

VS

PA-A-BM-556

309.2
S-15J

DEVELOPMENT
STUDIES

**DEVELOPMENT OF THE
CAM RANH BAY REGION:
EVALUATION AND STRATEGY**

Phase I Study

December 1966

**E.T.D. INTERNATIONAL AND
TECHNICAL REFERENCE
ROOM 1088 NS**

**STANFORD
RESEARCH
INSTITUTE**

William Bredo
Jack E. Van Zandt
William N. Breswick

**MENLO PARK
CALIFORNIA**

DEVELOPMENT
STUDIES

DEVELOPMENT OF THE
CAM RANH BAY REGION:
EVALUATION AND STRATEGY

Phase I Study

December 1966

TECHNOLOGY
MANAGEMENT
PROGRAM

SRI Project No. MU-6002

By:

William Bredo
Jack E. Van Zandt
William N. Breswick

STANFORD
RESEARCH
INSTITUTE



MENLO PARK
CALIFORNIA

Prepared for:

THE REPUBLIC OF VIETNAM AND THE
UNITED STATES AGENCY FOR
INTERNATIONAL DEVELOPMENT

Contract No. AID/fe-237

CONTENTS

I	INTRODUCTION	1
II	CONCLUSIONS AND SUMMARY	7
III	CURRENT STATUS OF DEVELOPMENT AND DEVELOPMENT PLANNING FOR CAM RANH CITY	13
	The Present Setting: Potentials versus Problems	13
	Location and General Geographical Setting	13
	Physical Features	21
	Climatic Features	25
	Physical Planning to Date	26
	Physical Facilities	34
	Roads and Highways	34
	Harbor and Port Facilities	36
	Railroad Facilities	36
	Airports	37
	Pipelines	37
	Water Supply and Distribution	37
	Sanitation	38
	Flood Control and Drainage	38
	Electric Power	39
	Communications	40
	Amenities and Services	40
	Population and Labor Force	40
	Administration and Land Ownership	42
	The Hinterland Region: Communication and Resources	43
IV	THE ECONOMY OF VIETNAM--STATUS AND PROSPECTS	45
	The Current Economic Situation in Vietnam	45
	The Overall National Economy	45
	Economic Affairs by Geographic Regions	47
	Economic Functions and Sectors	50
	Current Economic Problems	53
	Current Economic Strengths	55
	Future Economic Possibilities	56
	The Relation of Military Activity to Future Economic Affairs	56
	Future Economic Prospects	56

CONTENTS

V	DEVELOPMENT PROSPECTS OF CAM RANH BAY	61
	First Phase Study Conclusion	61
	Need for Industrial Dispersal	61
	Social Problems from Urban Over-concentration	63
	Comparison of Infrastructure Needs	64
	Possibility of Other Dispersal Points	65
	Reasons for Developing Cam Ranh Bay	69
	Factors Favoring Development Today	70
	Comparative Position of the Port of Cam Ranh Bay	70
	Port of Danang	76
	Port of Qui Nhon	78
	Port of Nha Trang	79
	Considerations in Locating Deep Water Port Facilities in Central Vietnam	80
	Port Improvements Suggested	84
VI	STRATEGY OF AN ACTION PROGRAM TO DEVELOP CAM RANH BAY . . .	93
	Development of Cam Ranh Bay Not Inevitable	93
	Government Commitment Essential to Develop Cam Ranh Bay . .	94
	Suggestion for Cam Ranh Bay Development Authority	94
	Liaison Responsibility in USAID/Vietnam	96
	Local Government in Cam Ranh City	96
	The Physical Security as It Relates to Development	96
	Joint Use of Military Constructed Facilities	98
	Emphasis on Development Through Private Investment	101
	Role of Foreign Economic Assistance in the Development of Cam Ranh Bay	101
	An International Port and Industrial Complex - Key to Development	102
	Steps in the Creation of a Port Industrial Complex	102
	The An Hoa-Nong Son Complex versus a Petro-chemical Complex	105
	Manufacture of Salt, Caustic Soda, Chlorine, Soda Ash, and Glass	106
	Cement Manufacturing	107
	Construction Materials	107
	Processing of Forest Products	108
	Expansion of the Fishing Industry	108
	Expansion of Irrigated Agriculture	109
	Establishment of Industrial Estates	110
	Manufacturing Based on Nonlocal Resources	110

