69: Recommended Improvement on Micro Beach Road

SL-5 Construct Pedestrian facilities and bike lanes along Chalan Pale Arnold

Chalan Pale Arnold is the principal thoroughfare for Saipan serving the largest traffic demands and provides vital connections to other primary routes on the island. Unfortunately, adequate pedestrian and bicycle facilities are not provided along Chalan Pale Arnold. Land uses along Chalan Pale Arnold vary and include residential, commercial, retail and office. Pedestrian activity and bicycling could be substantial if non-motorized circulation was enhanced and made safer with a sidewalk and bike lanes. At a minimum a single sidewalk is recommended along the east side of Chalan Pale Arnold where more available right-of-way exists and power is available to provide lighting the new sidewalk. There are existing street lights along the majority of Chalan Pale Arnold on the eastern side. Six-foot bike lanes on both sides of Chalan Pale Arnold would provide a safer facility for bicyclists. Providing pedestrian facilities and bike lanes along Chalan Pale Arnold would improve pedestrian and bicycle safety and attract more usage of these alternatives to driving. Figure 70 shows an aerial location of the recommended improvement on Chalan Pale Arnold. Figure 71 shows the existing and recommended cross-section of Chalan Pale Arnold.

Figure 70: Recommended Improvement on Chalan Pale Arnold

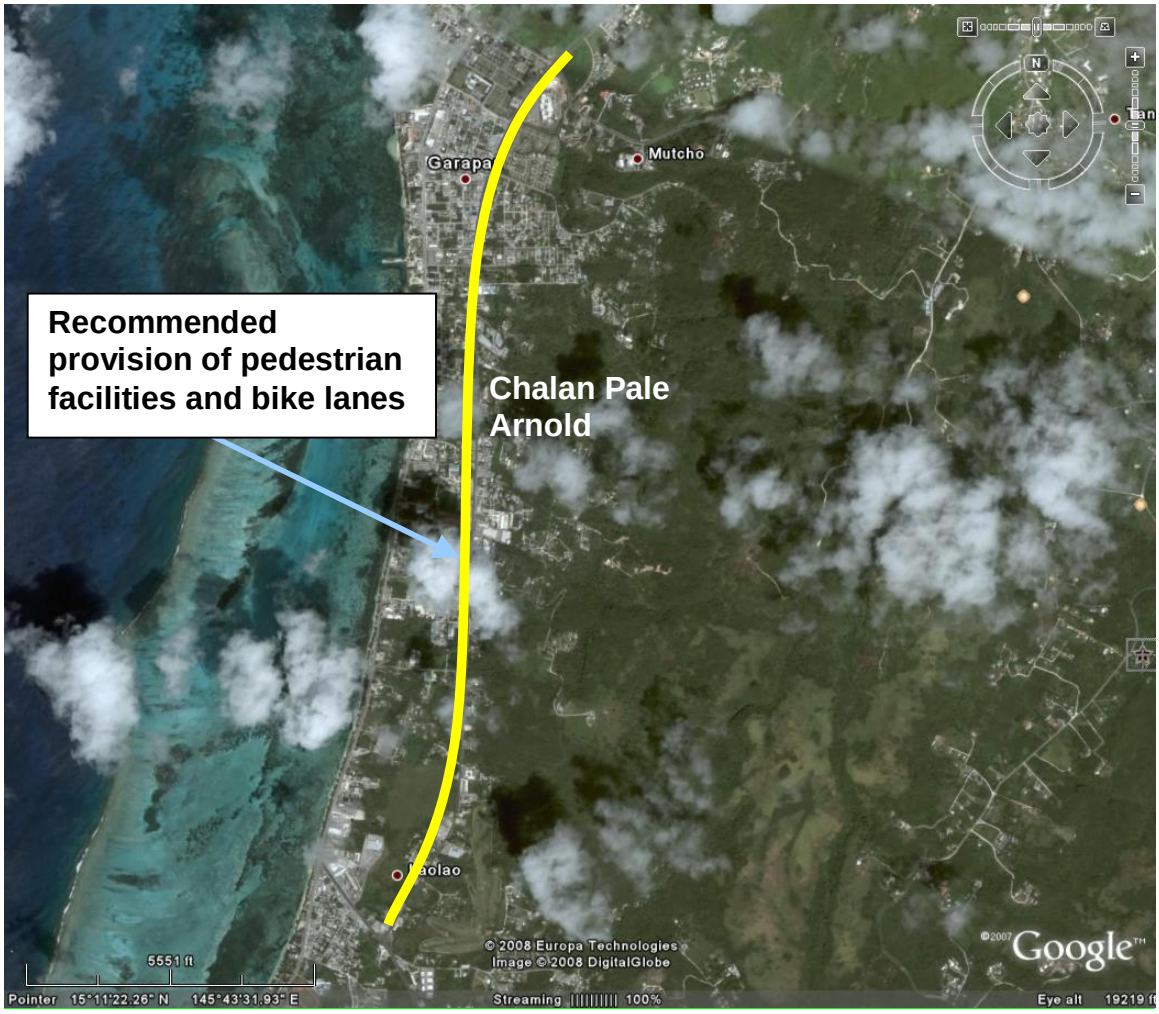


Figure 71: Recommended Roadway Cross-section: Chalan Pale Arnold

SL-6 Drainage upgrade along Chalan Monsignor Guerrero near Chalan Tun Herman Pan Road

Chalan Monsignor Guerrero near Chalan Tun Herman Pan Road is in need of drainage improvements as the road currently has potholes that decrease the safety of drivers especially during monsoon season. The road should be repaved and the drainage improved. Figure 72 shows the location on Chalan Monsignor Guerrero Road that needs drainage upgrade.

Figure 72: Recommended Improvement on Chalan Monsignor Guerrero

SL-7 Widen Beach Road from Chalan Monsignor Guerrero to Afetna to install two-way left-turn lane

According to the accident data and accident rate analysis, the roadway segment between Chalan Monsignor Guerrero and Afetna Road on Beach Road is one of the high accident rate locations. Approximately 24% of all accident occurred on Beach Road takes place in Susupe with majority of it being auto-auto. Since details of accidents were not readily available therefore the causes are unknown. Based on the existing conditions of the road, it's likely that these accident were rear-ends. Since no left turn pockets are available, possible rear-end collisions could occur when vehicles stop in a through lane waiting to execute the turn movement. During the conference call with DPS, it was discussed that turning movements into and out of the driveways is difficult along this roadway segment due to high traffic volumes on Beach Road. In addition, there are right-angle commercial parking areas along both sides of Beach Road, and backing vehicles always have conflicts with pedestrians and vehicles traveling on Beach Road.

In order to improve the safety of this roadway segment on Beach Road, it is recommended providing a two-way left-turn lane (TWLTL) on Beach Road between Chalan Monsignor Guerrero and Afetna to allow easier turn movements of vehicles into and out of the driveways. This could be done by widening Beach Road and restripe the travel lanes to include a TWLTL in the middle. Eliminating the right-angle commercial parking spaces and introducing designated commercial parking lots are also recommended to eliminate any conflict between the backing vehicles and vehicles traveling on Beach Road.

SL – 8 Widen and improve Route 31 from Kagman Road to Chalan Pale Arnold (Reconstruction Project Phase IIB and Phase III)

Route 31, also known as Isa Drive, is currently a two-lane roadway between San Vicente and Sadog Tasi. The majority of this segment is an unpaved dirt road that traverses through mountainous terrain with narrow travel lanes. As traffic volumes on Isa Drive continue to increase in the future, it is important that the corridor be widened and paved between San Vicente and Sadog Tasi.

It is recommended that 12-ft lanes and 4-ft shoulders be provided throughout the corridor. The roadway improvement involved include new asphaltic concrete pavement with dense graded anti-skid pavement, new drainage facilities, driveway connections, new retaining walls, and guardrails at curvy and winding segments. Warning and regulatory signs should be installed along the corridor, especially along the mountainous and curvy segments, and visible striping and pavement delineation shall be provided along the entire corridor.

Reconstruction of Route 31 between San Vicente and the intersection of Kagman Road is expected to begin construction in the near future as part of the Route 31 Reconstruction Project Phases I and IIA as summarized in an earlier section of the report. The proposed long range improvements for Route 31 in this section are the extension of the Reconstruction Project for Route 31 for the roadway segment between Talofofo Road and Chalan Pale Arnold. The implementation of the recommended improvements are phased in a way that Project Phase IIB would cover the segment between Kagman Road and Talofofo Road, and Phase III would cover segment from Talofofo Road to Chalan Pale Arnold.