CONTENTS

VI	Continued	
	Boatbuilding Industry	111
	Services and Production for the Local Market	111
	Development of a Free Trade Zone	111
	Future Employment in Cam Ranh City	112
	Physical Planning and Urban Design	113
	Relation of Cam Ranh City to Development of the Region . .	115
	Interim Urban Development Approaches	116
VII	STUDIES FOR THE COMPREHENSIVE REGIONAL DEVELOPMENT PLAN . .	123
	Planning Sequence	123
	Sequence of Studies	124
	Immediate Actions	124
	Cam Ranh Bay Hydrologic Data Program	124
	Cam Ranh City Weather Data Program	126
	Cam Ranh Bay Hydrographic Data Program	127
	Preliminary Soils and Geological Surveys	127
	Study of Steps to Resume Silica Sands Export	131
	Local Procurement by Cam Ranh Bay Military Base	132
	Basic Socioeconomic Studies	132
	Framework for Economic Growth and Development	133
	Demographic Studies	134
	Studies of Public Administration Needs	134
	Special Feasibility Studies	135
	Feasibility of a Fertilizer Complex at Cam Ranh Bay . . .	135
	Feasibility of Producing Salt, Caustic Soda, Chlorine, and Soda Ash	137
	Feasibility of Solar Salt Evaporation Ponds	138
	Industrial Estates and Industrial Dispersal Policy . . .	139
	Feasibility of Forest Products Industries at Cam Ranh City	140
	Feasibility of Cement Manufacture at Cam Ranh Bay	141
	Analysis of the Fishing Industry in Khanh Hoa and Ninh Thuan Provinces	142
	Screening Studies of Candidate Industries	142
	Restudy of Water Use--Da Nhim and Phan Rang Projects . .	143
	Feasibility of Extending Irrigation in the Suoi Tra Duc Valley	144
	Exploration of Resources in Western Highlands of Cam Ranh Bay Region	145

CONTENTS

VII	Continued	
	Intermediate and Final Development Planning Studies	145
	Outline for a Comprehensive Urban Development Plan	146
	Statement of Development Policy	146
	Regional Considerations	147
	Official and Community Coordination	147
	Social Science Studies	147
	Economic and Population Forecasts, Standards, and Future Land Requirements	147
	Alternative Concepts for the Future Form and Character of the City	148
	Alternative Preliminary Plans	149
	General Land Use Plan	149
	Implementation Features	150
	Public Works Systems Plans	152
VIII	DEVELOPMENT PLANNING PROGRAM SCHEDULE AND INTERIM ACTION PLAN	157
	Summary View	157
	Provision for Specific Review	157
	Time Phasing	161
	Interim Action Program	161
	Appendixes	
A	GENERAL BIBLIOGRAPHY	163
B	CARTOGRAPHY BIBLIOGRAPHY	175
C	LIST OF INTERVIEWS	181
D	DETAILED STATISTICAL DATA	191
E	RECONNAISSANCE WATER SUPPLY STUDY--CAM RANH CITY	199

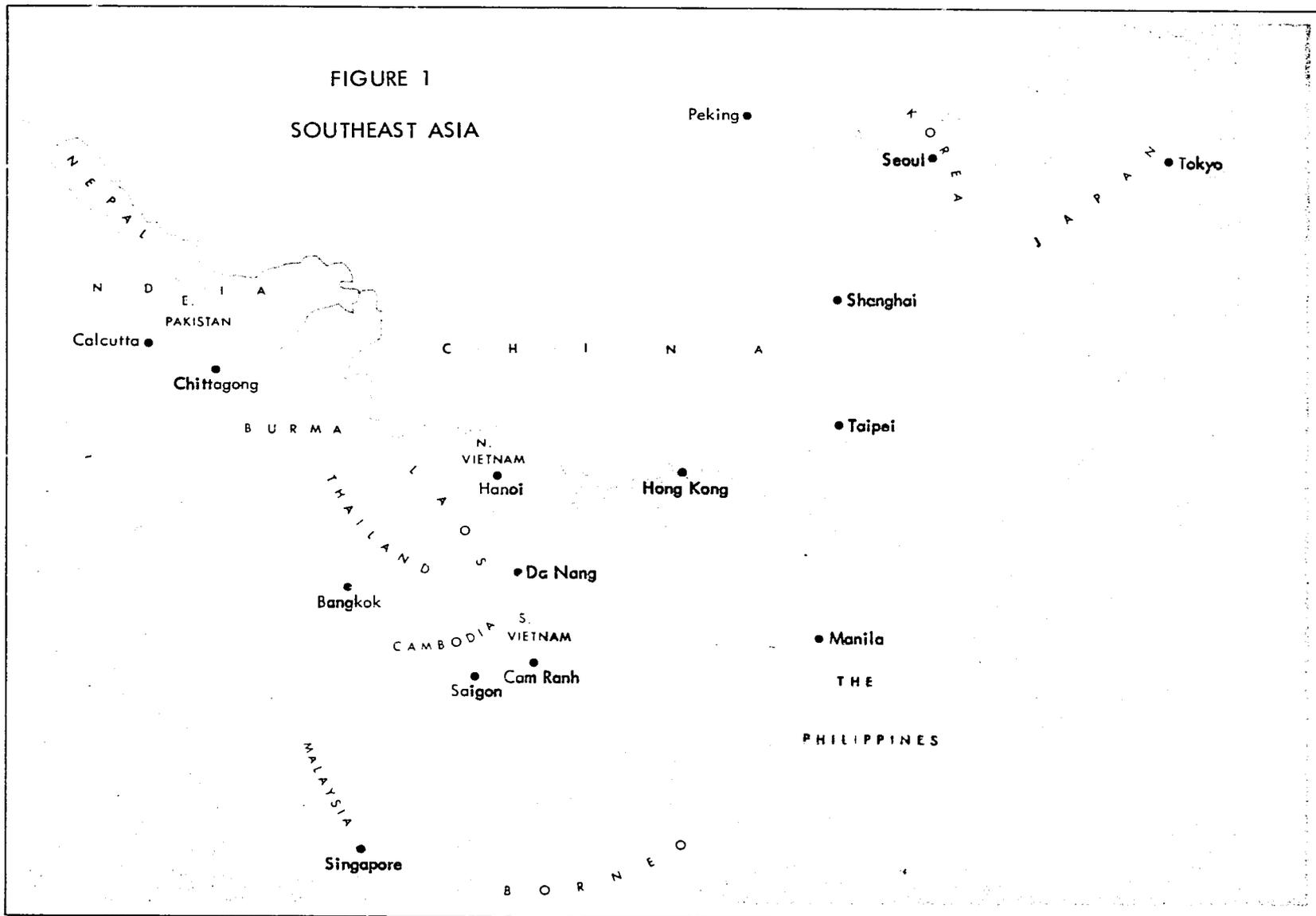
ILLUSTRATIONS

1	Southeast Asia	x
2	Relief Map--Cam Ranh Bay Region	14
3	Cam Ranh City	17
4	Geologic Map--Cam Ranh Bay Area	23
5	General Soil Map--Cam Ranh Bay Area	24
6	Population of Zones, Provinces, and Major Cities of Vietnam .	48
7	Provinces of Vietnam and Regional Population	49
8	Provinces and Major Ports of Vietnam	71
9	Steps in Preparation of Comprehensive Development Plan for Cam Ranh Bay	159

TABLES

1	Area Analyses - Cam Ranh City	19
2	Distribution of Population of Vietnam, Showing Percent Change in Regions	62
3	Population of Regions, Provinces, and Major Cities and Distances of Major Ports from Saigon	67
4	Ocean and Coastal Traffic of Major Ports of Vietnam	73
5	Projections of Total Traffic Through Major Vietnam Ports	75
6	Summary of Port Facility Improvements Proposed by DMJM	87
B-1	Cartography Bibliography	177
D-1	Population of Vietnam by Province and Region	193
-2	Population of Vietnam by Province and Zone	194
-3	Area and Population Characteristics of the Nha Trang- Cam Ranh-Phan Rang-Dalat Area	195
-4	Total Traffic Through Vietnam Ports	196
-5	Vietnam General Cargo Projections	197
-6	Details on Adjusted Figures of Cargo Projections	198

FIGURE 1
SOUTHEAST ASIA



I INTRODUCTION

The Problem

Despite Cam Ranh Bay's magnificent setting and excellent natural harbor, little effort has been made to develop this fine site into a major port and urban center. In the past, it has lacked a population, and this has been a deterrent to development. Until recently, the local people, principally farmers and fishermen, have made their homes in several scattered villages and hamlets of the Bay area. More recently, the immense U.S. military buildup in the construction of a major logistics base for the prosecution of the war has attracted many Vietnamese workers. Since November 1965, the population has expanded from 31,000 to about 50,000 a year later. But the growth has been haphazard, marked by squatting and the sprawl that are characteristic of an unplanned community, and the future Cam Ranh "City" still remains to be created.

The presence of military activity of itself cannot integrate a randomly distributed population into an organic and rationally growing urban center, as is demonstrated by historical experience. First the French, then the Japanese in World War II, and finally the Vietnamese--all have used Cam Ranh Bay, for military operations and sporadically limited commercial shipping; yet the only evidence of these activities remains as a dilapidated pier in the harbor.

However, history need not repeat itself in this pessimistic sense. The immense operations and logistical base under construction in the Cam Ranh Bay area to support the military forces provides unmistakable opportunities for giving this area a new and positive direction. Coordinated military and civilian endeavor can lay the groundwork for a long term transformation of the Cam Ranh Bay area into an urban complex, while still providing amply for the fulfillment of all the short term military requirements posed by the present national emergency in Vietnam. This can be achieved by imaginative, forward looking planning, which creates the guidelines of a conceptual framework and the detailed steps and procedures whereby the goals of rational growth and development can be reached.

The conditions for successful future growth of Cam Ranh Bay are much more favorable today than at any other time in Vietnam's history. Already, the in-migration of people seeking employment in military construction is rapidly forming the large manpower pool that is so necessary to development on any ambitious scale. In addition, money and enterprise are more available now. In the past, except for military involvement, neither governmental initiative nor private enterprise has come forward to develop the port, doubtless because development would have required a large investment and a permanent commitment of major dimensions. And finally, there is the overall environment of wartime activity and expansion. Cam Ranh

City's potential for growth is bound to be profoundly affected by conditions, resources, and policies that exist or are generated outside the region and in the national economy. The City's future will be determined by the course of the war and the extent of the Vietnamese Government's commitment of resources for development in the period of postwar reconstruction.