SL – 9 Upgrade and improve Route 35 (Chalan Tun Herman Pan)

Chalan Tun Herman Pan Road connects Saipan International Airport with Chalan Monsignor Guerrero and is a critical roadway providing mobility between the Saipan International Airport and the western and northern parts of the island. This roadway is currently a two-lane undivided facility. As traffic volumes continue to grow as a result of increase in population and tourist activities on the island, upgrades to the roadway would be required to maintain its accessibility and mobility capacity between the airport and the rest of the island.

Recommended upgrades include widening the roadway in some segments so that two vehicles can pass each other or at a minimum providing wider vehicle pullout areas for passing of slower traffic. Paving the roadway would also improve driver comfort, increase travel speeds, reduce travel times and provide drivers with a safer facility, therefore, it is recommended to upgrade the pavement structure of the roadway which includes laying hot asphaltic concrete pavement with dense graded anti skid pavement and new barriers. New roadside signs and pavement markings should be installed as the new pavement is laid. In addition to the roadway paving, drainage facilities should also be constructed where runoff would be captured, detained and treated.

SL – 10 Widen and pave Route 316 (Chalan Savana)

Route 316 connects the residential areas located to the north and central parts of the islands to Isa Drive and the rest of the island. Apart from the short paved segment where it meets Isa Drive, the rest of the route is unpaved, bumpy, and practically requires a four-wheel vehicle for safe traveling. The roadway surface is uneven and contains hazards such as potholes, rocks, and standing water. In some segments the roadway is very narrow and two vehicles cannot adequately pass each other while moving at a safe speed. Usually one vehicle has to pull over and stop while the other vehicle passes with caution at a slow speed. During a rain or if the route is wet, travel is even more difficult due to the standing water and potholes filling up with water.

This roadway needs to be upgraded and paved. Upgrades include widening the roadway in some segments so that two vehicles can pass each other or at a minimum providing wider vehicle pullout areas for passing of slower traffic, installing new asphaltic concrete pavement, new pavement markings, roadside signage, new barriers, and drainage system.

SL – 11 Upgrade and improve Route 310 towards Mt. Tapochao

Route 310 provides connectivity to Isa Drive for the residential areas located south of Isa Drive. It terminates in the south at Mt Tapochao. The roadway condition of Route 310 is similar to that of Route 316. The majority of the route is an unpaved dirt road, bumpy, narrow, and requires a four-wheel vehicle for safe traveling. Two opposing vehicles may not be able to travel comfortably on some segments of the corridor. This condition is especially hazardous to drivers along winding and steep segments of the road where sight distance is limited.

To provide a safer and comfortable condition to drivers, the roadway needs to be upgraded and paved. Upgrades include widening the roadway in some segments to provide enough right-of-way for two vehicles to pass each other; paving the roadway to enhance drivers' comfort and increase travel speed; installing new pavement, warning signs along winding and curved sections of the road; striping and pavement delineation devices along the route, and installing new barriers and drainage system.

7.4 Tinian Roadway Improvements

Tinian is served by a roadway network in which the majority was constructed in the mid 20th Century (War World II) era by the United States Government (US). Most of the principal roadways are in decent or servable condition whereas other highly used routes are in poor condition but not in the Territorial Highway System. As demand grows on the Tinian roadway network, repairs, modifications, and improvements to the highway system will be needed. Potential transportation modifications, upgrades and improvements are identified based on comments from the project's informational meeting, discussions with DPW staff on traffic and safety issues and operations, and field investigations and observations. These recommendations are intended to maintain and improve Tinian's circulation for both vehicles and pedestrians and bicyclists, reduce potential circulation impacts while maintaining the local natural environment, and provide future capacity and facilities to meet the growing needs on Tinian.

To maintain the mobility on the islands, the identified improvements are divided into long term and short range recommendations. The designated timeframe for long range improvements would be from 5 to 10 years whereas the designated timeframe for short range recommendations would be from 0 to 4 years. Long range recommendations are improvements or upgrades that may be on a larger scale and take a longer time period to implement or modifications that are not immediately necessary but should be implemented to maintain the mobility on the islands. Short range improvements are modifications and upgrades that should be implemented due to their critical nature or are on a smaller scale and could be implemented in a shorter timeframe.

Proposed long and short range improvements recommended for Tinian include the following listed below. A detailed discussion of the each recommendation is presented.

7.4.1 Short Range Improvements

The short range improvements for Tinian are listed below and shown in Figure 73.

TS - 1. Implement directional and guide sign program on Tinian especially in San Jose Village

Figure 73: Tinian Short Range and Long Range Improvements

TS – 1 Implement Directional and guide sign program on Tinian especially in San Jose Song Village

There are very few existing directional and guide signs on Tinian. For unfamiliar travelers on Tinian finding various points of interests, districts, communities or land uses can be frustrating, confusing and time consuming. Tinian has various attractions and destinations but driving to them is difficult due to the lack of directional and guide signage unless you are a resident or familiar with Tinian. Even in San Jose Village finding a destination can be difficult since the street layout is not in a typical street block network.

Directional and guide signs would enhance the driver experience and eliminate confusion especially for visitors and unfamiliar motorists. Popular attractions, such as the resorts, beaches, harbor, island areas, and airport should be signed better.

7.4.2 Long Range Improvements

The long range improvements for Tinian are listed below and shown in Figure 73.

TL - 1. Upgrade and pave roadways and construct pedestrian facilities in San Jose Village

TL - 2. Upgrade and improve Broadway from Route 201 south to Limestone Forest Trail

TL - 3. Upgrade and improve major roadways in Lower Pina, Marpo and Carolinas

TL - 1 – Upgrade and pave roadways and construct pedestrian facilities in San Jose Village

In San Jose Village the roadway network varies in condition. Some route segments are in fair condition and provide a comfortable driving experience with fewer rough surfaces, rocks and other hazards such as overgrown vegetation. On the other hand, there are many segments that are in need of repaving or paving because the current roadway is uneven with major ruts or erosion, has no delineation (striping) and is adjacent to hazardous objects with no signage. Several roadway facilities such as the areas that connect Routes 201 and 202 by the government buildings and edges of roadways fronting buildings and residents have uneven surfaces where the edge of travelway ends. In addition, walking adjacent to these roadways is also a hazardous situation due to the uneven pavement and poor condition of the roadway. There are no designated sidewalks in San Jose Village. Walking in the village can be challenging due to uneven surfaces and lack of paved walking areas. The routes and roadways on Tinian do not have bicycle lanes.

The roadways in San Jose Village need to repaired and upgraded. Where possible the existing roadway should be improved to provide a smooth surface and improve drainage to eliminate ponding and erosion. Various segments on Routes 21, 201, and 202 are experiencing pavement fatigue and failure. Part of this pavement failure is due to poor drainage facilities or the lack of roadway drainage. Roadway upgrades must include drainage facilities to drain the routes during storms and catch, detain and treat the storm water run off. An applicable and feasible drainage solution could be the installation of grassy swales with shallow detention basins. In addition, upgrades of the routes within San Jose Village should include adjacent sidewalks. The sidewalks should be paved and provide safety and comfortable walking paths within the village. Where possible (where substantial impacts would not occur), the routes should also be widened so that bicycle lanes can be designated within the village. Adding sidewalk facilities and bike lanes would enhance non-motor circulation.

TL - 2 – Upgrade and improve Broadway from Route 201 south to Limestone Forest Trail

Broadway is the principal highway and serves the highest vehicle demands on Tinian. Access to the Airport and the most direct connection to San Jose Village is via Broadway. Broadway is a divided highway with an approximate 30 foot, landscaped median separating north and southbound traffic from Route 201 north to the roundabout at the Hinode America Memorial. The current geometrics and layout of Broadway north of Route 201 (2 lane divided highway) provides a safer facility (due to its separation of opposing traffic) and scalability (right-of-way for increasing capacity). Broadway is the most critical corridor on Tinian and it should be upgraded and improved to maintain it as the central transportation corridor for north-south travel and as the intersection of other island routes.

Upgrades and modifications for Broadway are necessary to continue its mobility capacity and street network connections. Improving Broadway would allow it to serve as the principal highway and corridor for Tinian. Future access along Broadway should also be limited to prevent an overstation of driveways, intersections and streets that would impact operations and safety on Broadway. Recommended improvements and upgrades for Broadway and listed below and shown in Figure 74:

- Continue the two-lane, divided alignment of Broadway from Route 201 south to intersection just south of the Tinian Dynasty Hotel and Resort.

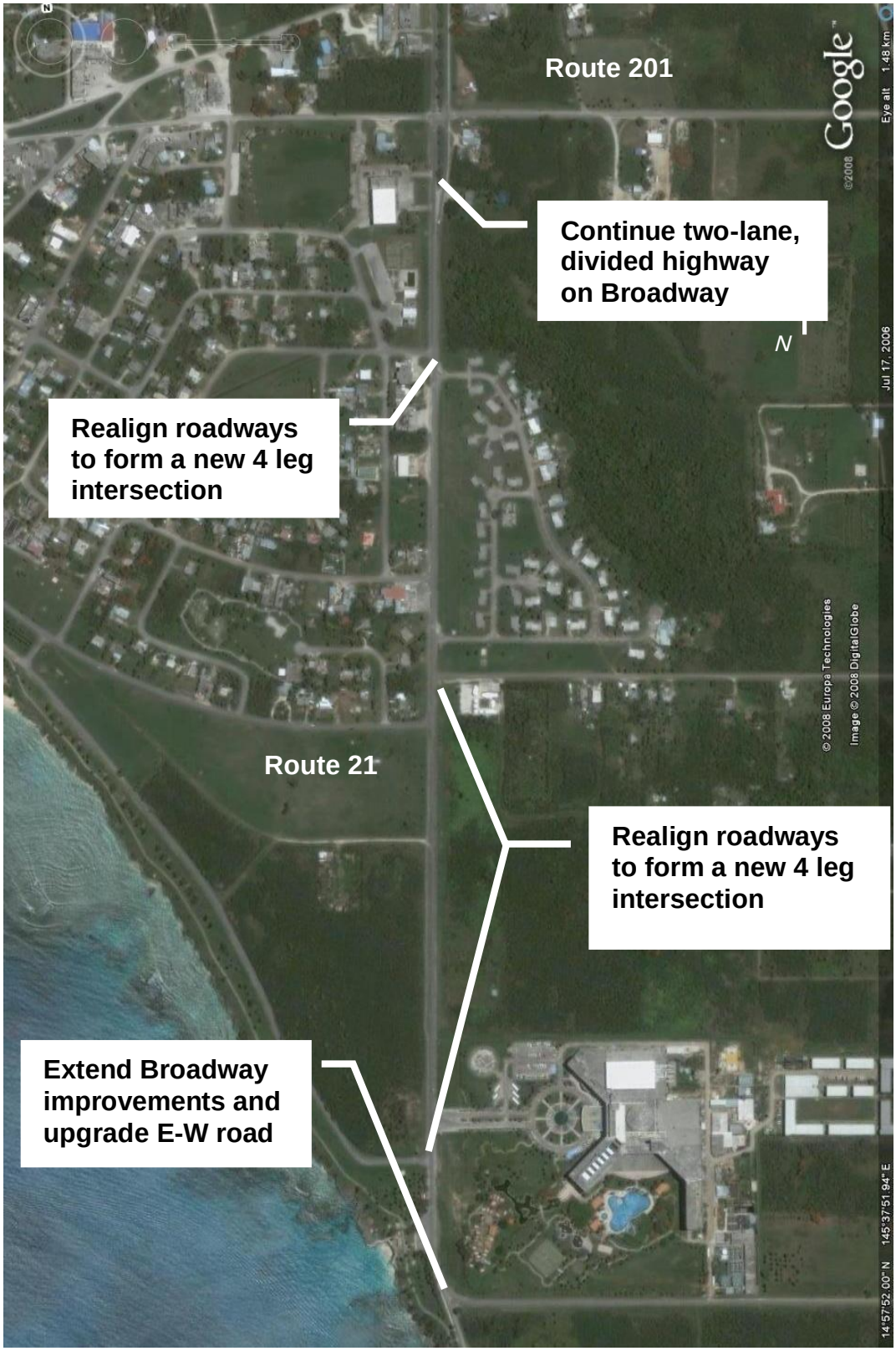
- Realign several intersections on Broadway (T intersections) that are within 100 feet of another T intersection along Broadway. These roadways access residential areas and should be realigned to form four leg intersections. Access control along Broadway to limit vehicles accessing Broadway.

- Upgrade the intersection with Routes 201 and 202 to provide delineated left-turn pockets with a minimum length of 100 feet and a standard transition from the through lanes.

- Install positive traffic control or barriers (possibly metal beam guard rail) along curves, fixed objects, and/or intersection corners to eliminate potential vehicle conflicts and incidents.

- Maintain the two-lane, divided alignment on Broadway to provide a safer facility and allow for future roadway capacity increases.

Figure 74: Recommended Improvements on Broadway



TL – 3 Upgrade and Improve major roadways in Lower Pina, Marpo and Carolinas

As summarized earlier in the report, some of the roadways around the Lower Pina and around Marpo and Carolinas are proposed to be included in the roadway classification system of the island due to a new casino development in Lower Pina area and the expected population growth in Marpo and Carolinas. Since the majority of these roadways as shown in Figure 75 are currently narrow or unpaved local facilities, upgrades and improvements are necessary in order to bring these roadways up to the standard of the proposed roadway classification and therefore are recommended to be included as one of the long range improvement plans for the island of Tinian.

The recommended roadway upgrades and improvements nclude right-of-way acquisitions to widen the roadways according to the roadway classification assigned, installing new pavement and new pavement striping and markings, installing new warning and regulatory signs, upgrading draining facilities along the roadways, and upgrading intersections along the roadways.

Figure 75: Proposed Roadways to be improved in Lower Pina, Marpo and Carolinas

7.5 Rota Roadway Improvements

Overall, the existing circulation and mobility on Rota is uncongested with moderate demands (see Chapter 4 for current traffic operations on Rota). Traffic counts were conducted on Rota as well as other information that included comments from the project's informational meeting, discussions with DPW staff on traffic and safety issues and operations, and field investigations and observations. These recommendations are intended to maintain and improve circulation, increase safety for pedestrians, bicyclists and motorists, reduce potential impacts that impact circulation while maintaining the local natural environment, and provide for the future.

To maintain the mobility on the islands, the identified improvements are divided into long range and short range recommendations. The designated timeframe for long term improvements would be from 5 to 10 years whereas the designated timeframe for short term recommendations would be from 0 to 4 years. Long range recommendations are improvements or upgrades that may be on a larger scale and take a longer time period to implement or modifications that are not immediately necessary but should be implement to maintain the mobility on the islands. Short range improvements are modifications and upgrades that should be implemented due to their critical nature or are on a smaller scale and could be implemented in a shorter timeframe.

Proposed short and long range improvements include the following. Detailed discussions of the each recommendation are presented. Figure 76 illustrates some of the specific short range and long range improvements for the island of Rota.

7.5.1 Short Range Improvements

The short range improvements for Rota are listed below and shown in Figure 76.

RS - 1. Implement directional and guide sign program on Rota especially in Song Song Village

RS - 2. Eliminate sight distance issue at Route 10 intersection leading to Route 100 in Song Song Village

RS - 3. Install positive traffic control on Route 100 between Bay Breeze Restaurant/Bar and East Harbor entrance.

RS - 4. Hazard Elimination along Route 10

RS - 5. Comprehensive drainage study in Song Song Village

Figure 76: Rota Short Range and Long Range Improvements

RS – 1 Implement directional and guide sign program on Rota especially in Song Song Village

The existing roadways on Rota are unsigned and not clearly designated. Very few guide signs exist along Route 1 or other routes. Non-residents or motorists who are unfamiliar with Rota's roadways may become lost, disorientated, and/or frustrated when driving on the island. While driving on Rota, for a motorist unfamiliar with the roadway network, often times turns to additional routes and local roadways will be missed.

The roadway network on Rota needs to be inventoried and categorized. After the roadway network is designated for the type, names, and direction, a guide and directional street name sign program needs to be implemented. The street name sign program will aid in providing direction and reduce confusion for non-local drivers. A roadway signing program can assist in the identification of deficiencies and landmarks on the islands. In addition, the roadway identification and street name sign program additional roadway signs could be implemented to provide additional traffic controls, motorists warning and directions.