This study is principally addressed to the question of how the development of Cam Ranh Bay can be initiated to obtain expeditious growth of the regional economy. Although a program to generate growth should be based on maximum private investments (and minimum public investments), nevertheless in this case, some governmental direction and support are essential if investments from the private sector are to attract entrepreneurs from Vietnam and abroad.

Stages of Planning

This report, concerned with planning for the development of the Greater Cam Ranh Bay area, is submitted in fulfillment of Contract No. AID/fe-237 between the Republic of Vietnam, the United States Agency for International Development, and Stanford Research Institute. This study was conceived as the first phase of a much larger overall project, which would encompass a comprehensive survey of the Greater Cam Ranh Bay region, including the conduct of specific feasibility studies. The comprehensive survey is intended to produce an evaluation of the human, natural, and financial resources required for the establishment of an industrial and commercial center at Cam Ranh Bay. The end objective of the comprehensive survey is the preparation of a detailed development plan for the Greater Cam Ranh Bay area.

Within the framework of the broad objective, this first phase study is concerned with a preliminary assessment of the development potential of the Greater Cam Ranh Bay area, and with an outline of plans for the intensive studies to be conducted in the subsequent second phase of the overall project. The present study includes interviews with responsible officials and other knowledgeable individuals. It includes a special effort aimed at collection of important background studies and maps essential for research and planning studies relating to the development of Cam Ranh Bay.

This introductory study is designed to assist in reaching decisions on the steps that need to be taken with respect to the development of the Greater Cam Ranh Bay area. Some of these decisions are on policy, which will be the concern of the Government of Vietnam and the United States Agency for International Development. The report also outlines a comprehensive program of feasibility and planning studies, based on a time table of performance, and arranged in a sequence logically related to a future development program supporting rational future growth of the Cam Ranh Bay community.

At this stage of the research, prospective growth of Cam Ranh Bay and of the surrounding region cannot be clearly visualized, although the general impression is that future prospects appear favorable. In any event, the question of future growth should receive more detailed study

in the next phase of research, in order to assess the effect of various investment levels and patterns on the future growth of the port-oriented Bay area industrial complex and the hinterland region. Some studies are proposed, therefore, on the role of an industrial nucleus and port complex in fostering extended development of the Central Vietnam economy, with the objective of decentralizing national economic activity, particularly in the industrial sector.

Scope of Present Study

Chapter III examines the physical environment, the physical infrastructure, and the amenities existing in Cam Ranh City, in order to provide an understanding of the base from which further plans for development will necessarily have to proceed.

Plans for future development of Cam Ranh City and the surrounding region must be cast within the framework of Vietnam economic growth. This matter is discussed in Chapter IV, which views the growth of the port and industrial complex within the national setting, and which is designed to contribute to knowledge of regional dispersal of industrial activity.

Chapter V presents a tentative discussion on the economic development prospects of Cam Ranh City, emphasizing the assets and strengths of a major port and industrial complex located at Cam Ranh Bay.

The conditions that must prevail and the strategy of development to be pursued in establishing a successful industrial and trading center at Cam Ranh Bay are discussed in Chapter VI, which leads to the research and planning program described in Chapter VII.

The suggested program of studies in Chapter VII represents a design for structuring the content of the future development program for Cam Ranh City and the overall region. In Chapter VIII, these studies are time-phased in a logical sequence to each other, and in relation to the planning and design of facilities. The first three appendixes bring together the extensive literature consulted, the excellent cartography available, and a list of the numerous persons interviewed and contacted.

With respect to future industrial development on which heavy weight may well have to be placed, the planning includes (1) a proposed series of pre-investment feasibility studies, based principally on resources available in and around the Cam Ranh Bay area; and (2) studies to screen industrial investment possibilities not based on local resources--i.e., studies oriented to domestic and foreign market opportunities. Studies are also proposed to develop the agricultural production potentialities of the Bay area and to provide the basis for organized physical development of Cam Ranh City in particular. Feasibility and planning studies are required for developing the physical and socioeconomic infrastructure.

In this planning study, the view has been taken that the opportunity should not be missed, when creating the physical comprehensive plan and planning the future amenities of Cam Ranh City, to build in a decided

aesthetic tone and to establish a community which will attract investment and stimulate entrepreneurship.

The team which initially embarked on field work in Vietnam consisted of two economists, including the team leader, and a civil engineer. Immediately on arrival in Vietnam, it was agreed among the parties concerned that the water supply situation at Cam Ranh Bay could seriously affect future development of the Bay area, and a clause of the contract was activated to bring a water resources specialist to Vietnam for an investigation of what was known of the water situation and what steps would need to be taken to define and solve the potential water problem.

The field work in Vietnam was conducted over the period May 3 to June 5, 1966. Most of the survey was conducted in Saigon. All members of the team had the benefit of one or more visits to the Cam Ranh Bay area and Nha Trang, and some members visited Phan Rang. The trips included close-up-helicopter observations of the entire area in and around the Bay, including the peninsula and the Tra Duc Valley on the mainland west of Ba Ngoi. The team leader returned to Vietnam for ten days between August 17-26 for briefing discussions on the draft final report. At that time, he visited Cam Ranh Bay again to observe at first hand the rapid developments and transformations currently in progress there.