RS – 2 Eliminate sight distance issue at Route 10 intersection leading to Route 100 in Song Song Village

In Song Song Village, the existing four-leg intersection connecting Route 10 to Route 100 that currently has stop sign control for the east-west Route 100 traffic. The north-south (Route 10) traffic proceeds uncontrolled. On the east leg, westbound traffic (stop sign controlled) has limited sight distance due to a masonry wall along the north east side of intersection adjacent to the Tonga Tonga Cafe. The wall hinders sight distance for westbound traffic especially blocking the view of southbound traffic. Due to the limited sight distance for westbound traffic, traffic will travel into the intersection to see if oncoming or opposing traffic is approaching and if it is safe to proceed. Sight distance for southbound traffic is also restricted due to the height and length of the masonry wall. The wall's current height and length near the corner of the intersection creates a hazardous situation. Figure 77 shows the intersection, looking northbound on Route 10. The wall is restricting the sight distance for southbound and westbound traffic.

Figure 77: Intersection connecting Route 10 to Route 100

Reducing the height and/or reducing the length of the wall would improve sight distance and safety. The entire wall does not have to be eliminated or shorten. The wall could be shortened from the cross street approximately twenty-five (25) feet or shortened to approximately 30 inches in height for an approximate length of twenty-five (25) feet.

RS – 3 Install positive traffic control on Route 100 between the Bay Breeze Restaurant/Bar and East Harbor entrance

Along the eastbound direction of Route 100, approaching the access to East Harbor is a sharp curve just east of the Bay Breeze Restaurant/Bar. The entrance to the East Harbor is located on the curve. This is a hazardous situation as large vehicles will be accessing East Harbor and will have to maneuver along this tight roadway alignment. Compounding this hazardous situation is an existing power pole or fixed object along Route 100 without any advance warning signage or positive traffic protection (barriers). This location will potentially have a safety issue once the East Harbor improvement project is complete. Trucks will access the East Harbor and be required to navigate along this tight curve. Large vehicles will also have to maneuver past the existing power pole creating a high probability that that power pole will be hit or damaged. In addition, roadway lighting is not provided along the curve. Figure 78 shows a picture of the tight curve on Route 100 and the existing power pole right off the curve.

Figure 78: The tight curve on eastbound Route 100

The proposed improvement is to install a positive traffic control system such as a metal beam guard rail around the outside of the curve (eastbound direction) or at a minimum install advance warning signs and curve warning signs along the curves. A metal beam guard rail would prevent vehicles from driving off the curve (there is a drop off from Route 100 to the harbor) and protect the existing fixed object (power pole). Installation of advance warning signs and curve warning signs would also be a substantial upgrade to the existing roadway features. Highway lighting (a luminaire) should also be installed on the existing power pole to provide roadway lighting along the curve.

RS – 4 Hazard Elimination on Route 10

Route 10 is a two-lane undivided roadway located along the coastal area of the island. One of the hazardous situations along the route is sharp curves along the road with a lack of warning signs. This is especially dangerous along the narrow segments of the route. In addition to the curves and lack of signage, striping along the route is generally faded or does not exist.

To improve the safety of the route, it is recommended to reconstruct the roadway with superelevation at the curved segment of the roadway, pave the road with anti-skid asphaltic concrete pavement, and install advance curve warning signs, edge of pavement delineation devices to provide advance warning to drivers of changing roadway condition ahead. Concrete barriers or guardrails should be installed at the edge of curved roadways to prevent vehicles from running off the road. Installing new pavement markings, new center stripes and edge of pavement striping would also be a substantial upgrade to the roadway facility. The drainage system at flooded areas along the route should also be improved and upgraded.

RS – 5 Comprehensive Drainage Study for Song Song Village

One of the major roadway issues in Song Song Village on Rota is the lack of roadway drainage. During the monsoon season, moderate to heavy rain often results in depositing erosion debris and flooding along roadways, especially the residential and business areas along San Francisco de Borja in the village. A comprehensive drainage study in Song Song Village focusing on evaluating the existing drainage system, identifying specific drainage issues and providing recommendations on drainage improvements along roadways in the area should be conducted.

7.5.2 Long Range Improvements

The long range improvements for Rota are listed below and shown in Figure 76.

RL - 1. Drainage upgrade along Route 10 from Tatachok Point south to Pinatang Park

RL - 2. Upgrade and pave Route 101 from Route 10 (College of Marianas) and along Route 11 to Ginalahan Community

RL - 3. Complete, widen, and pave Route 100 from Song Song Village to Ginalahan Community and Airport

RL - 4. Expansion of roadway and other infrastructures to Dugi area from Route 103 in Gampapa and Pegnasu areas

RL - 5. Construct bike/pedestrian path along the coastal road and collector's area

RL - 6. Widen and upgrade roadways between Sinapalo area and Bird Sanctuary Park

RL - 7. Widen and upgrade roadway connecting Gagani and Haofna

RL - 8. Upgrade and pave Route 102

RL - 9. Upgrade and pave Route 103

RL - 10. Upgrade and pave alternate routes from Song Song Village to Sailigal Hulo and to Ka'an

RL – 1 Drainage upgrade along Route 10 from Tatachok Point south to Pinatang Park

Segments of Route 10 approaching Song Song village from the Airport have poor drainage facilities that are resulting in maintenance issues (roadway pavement, erosion, and impacts to the natural environment due to the untreated runoff and erosions of the side slopes at the edge of the roadway). On the west side of Route 10 is the coast line and run off drains directly into the ocean. Erosion is also occurring along the roadway as the coastline encroaching on the roadway and in some areas eroding away at the edge of the roadway pavement section. Another impact is that this run off is untreated and threatens the natural environment by introducing toxins, pollution, and waste into the ocean and surrounding ecosystems. Eventually the untreated runoff will result in substantial impacts to the local beaches, coral reefs, indigenous animal and plant species and beauty of the environment.

Drainage facilities are needed along the roadways on Rota especially those roadways adjacent to the coast line such a Route 10 and Route 100. Drainage facilities should also include water and runoff treatment facilities such as natural detention basins and grassy swales to capture, detain, and treat the storm water runoff. This would reduce the amount of untreated runoff and pollution entering the ecosystem and reducing erosion along the highway.

RL -2 – Upgrade and pave Route 101 from Route 10 (College of Marinas exit) and along Route 11 to Ginalahan Community

Route 101 connects the southwest side of Rota to the central areas of the islands eventually connecting to Route 11 and the Ginalahan Community and Airport. Route 101 and Route 11 are very uneven, bumpy, and practically require a four-wheel vehicle for safe and adequate traveling. Both roadways are unpaved and are surrounded by thick vegetation and growth as shown in Figure 79. The roadway surface is uneven and contains hazards such as potholes, rocks, and standing water. In some segments the roadway narrows and two vehicles cannot adequately pass each other while moving at a safe speed. Usually one vehicle has to pull over and stop while the other vehicle passes with caution at a slow speed. During a rain or if the route is wet, travel is even more difficult due to the standing water and potholes filling up with water.

Figure 79: Route 101 near the college of Marianas

This roadway needs to be upgraded and paved. Upgrades include widening the roadway in some segments where two vehicles could pass each other or at a minimum providing a safe and wider vehicle pullout so that safer passing is provided for on-coming traffic. Paving the roadway would also improve driver comfort, increase travel speeds, reduce travel times and provide a much safer facility. In addition to the roadway paving, drainage facilities should also be constructed where runoff would be captured, detained and treated. Grassy swales could be a practical option for the detention and treatment as the water would eventually filter back into to ground water system.

RL - 3 – Complete, widen, and pave Route 100 from Song Song Village to Ginalahan Community and Airport

Route 100 is paved east of Song Song Village for just over two miles then becomes a natural roadway approximately 0.2 miles before the Old Japanese Cannon. The highway becomes very narrow in some segments that maintain a travel-way width where only a single vehicle can proceed if there are two opposing vehicles. If two opposing vehicles happen to meet in one of these narrow segments, one of the vehicles must stop and pull over while the other vehicle proceeds to drive through. Route 100 also has narrow bridges, as shown in Figure 80, that only allow a single direction of travel (i.e. a single vehicle) to proceed. Near the Japanese Cannon on the east side of the island, Route 100 also has visual erosion problems along the coastal edge of the highway. Proceeding northeast to the Ginalahan Community, the roadway also is uneven with substantial potholes and rocks. Travel on Route 101 east of Ponya Point is recommended to be traveled by four wheel drive vehicles. As development and growth occur, upgrades to Route 100 would be needed since it is the only east-west, coastal route in the southern and central parts of Rota.