Acknowledgments

The Institute team benefited at all times by the full cooperation and assistance obtained from all officials contacted among the various agencies of the Government of Vietnam and the U.S. Agency for International Development. The great interest of Government officials in the development of Cam Ranh Bay and in assisting the SRI team was exceptionally evident. Special mention for assistance rendered must be made of Mr. Nguyen Anh Tuan, Director General of Planning and Chairman of the Cam Ranh Bay Committee; of Mr. Khuong Huu Dieu, Secretary to the Cam Ranh Bay Committee and Assistant for Commerce to the Minister of Economy; of Mr. Au Ngoc Ho, Assistant for Industry to the Minister of Economy; of Mr. Au Truong Thanh, Minister of Economy and Finance, who gave the team useful policy guidance and made the resources of his Ministry available; and of Mr. Truong Thai Ton, Secretary of State, who advised in connection with the revision of the final report.

The SRI team is indebted for valuable assistance received from all officials and staff members in the U.S. Agency for International Development. In the Washington office of AID, unstinting help was given by Mr. Selig A. Taubenblatt, Director, Office of Capital Development and Finance, Bureau for Far East; by Mr. Nahman Zirinsky of the same office; and by Mr. Donald P. Barnes, Director, Engineering Staff, Bureau for Far East, and various members of his staff. In Saigon, the team was fortunate to have its work supported by the great personal interest in the Cam Ranh Bay project on the part of Mr. Charles A. Mann, Director, U.S. Agency for International Development in Vietnam, whose staff at all levels provided generous support. The team is especially grateful for

the assistance rendered by Mr. Frank Werther, Director, by Mr. Frederick Ritchie, and by other members of the Private Enterprise and Industry Division, USAID/Vietnam, who acted in a liaison capacity and assisted in planning and guiding operations during the survey.

This project was carried out at Stanford Research Institute under the continuous interest of Dr. Stewart Blake, Executive Director, Management and Social Systems Research Area, and of Mr. Albert Shapero, Director, Technology Management Programs, whose staff had direct responsibility for conducting the project. The project was conducted under the direction of Dr. William Brodo, Senior Economist. He was substantially assisted in the field as well as at Menlo Park by Dr. William N. Breswick, Economist, and by Mr. Jack E. Van Zandt, Civil Engineer. Mr. Robert L. Nevin, Consulting Civil Engineer of Los Altos, California, was primarily responsible for the portions of the study concerned with water resource development planning. Brief consulting assistance on urban planning aspects was rendered by Mr. Abraam Krushkhov, member of the city and regional planning firm of Ruth and Krushkhov, Berkeley, California. Appreciation is also due to Mrs. Margaret A. Carroll, Research Analyst, to Mr. James L. Bicksler, Financial Economist, and to Dr. S. A. Cogswell, Senior Industrial Economist, for research assistance, and to Miss Donna J. Chicka and Mrs. Constance B. Ruch for secretarial support. Special acknowledgment is made of the substantial contribution of Mr. Frederick Goshe, Senior Editor. Other members of the Institute staff contributed to the content and quality of the report through individual consultations.

II CONCLUSIONS AND SUMMARY

Rationale

Events at Cam Ranh Bay are today providing an unprecedented opportunity for developing a deep water port and associated urban-industrial complex at this well-located and unusual natural harbor of Central Vietnam.

Current construction of a large military base is correcting some deficiencies that have heretofore retarded the development of Cam Ranh Bay:

1. Many workers, including refugees with families, are being attracted to the construction project, so that the population may soon be large enough to function as the nucleus of an urban center.
2. The influx of people is inducing all those concerned--the military in charge of construction, the Government of Vietnam, and the U.S. Agency for International Development--to plan the necessary human facilities: e.g., housing, water supply and distribution systems, sewage systems, schools, places of worship.
3. There is the practical possibility that some infrastructural elements, such as water and sewage systems, may be built jointly for the use of civilians and military personnel; that other facilities, such as an airstrip, may be turned over to community use when the war emergency is over; and that new facilities, such as the bridge across the Bay narrows, will generally enhance the conditions for living and working in Cam Ranh City.

Early Decisions

There is urgent need for early action on development work at Cam Ranh Bay to take advantage of the military construction program while it is still in progress. The Government of Vietnam will therefore want to come to an early decision on whether it wants to undertake a major effort to develop Cam Ranh Bay. In view of the desirability of the location and the apparent good future prospects of Cam Ranh Bay--insofar as these can be determined at this stage--the Government may find it useful to make the decision within a broad industrial policy framework.

By all measures, the Vietnam economy is highly concentrated in the Southern Region, which contains both the rich agriculture of the Delta and the commerce and manufacturing of Saigon. About 90% of manufacturing employment is located in Saigon, which is also the financial center of the country. The Government is keenly aware of this tendency toward

"over-concentration" in Saigon, and of the disparities in regional per capita levels of living that are bound to stem from it. Consequently, the Government may wish to consider seriously a national policy for industrial dispersal as a means of making calculated economic impacts in selected regions. A decision to develop a major port and industrial complex at Cam Ranh Bay could be the first step in the implementation of a policy of national industrial dispersal.

A decisive commitment by the Government of Vietnam to develop Cam Ranh Bay is essentially a public statement of intentions. Among other useful purposes, the statement would inform the business community of the commitment and should encourage the private investment that is vital to industrial and commercial development of Cam Ranh Bay.

At the same time, the assistance of aid-giving countries in this venture may be explored by the Government in order to obtain funds for direct investment in specific facilities of the infrastructure, or foreign nationals may be persuaded to invest in the establishment of certain industrial plants.

For effective implementation of the decision to develop Cam Ranh Bay, the Government of Vietnam may wish to consider establishing a special agency charged with this responsibility--possibly designated as the Cam Ranh Bay Development Authority. The Chairman of the Authority would have executive responsibility and would be guided in policy matters by four to six board members chosen from dedicated officials of the government and respected members of the business community. The Cam Ranh Bay Development Authority would operate as a semi-autonomous agency, possibly reporting to the Minister of Economy and Finance. It would have essentially a planning, promotional, and developmental function with an adequate budget and staff. It would implement the program for developing the Cam Ranh Bay Region through promotional and liaison activity with existing agencies and private enterprise, and through possibly direct involvement in establishing and managing certain infrastructural facilities for port and industrial development.

Immediate research and planning studies should be undertaken in order to initiate comprehensive planning for the development of the Cam Ranh Bay Region, with emphasis on the development of Cam Ranh City. The opportunity now presented should be seized, and current decision-making investments having a communitywide effect should be guided so that the social benefits are enhanced.

Program for Development of Cam Ranh Bay

In a comprehensive program for developing the Cam Ranh Bay Region, emphasis should be placed on physical design planning for Cam Ranh City, development of the urban-industrial complex, and development of deep water port facilities. The development of projects in the hinterland should be integrated into this overall objective. The creation of a new center of economic activity in the Central Region would assist in raising income levels more comparable with levels in other areas of Vietnam.

All research and planning studies would be designed to contribute to the formulation of the comprehensive regional development program as the end-product. The plan would be the basis for public and private action under the leadership of the Cam Ranh Bay Development Authority.

Some immediate action decisions regarding the Cam Ranh Bay area are available to the Government of Vietnam. These could include:

1. Determine a means of obtaining a resumption of the silica sand exports.
2. Initiate collection of environmental data that would contribute to better future planning.
3. Study means of undertaking procurement of selected goods and services by the Cam Ranh Bay military authorities from local business sources.
4. Study the feasibility of establishing a chemical industries complex, preferably at Cam Ranh Bay, with appropriate decisions regarding the An Hoa-Nong Son complex, the refinery of the Vietnam Refining Company, and the possibility of using the equipment of the An Hoa-Nong Son enterprise already in Vietnam.
5. Study the Phan Rang Irrigation Project to resolve certain key problems affecting its future development, including future land use and exportable supplies of water available to Cam Ranh City.

Additional industrial feasibility studies, based principally on resources of the region, are proposed. These studies, if indicated as industrially feasible and implemented, could eventually lead to the formation of a strong chemical industries complex at Cam Ranh Bay. Industries based on fisheries and forest products also represent future possibilities. Screening studies for other industrial investment possibilities are suggested. Also of high priority is a study to explore the terms and conditions of a possible policy of incentives to encourage the movement of industrial investment to Cam Ranh Bay.

Several socioeconomic studies are proposed. A study projecting future port traffic and economic growth within the national economic framework and prospects is considered basic for a more definitive evaluation of Cam Ranh City's future economic prospects. Demographic studies, particularly of the local population, its structure and needs, are essential for the physical planning studies. Public administration needs of the growing city should be studied, with the goal of establishing future local government on a stable and effective basis, politically and financially.

General intermediate planning studies are required for assessing the feasibility of various projects of the infrastructure: water supply and distribution systems; sewage distribution system; local traffic and highway improvement program; housing construction programs; and so on. 11

these cases, projections of future requirements would be based on the socioeconomic studies. The intermediate studies should include the study and creation of alternative urban design plans for Cam Ranh City.

Finally, studies of the various systems comprising the components of the planning program will be assembled, along with the City's general land-use and urban design plans, which are the final product of urban planning and design efforts. This work is considered a mandatory part of the program for the development of Cam Ranh City. The general land-use and urban design plans establish the aesthetic tone of the future community, and when implemented, will determine the way in which people, space, structures, and natural features will relate to each other in all aspects of daily life for a long time to come. All this work must be of high quality, consonant with the unusually fine natural setting of Cam Ranh Bay and matching the boldness of the program to develop it.