Figure 80: Existing Bridge with limited travel-way width on Route 100

RL – 4 Expansion of roadway and other infrastructures to Dugi area from Route 103 in Gampapa and Pegnasu areas

The development and expansion of the homestead lots in the vicinity of Dugi area in Rota could eventually be converted into primarily residential communities in the future, with corresponding rapid increases in population expected in the area. The Dugi area is mainly undeveloped with unpaved roads under the current condition. As the new developments occur in the future, the

majority of the roadways and infrastructure in the area would require upgrades and improvements in order to meet the future demand. It is recommended that roadways connecting Route 103 in the Gampapa and Pegnasu areas to the Dugi area be widened and paved. As the development footprint becomes available in the future, the details and work involved in the expansion of roadways in the area should be evaluated and finalized.

RL – 5 Construct bike/pedestrian path along the coastal road and collector's area

As growth in tourism and visitor activities is expected on Rota due to future casino resorts and development, it is very important that a convenient and user-friendly pedestrian and bike network be established in key tourist areas on the island in order to attract tourists, visitors, and resident population. There are currently no pedestrian or bike paths on any of the major roadways on Rota. As an enhancement action, new pedestrian and bike paths should be considered along major roadways in Song Song Village, and along coastal roadways, Route 10 and Route 100. Since the introduction of new pedestrian and bike paths on existing roadways would require roadway widening and right-of-way acquisition, it is recommended that the implementation be prioritized and phased, and be coordinated with other roadway upgrade or improvement projects in the area.

RL – 6 Widen and upgrade roadways between Sinapalo area and Bird Sanctuary Park

As Rota expects growth in tourism and visitor activities, it is necessary that roadway improvements from Sinapola to the popular tourist attraction site at Bird Sanctuary Park in Chenchon be considered in this master plan to accommodate the possible increase of tourist and visitor populations. Roadway improvements in these areas will not only serve the tourist activities but be beneficial to those farmers who have agricultural homesteads and farms and who conduct eco-tours in As Nieves, Chenchon and Chugai area.

The roadway upgrades should include widening the existing limited roadway width to allow two opposing vehicles to pass simultaneously, repairing and implementing preventative erosions modifications, and implementing a roadside signing program for regulatory warning and guide signs.

RL – 7 Widen and upgrade roadway connecting Gagani and Haofna

The residents of Rota are depending on the main water source that supplies Song Song and Sinapalo Village. The transportation route between Gagani and Haofna is very important as this is the only roadway that CUC is using during check-up and maintenance of the main water source and distribution line. It is recommended that improvement of the roadway in the southern area from Gagani leading to Haofna be included as a long-range improvement plan for Rota. This roadway is also a potential route for eco-tours and aquaculture development.

The roadway improvements should include widening the roadway to allow two opposing vehicles to pass simultaneously; repaving the roadway surface, repairing and implementing preventative erosions; and implementing a roadway signing program for regulatory warning and guide signs.

RL – 8 Upgrade and pave Route 102

As the development and expansion of the homestead lots in the vicinity of the Dugi area in Rota occurs in the future and new roadways and infrastructure in the areas get upgraded and

improved, Route 102 that potentially provides mobility between Dugi and the rest of the island along the coastline would require upgrades and improvements in order to accommodate the increased traffic in the future. In addition, the Rota Resort and Country Club also is generating traffic to the area consisting of tourist and worker traffic.

This route currently consists of narrow unpaved dirt roads with lanes wide enough for one vehicle at a time. The goal in the long term is to widen and upgrade Route 102 to a standard two-lane roadway with 12-ft travel lanes and 4-ft shoulders in both directions as the development in Dugi area occurs. New concrete barriers, asphalt pavement, roadway signage and pavement markings and striping should be provided as the roads get widened. In addition, drainage facilities should also be constructed where runoff would be captured, detained and treated.

RL – 9 Upgrade and pave Route 103

Similar to Route 102, Route 103 is another potential roadway for providing mobility between Dugi and the rest of the island. Therefore, it would require upgrades and improvements in order to accommodate the increased traffic in the future. This route currently is a narrow unpaved dirt road with lanes wide enough for one vehicle to pass at a time. The goal in the long range is to widen and upgrade Route 102 to a standard two-lane roadway with 12-ft travel lanes and 4-ft shoulders in both directions as the development in Dugi area occurs. New concrete barriers, asphalt pavement, roadway signage and pavement markings and striping should be provided as the roads get widened. In addition, drainage facilities should also be constructed where runoff would be captured, detained and treated.

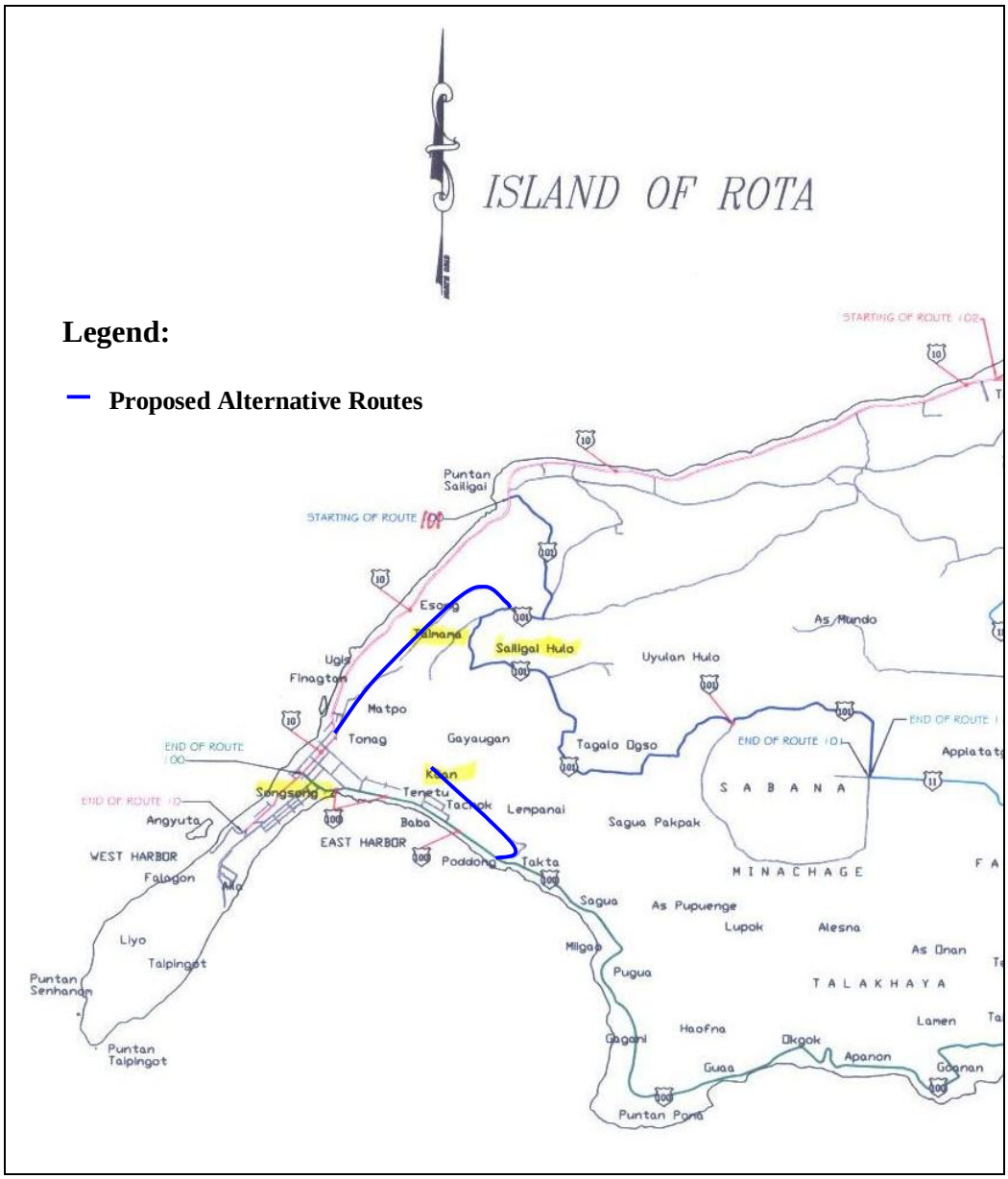
RL – 10 Upgrade and pave alternate routes from Song Song Village to Sailigal Hulo and to Ka'an

Rota currently has major paved roadways that connect the airport, Sinapalo and Song Song Village; however, these major transportation routes are mainly located along the coastal area of the island. Should there be a tsunami warning or alert, an alternate route should be provided to the public in Song Song village to access a safer place like Sinapola Village, Ka'an or another high level area. This alternate route is currently not available.

By reviewing the existing infrastructure and its condition, it is recommended that the road that connects the cross at Taimama to Sailigar Hulo and the road that connects Route 100 to Ka'an be considered as the emergency transportation route for the public in Song Song Village. The two proposed alternate routes are shown in Figure 81.

These two roadways are currently unpaved and narrow roads. In order for these roadways to better serve as an emergency transportation routes, upgrades to the roadways are necessary. These roadway upgrades should include widening the existing limited roadway width to allow two opposing vehicles to pass simultaneously, install new asphaltic concrete pavement and new pavement markings, and implementing a roadside signing program for regulatory, warning and guide signs.

Figure 81: Alternative Routes from Song Song Village to Sailigal Hulo and to Ka'an



7.6 Cost Estimates

Table 46 and Table 47 summarize the engineer cost estimates for the recommended roadway improvements for the three islands. The estimated total cost is $12.4 million for all the short range improvements and $243.6 million for all the long range improvements. The cost estimate worksheets for the recommended improvements are provided in Appendix E.

Table 46: Short Range Improvements Cost Estimates

Cost Estimates - Short Range Roadway Improvements		
Saipan		
SS-1	Intersection Modifications at 6 locations	$552,400
SS-2	Install new traffic signals at 5 locations	$1,502,900
SS-3	Add vehicle turnout along Isa Drive in Capital Hill	$419,700
SS-4	Relocate existing pedestrian crossing on Chalan Pale Arnold near Commonwealth Drive	$345,700
SS-5	Improve signage and relocate driveway on Chalan Tun Road in As Terlaje	$6,600
SS-6	Add pedestrian pathway on Micro Beach Road	$367,900
SS-7	Improve signage on Isa Drive (Route 31) near Kagman Road	$35,300
SS-8	Improve signage on As Perdido Road (Route 32)	$8,200
SS-9	Add mid-block or signalized crosswalks on Beach Road	$20,200
SS-10	Speed enforcement on Chalan Monsignor Guerrero and Chalan Pale Arnold	$45,200
SS-11	Parking enforcement in Garapan	$5,500
SS-12	Vehicle Circulation in Garapan	$512,700
SS-13	Hazard Elimination along Route 30 (Chalan Pale Arnold)	$2,703,000
	SUBTOTAL	**$7,066,900**
Tinian		
TS-1	Implement directional and guide sign program on Tinian especially in San Jose Village	$46,000
	SUBTOTAL	**$46,000**
Rota		
RS-1	Implement directional and guide sign program on Rota	$164,400
RS-2	Eliminate sight distance issue at Route 10	$3,800
RS-3	Install positive traffic control on Route 100	$12,200
RS-4	Hazard Elimination along Route 10	$5,028,000
RS-5	Comprehensive drainage study in Song Song Village	$69,000
	SUBTOTAL	**$5,277,400**
	TOTAL	**$12,390,300**

Table 47: Long Range Improvements Cost Estimates

Cost Estimates - Long Range Roadway Improvements		
	Saipan	
SL-1	Construct new bridge and connection along Route 36	$9,762,000
SL-2	Upgrade and pave Laulau Road to Kagman	$11,009,000
SL-3	Realign Texas Road and modify Chalan Pale Arnold and Monsignor Guerrero Road	$6,611,000
SL-4	Realign Micro Beach Road between Beach Road and Chalan Pale Arnold. Widen roadway to provide a third lane that would become a WB left-turn lane, and add bike lanes. Add pedestrian pathway on Micro Beach Road.	$813,000
SL-5	Construct pedestrian facilities and bike lanes along Chalan Pale Arnold	$7,366,000
SL-6	Drainage upgrade along Chalan Monsignor Guerrero	$292,000
SL-7	Widen Beach Road from Monsignor Guerrero to Afetna Road to install Two-Way Left-Turn Lane	$7,588,000
SL-8a	Widen and improve Route 31 from Kagman Road to Talofofo Road (Route 31 Reconstruction Project Phase IIB)	$8,307,000
SL-8b	Widen and improve Route 31 from Talofofo Road to Chalan Pale Arnold (Route 31 Reconstruction Project Phase III)	$8,641,000
SL-9	Upgrade and Improve Route 35 (Chalan Tun Herman Pan)	$7,542,000
SL-10	Widen and pave Route 316 (Chalan Savana)	$4,362,000
SL-11	Upgrade and improve Route 310 towards Mt Tapochao	$7,673,000
	SUBTOTAL	**$79,966,000**
	Tinian	
TL-1	Upgrade and pave roadways and construct pedestrian facilities in San Jose Village	$6,655,000
TL-2	Upgrade and improve Broadway from Route 201 south to Limestone Forest Trail	$4,560,000
TL-3	Upgrade and improve major roadways in Lower Pina, Marpo and Carolinas	$11,500,000
	SUBTOTAL	**$22,715,000**
	Rota	
RL-1	Drainage upgrade along Route 10	$82,000
RL-2	Upgrade and pave Route 101 and along Route 11	$31,666,000
RL-3	Complete, widen, and pave Route 100 from Song Song Village to Ginalahan Community and Airport	$26,957,000
RL-4	Expansion of roadway and other infrastructures to Dugi area from Route 103 in Gampapa and Pegnasu areas	$3,068,000
RL-5	Construct bike/pedestrian path along the coastal road and collector's area	$8,884,000
RL-6	Widen and upgrade roadways between Sinapalo area and Bird Sanctuary Park	$18,300,000

Cost Estimates - Long Range Roadway Improvements		
RL-7	Widen and upgrade roadway connecting Gagani and Haofna	$8,521,000
RL-8	Upgrade and pave Route 102	$19,421,000
RL-9	Upgrade and pave Route 103	$15,413,000
RL-10	Upgrade and pave alternate routes from Song Song Village to Sailigal Hulo and to Ka'an	$8,572,000
	SUBTOTAL	**$140,884,000**
	TOTAL	**$243,565,000**

7.7 Project Evaluations

Table 48 ranks the improvement projects for each of the three main islands and for both short and long range time frames, based on the following five criteria and scores (where higher scores are better):

- Safety (score of 1 for minimal or no safety improvement, 2 for moderate improvement, 3 for substantial improvement, and 4 for exceptional improvement).
- Traffic Operations (score of 1 for minimal or no traffic flow improvement, 2 for moderate improvement, 3 for substantial improvement, and 4 for exceptional improvement).
- Environmental Impacts (score of 1 for potentially severe environmental impacts, 2 for potentially substantial impacts, 3 for potentially moderate impacts, and 4 for minimal to no impacts).
- Construction Costs (score of 1 for construction costs <$250,000, 2 for costs between $250,000 and $1M, 3 for costs between $1M and $10M, and 4 for costs over $10M).
- Operations and Maintenance Costs (score of 1 for potentially very high operations and maintenance cost, 2 for potentially high cost, 3 for potentially moderate cost, and 4 for minimal to no cost).