Future Prospects

The future prospects of a port and industrial complex at Cam Ranh Bay appear favorable at this stage. Long range cargo projections place Cam Ranh Bay next in importance in volume of traffic to Danang by 1985, but growing at a faster rate. Both of these ports show higher projected rates of growth than Saigon, for which a trebling of cargo tonnage is forecast. With good deep water port facilities and supported by the excellent sheltered harbor, Cam Ranh City would probably compete as far north as Qui Nhon and halfway to Saigon--an expanse that would represent a large hinterland region. The plan to develop a Cam Ranh Bay port should take the longer range view of considering it in the context of completion with other ports on the Central Vietnam Coast. A reasonable long range strategy would be to bring the port facilities at Cam Ranh Bay to a satisfactory level and to let it become the dominant port on the central coast between Saigon on the south and Qui Nhon and Danang to the north, rather than to build up competing ports by scattered investments at this time. However, further economic study of this matter is needed, since the future comparative position of the port of Cam Ranh City will be directly affected by a Government decision to undertake development of a major regional industrial complex at this location.

Summary

- The choice of Cam Ranh Bay as the site for a new city of substantial urban growth potential can, at this stage, be said to be the correct one, subject only to (1) the extent of the public commitment toward its development and to (2) the imagination of its designers. The setting parallels that of other great bay regions throughout the world, and if treated with respect and care, could be developed into one of Southeast Asia's and the world's most handsome and functionally efficient port cities.

- In attaining this goal, the overall problem is finding the best way to integrate natural features with man-made facilities under the constraints of time, financial resources, and immediate needs. There are unremitting pressures to convert the area to urban uses as quickly as men, machines, and money can do the job, with the consequent risk of neglecting long range objectives for expediency. Every day, the pressure to make decisions adds new constraints to planning for this future new city.
- Every decision affecting the physical development of Cam Ranh Bay should be conceived in a long range context; too much is at stake to settle for short range solutions. Time and history will bear out this judgment.
- If sought in time, the answer to this overall problem lies in an action plan based on meaningful knowledge, intelligent analysis, creative design, far-sighted political leadership, and effective financial and implementation programs.
- The only realistic, yet practical, way in which this plan of action can commence is by initiating immediately the comprehensive development planning and research program for Cam Ranh Bay highlighted in this chapter, the details of which are contained in Chapters VII and VIII of this report. The results of such a program -- the Development Plan -- will represent a comprehensive statement on how people, land, money, community facilities, public utilities, governmental policies, and administrative and incentive programs can be brought together into a meaningful viable force for rational development.
- Concurrent with the initiation of the long range comprehensive program, problems of the most imminent nature must be met by the preparation of an Interim Land Use Plan for Cam Ranh City, including (1) an interim program for the location of in-migrants, (2) an interim land sale policy, and (3) a possibly modified community housing project. It will be essential to maintain a posture of the greatest flexibility in initiating the features of the Interim Land Use Plan.
- Finally, it will be necessary to initiate required physical improvements (discussed in Chapter VI) (1) to maximize Cam Ranh Bay's competitive position as potentially the second largest port facility in Central Vietnam (next to Danang), and (2) to satisfy the immediate health, safety, and welfare environmental factors of Cam Ranh Bay's burgeoning population.

III CURRENT STATUS OF DEVELOPMENT AND DEVELOPMENT PLANNING FOR CAM RANH CITY

The Present Setting: Potentials versus Problems

Cam Ranh Bay has all the natural characteristics required for a great social, cultural, and economic center. Mountains, vegetation, and flatland offer a variety of visual appeals and habitable situations to accommodate a growing population. Yet this potential is also accompanied by serious problems for planners and developers. The overall problem is finding the best way to integrate natural features with man-made facilities under the constraints of time, financial resources, and immediate needs. There are unremitting pressures to convert the area to urban uses as quickly as men, machines, and money can do the job, with the consequent risk of neglecting long range objectives for expedience. Another constraint is that military requirements for a major logistics base preempt the use of the peninsula enclosing the Bay on the east. The demand is urgent for housing, community facilities, and public utilities to support the growing resident population employed on military construction. Projects are being approved and implemented before a comprehensive analysis and plan can be completed to assure that everything will be located in its proper place, that every dollar of the infrastructure will be properly spent, and that every fine feature in the landscape and the seascape will be protected from abuse and encroachment in the years ahead. Security problems brought about by the national military emergency hamper complete studies of the Bay area and the hinterland. The in-migration of refugees from war-torn villages and hamlets aggravates both the plight of those displaced and the ability of the area to accommodate them properly and humanely. The daily pressure to make immediate decisions adds new constraints to planning for the future.