Table 48: Ranked Short and Long Range Improvements

Island	Time Frame	Improvement		Construction Cost	SCORE					
					Safety	Traffic Operations	Environmental Impacts	Construction Costs	Operations & Maintenance Costs	Total Score
Saipan	Short Range Improvements	SS-8	Improve signage on As Perdido Road (Route 32)	$8,200	3	2	4	4	3	16
		SS-7	Improve signage on Isa Drive (Route 31) near Kagman Road	$35,300	3	2	4	4	3	16
		SS-4	Relocate existing pedestrian crossing on Chalan Pale Arnold near Commonwealth Drive	$345,700	3	2	4	3	4	16
		SS-1	Intersection Modifications at 6 locations	$552,400	3	3	4	3	3	16
		SS-5	Improve signage and relocate driveway on Chalan Tun Road in As Terlaje	$6,600	3	2	3	4	3	15
		SS-9	Add mid-block or signalized crosswalks on Beach Road	$20,200	3	1	4	4	3	15
		SS-2	Install new traffic signals at 5 locations	$1,502,900	3	4	3	2	3	15
		SS-10	Speed enforcement on Chalan Monsignor Guerrero and Chalan Pale Arnold	$45,200	3	2	4	4	1	14
		SS-6	Add pedestrian pathway on Micro Beach Road	$367,900	3	2	3	3	3	14
		SS-13	Hazard Elimination along Route 30 (Chalan Pale Arnold)	$2,703,000	4	2	3	2	3	14
		SS-3	Add vehicle turnout along Isa Drive in Capital Hill	$419,700	2	3	2	3	3	13
		SS-12	Vehicle Circulation in Garapan	$512,700	1	2	4	3	3	13
		SS-11	Parking enforcement in Garapan	$5,500	2	1	4	4	1	12
	Long Range Improvements	SL-6	Drainage upgrade along Chalan Monsignor Guerrero	$292,000	2	1	2	3	4	12
		SL-4	Realign Micro Beach Road between Beach Road and Chalan Pale Arnold. Widen roadway to provide a third lane that would become a WB left-turn lane, and add bike lanes. Add pedestrian pathway on Micro Beach Road.	$813,000	3	3	1	3	2	12
		SL-10	Widen and pave Route 316 (Chalan Savana)	$4,362,000	3	4	1	2	2	12
		SL-5	Construct pedestrian facilities and bike lanes along Chalan Pale Arnold	$7,366,000	3	2	2	2	2	11
		SL-7	Widen Beach Road from Monsignor Guerrero to Afetna Road to install Two-Way Left-Turn Lane	$7,588,000	3	4	1	2	1	11
		SL-8a	Widen and improve Route 31 from Kagman Road to Talofofo Road (Route 31 Reconstruction Project Phase IIB)	$8,307,000	3	4	1	2	1	11
		SL-8b	Widen and improve Route 31 from Talofofo Road to Chalan Pale Arnold (Route 31 Reconstruction Project Phase III)	$8,641,000	3	4	1	2	1	11
		SL-9	Upgrade and Improve Route 35 (Chalan Tun Herman Pan)	$7,542,000	3	3	1	2	1	10
		SL-11	Upgrade and improve Route 310 towards Mt Tapochao	$7,673,000	3	3	1	2	1	10
		SL-1	Construct new bridge and connection along Route 36	$9,762,000	2	3	1	2	2	10
		SL-3	Realign Texas Road and modify Chalan Pale Arnold and Monsignor Guerrero Road	$6,611,000	2	3	1	2	1	9
		SL-2	Upgrade and pave Laulau Road to Kagman	$11,009,000	3	3	1	1	1	9

Island	Time Frame	Improvement		Construction Cost	SCORE					
					Safety	Traffic Operations	Environmental Impacts	Construction Costs	Operations & Maintenance Costs	Total Score
Tinian	Short Range Improvements	TS-1	Implement directional and guide sign program on Tinian especially in San Jose Village	$46,000	2	2	3	4	3	14
	Long Range Improvements	TL-2	Upgrade and improve Broadway from Route 201 south to Limestone Forest Trail	$4,560,000	3	3	2	2	2	12
		TL-1	Upgrade and pave roadways and construct pedestrian facilities in San Jose Village	$6,655,000	3	3	1	2	1	10
		TL-3	Upgrade aand improve major roadways in Lower Pina, Marpo and Carolinas	$11,500,000	3	3	1	1	1	9
Rota	Short Range Improvements	RS-2	Eliminate sight distance issue at Route 10	$3,800	3	3	3	4	4	17
		RS-3	Install positive traffic control on Route 100	$12,200	3	3	3	4	3	16
		RS-1	Implement directional and guide sign program on Rota	$164,400	2	2	4	4	3	15
		RS-5	Comprehensive drainage study in Song Song Village	$69,000	2	1	3	4	4	14
		RS-4	Hazard Elimination along Route 10	$5,028,000	4	2	3	2	2	13
	Long Range Improvements	RL-1	Drainage upgrade along Route 10	$82,000	3	1	3	4	3	14
		RL-7	Widen and upgrade roadway connecting Gagani and Haofna	$9,854,000	3	4	1	2	1	11
		RL-4	Expansion of roadway and other infrastructures to Dugi area from Route 103 in Gampapa and Pegnasu areas	$3,068,000	3	3	1	2	1	10
		RL-5	Construct bike/pedestrian path along the coastal road and collector's area	$8,884,000	3	2	2	2	1	10
		RL-10	Upgrade and pave alternate routes from Song Song Village to Sailigal Hulo and to Ka'an	$9,871,000	3	3	1	2	1	10
		RL-6	Widen and upgrade roadways between Sinapalo area and Bird Sanctuary Park	$18,300,000	3	4	1	1	1	10
		RL-3	Complete, widen, and pave Route 100 from Song Song Village to Ginalahan Community and Airport	$26,957,000	3	4	1	1	1	10
		RL-9	Upgrade and pave Route 103	$17,692,000	3	3	1	1	1	9
		RL-8	Upgrade and pave Route 102	$19,421,000	3	3	1	1	1	9
		RL-2	Upgrade and pave Route 101 and along Route 11	$31,666,000	3	3	1	1	1	9

Note: Higher scores are better.

8 CNMI FINANCIAL PLAN

8.1 Funding Sources

There are a variety of potential funding sources for CNMI Capital Improvement Projects (CIP). These include:

1. Covenant Funds
2. Local Revenues
3. Development Fees
4. Department of Interior Appropriation Measures
5. Other Federal Grants

8.1.1 Covenant Funds

Section 702 of the Covenant between the United States and the CNMI provides a commitment and pledge from the United States for the payment and an authorization for the appropriation of guaranteed annual levels of direct grant assistance to the Government of the CNMI for a number of years.

In 2005 the CNMI Government and the US Congress negotiated a Covenant Fund package that contains substantial infrastructure project funds for the CNMI. Included in the Act are $11.2 million for Capital Improvement Projects under the 702 Agreement signed in 2003.

The Covenant funds were to be allocated to the territories in a competitive system allowing opportunities to improve accountability and providing incentives for territorial management and financial reforms.

Under this new system the CNMI receives a base amount of $11 million, with an additional $200,000 as an incentive bonus for its good management and timely completion of CIP projects.

The Office of Insular Affairs annually ranks the territories on 13 criteria which are scored to determine the annual allocation of funding among the insular area grantees.

“The management criteria include the status of audits, quality of financial and grants management, and compliance with procurement rules. There are also project criteria, including how well each proposed project support economic development goals and objectives, whether a project has measurable objectives, if it has measurable milestones, and if the project has detailed cost estimates that are within budget targets.” (Source: Saipan Tribune, Aug 13, 2005)

For example, of the total amount budgeted for Covenant funds for FY 2006, the CNMI was to receive $5.171 million in Compact Impact funding under this budget as authorized in the 2003 renegotiated Compact funding agreement.

For these budgeting purposes in this Comprehensive Highway Master Plan Update, it is assumed that approximately 15% of the total Covenant fund could be used for projects in the CNMI Comprehensive Highway Master Plan Update.

8.1.2 Local Revenues and Development Fees

Historically, locally generated revenues and development fees have only comprised a small proportion of the total funds used for roadway improvement projects, largely because of the substantial amount of available covenant funds. However, there are substantial amounts of money generated through these sources, and even a small shift in the overall allocation of current funds would generate substantially more funds of highway capital improvement projects.

According to William H. Stewart a forensic economist, historian, and military cartographer. (Source: Saipan Tribune, January 19, 2007), during the period 1986 to 2004 the CNMI government's internally generated revenue was $3.07 billion. During this period the total expenditures on capital improvement projects in the Commonwealth as generated by their own internal sources was a 3.2 percent ($78.4 million). Over the above period, other government expenditures were wages and salaries of $1.6 billion (64 percent) and all other expenditures of $807.5 million (32.8 percent). The vast majority of the total expenditures made on capital improvement infrastructure projects resulted not from locally generated revenues but largely as a result of U.S. financial assistance in the form of program grants and loans and Covenant Funds. Over the period 1986 - 2004 the total reported business gross revenue generated by the private sector was $31.3 billion."

8.1.3 Department of Interior Appropriation Measures

Each year the CNMI Legislature passes appropriation measures for infrastructure improvements for roads, water, sewer and power.

The Department of Finance estimates gross budgetary resources to reach $169.55 million in fiscal year 2009, which runs from Oct. 1, 2008 to Sept. 30, 2009. However, some $3.67 million of this amount is earmarked to tobacco control, solid waste management, and the deportation fund. In addition, $7.47 million will go to payment of debts. This leaves $158.4 million available for appropriations. (Source: Saipan Tribune, April 8, 2008).

8.1.4 Other Federal Grants

The Federal Highway Administration (FHWA) has in the past and will likely continue be to a major source for potential highway improvement funds. Federal Highway grants from the FHWA have historically funded almost all major highway improvements. (Source: CNMI Highway Comprehensive Master Plan, 1997)

The National Highway Traffic Safety Administration (NHTSA) also provides grants for safety-related projects and programs through its SAFETEA-LU Overall Highway Safety Funding and

The funds allocated for the CNMI for FY 2008 total $642,112, comprising $562,175 under the S.402 formula and $79,937 under the S.405 Occupant Protection fund.

Approximately $400,000 by the CNMI was spent in FY 2007 (Source: CNMI Highway Safety Programs Annual Progress Report Year 2007.)

8.2 Likely Funding Sources for the Implementation of the CNMI Comprehensive Highway Master Plan Update

The CNMI Comprehensive Highway Master Plan Update consists of improvements totaling $255,955,300 over the 14-year period, with Short Range improvements totaling $12,390,300 over 4 years and Long Range improvements totaling $243,565,000 over the subsequent 10 years.

Funding could be provided through the Covenant the remainder potentially funded by a combination of local revenues, mainly taxes, development fees, Department of Interior appropriation measures, and other federal grants.

9 SUMMARY AND RECOMMENDATIONS

This Comprehensive Highway Master Plan updates the previous Comprehensive Highway Master Plan that was published in 1997. It provides updated traffic data, and forecasts for future year conditions for each of the three main islands. Roadway segments and intersections were analyzed to estimate traffic capacity and levels of service.

This Master Plan reassesses previous accident data and provides the status of the recommended improvements from the earlier master plan.

Based on public scoping meetings and interviews and discussions with DPW and other CNMI staff, further deficiencies and constraints in the existing roadway network were identified, and recommendations made for improvements.

To maintain the mobility on the islands, the identified improvements are divided into long range and short range recommendations. The designated timeframe for long range improvements would be from 5 to 10 years whereas the designated timeframe for short range recommendations would be from 1 to 4 years. Recommended improvements are provided both on a project-wide basis for all three CNMI islands and specific roadway improvement projects for each of the three islands.

Project-Wide Improvements

Short Range Improvements

PS-1 Roadway Pavement and Delineation Maintenance and Improvement Program

PS-2 Roadway Classifications

Saipan Roadway Improvements

Short Range Improvements

SS - 1. Intersection Modifications at the following intersections

a. Chalan Monsignor Guerrero and Chalan Pale Arnold
b. Chalan Monsignor Guerrero and Beach Road
c. Chalan Pale Arnold and Navy Hill Road
d. Beach Road and Garapan Street
e. Tun Herman Pan and Flame Tree Drive
f. Beach Road and Chalan Monsignor Martinez

SS - 2. Install new traffic signal at the following intersections:

a. Beach Road and Quartermaster Road
b. Beach Road and Gualo Rai Road
c. Beach Road and CPL Derence Jack Road
d. Beach Road and Micro Beach Road

e. Beach Road and Tun Segundo Street

SS - 3. Add vehicle turnout along Isa Drive in Capital Hill

SS - 4. Relocate existing pedestrian crossing on Chalan Pale Arnold near Commonwealth where new museum and skate park is being constructed and signalized intersection of Commonwealth and Chalan Pale Arnold

SS - 5. Improve signage and relocate driveway on Chalan Tun Road in As Terlaje

SS - 6. Add pedestrian pathway on Micro Beach Road

SS - 7. Improve signage on Isa Drive (Route 31) near Kagman Road

SS - 8. Improve signage on As Perdido Road (Route 32)

SS - 9. Add mid-block or signalized crosswalks on Beach Road

SS - 10. Speed enforcement on Chalan Monsignor Guerrero and Chalan Pale Arnold

SS - 11. Parking enforcement in Garapan

SS - 12. Vehicle Circulation in Garapan

SS - 13. Hazard Elimination along Route 30 (Chalan Pale Arnold)

Long Range Improvements

SL - 1. Construct new bridge and connection along Route 36

SL - 2. Upgrade and pave Lau Lau Road to Kagman

SL - 3. Realign Texas Road and modify Chalan Pale Arnold and Monsignor Guerrero to a four leg intersection

SL - 4. Realign Micro Beach Road between Beach Road and Chalan Pale Arnold. Widen roadway to provide a third lane that would become a WB left-turn lane, and add bike lanes. Add pedestrian pathway on Micro Beach Road**.**

SL - 5. Construct pedestrian facilities and bike lanes along Chalan Pale Arnold

SL - 6. Drainage upgrade along Chalan Monsignor Guerrero near Chalan Tun Herman Pan Road

SL - 7. Widen Beach Road from Chalan Monsignor Guerrero to Afetna to install two-way left-turn lane

SL - 8. Widen and improve Route 31

a. Widen and improve Route 31 from Kagman Road to Talofofo Road (Route 31 Reconstruction Project Phase IIB)

b. Widen and improve Route 31 from Talofofo Road to Chalan Pale Arnold (Route 31 Reconstruction Project Phase III)

SL - 9. Upgrade and improve Route 35 (Chalan Tun Herman Pan)

SL - 10. Widen and pave Route 316 (Chalan Savanna)

SL - 11. Upgrade and improve Route 310 towards Mt. Tapochao

Tinian Roadway Improvements

Short Range Improvements

TS - 1. Implement directional and guide sign program on Tinian especially in San Jose Village

Long Range Improvements

TL - 1. Upgrade and pave roadways and construct pedestrian facilities in San Jose Village

TL - 2. Upgrades and Improvements to Broadway from Route 201 south to Limestone Forest Trail

TL - 3. Upgrades and Improvements to major roadways in Lower Pina, Marpo and Carolinas

Rota Roadway Improvements

Short Range Improvements

RS - 1. Implement directional and guide sign program on Rota especially in Song Song Village

RS - 2. Eliminate sight distance issue at Route 10 intersection leading to Route 100 in Song Song Village

RS - 3. Install positive traffic control on Route 100 between Bay Breeze Restaurant/Bar and East Harbor entrance

RS - 4. Hazard Elimination along Route 10

RS - 5. Comprehensive drainage study in Song Song Village

Long Range Improvements

RL - 1. Drainage upgrade along Route 10 from Tatachok Point south to Pinatang Park.

RL - 2. Upgrade and pave Route 101 from Route 10 (College of Marianas) and along Route 11 to Ginalahan Community

RL - 3. Complete, widen, and pave Route 100 from Song Song Village to Ginalahan Community and Airport

RL - 4. Expansion of roadway and other infrastructures to Dugi area from Route 103 in Gampapa and Pegnasu areas

RL - 5. Construct bike/pedestrian path along the coastal road and collector's area

RL - 6. Widen and upgrade roadways between Sinapalo area and Bird Sanctuary Park

RL - 7. Widen and upgrade roadway connecting Gagani and Haofna

RL - 8. Upgrade and pave Route 102

RL - 9. Upgrade and pave Route 103

RL - 10. Upgrade and pave alternate routes from Song Song Village to Sailigal Hulo and to Ka'an

Estimates of the costs of the various transportation improvements were made. Based on research of potential funding sources and methods, a financial plan for funding such improvements over the next 14 years is also presented.

The CNMI Comprehensive Highway Master Plan Update consists of improvements totaling $255,955,300 over the 14-year period, with Short Range improvements totaling $12,390,300 over 4 years and Long Range improvements totaling $243,565,000 over the subsequent 10 years.

Funding could be provided through the Covenant and the remainder could potentially be funded by a combination of local revenues, mainly taxes, development fees, Department of Interior appropriation measures, and other federal grants.

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