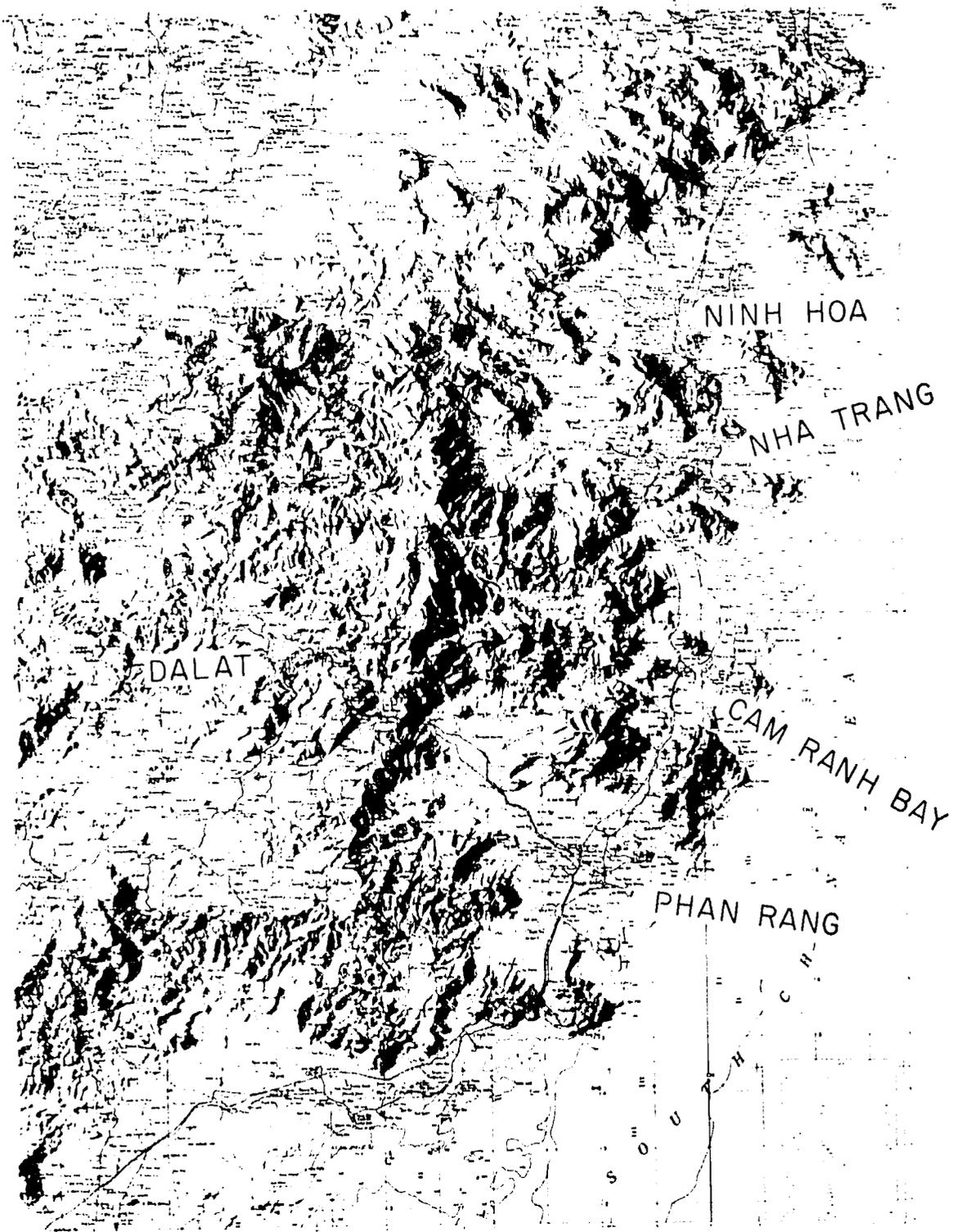
This chapter discusses the current status of development of Cam Ranh City. From visual observations and preliminary analyses, it is our opinion that every decision affecting the physical development of Cam Ranh Bay should be made in a long range context; too much is at stake to settle for short range expedients. Time and history may well bear out this judgment.

Location and General Geographical Setting

The newly created City of Cam Ranh is located at Cam Ranh Bay on the central coast of Vietnam on the South China Sea. It is situated midway on the coast, approximately 600 kilometers south of the 17th parallel and 600 kilometers north of the southern tip of Vietnam. See Figure 2.

FIGURE 2

RELIEF MAP - CAM RANH BAY REGION



Cam Ranh City is 300 kilometers by air and 383 kilometers by road northeast of Saigon, and approximately 430 kilometers by water from the port of Saigon.*

A further definition of this "central city" in Vietnam relates it to neighboring urbanized areas. Cam Ranh City lies equidistant between Nha Trang, 40 kilometers by air to the north, and Phan Rang, 40 kilometers to the south. Directly west about 80 air kilometers is the City of Dalat. These cities form an almost perfect triangle, with Cam Ranh City at a central position along the base. Each city has also a different character: Nha Trang (58 road km.) is a noted resort town to the north; Phan Rang (45 road km.) is a potentially major agricultural center to the south; and Dalat (114 road km.) is a major fruit and vegetable producing center as well as being a potentially excellent "mile-high" vacation city to the west. From a study of relief maps, elements of a future conurbation encompassing Ninh Hoa, Nha Trang, Cam Ranh, Phan Rang, and Thuang Thuy are readily apparent along the central coast of Vietnam.

Cam Ranh City, created by the Government of Vietnam (GVN) on October 25, 1965, consists essentially of seven small villages, which are situated along and around the shores of Cam Ranh Bay. The City formerly occupied areas in both Khanh Hoa and Ninh Thuan Provinces. The temporary administrative offices, including the mayor's office, are located at the village of Ba Ngoi. Ba Ngoi, with a reported population of approximately 25,000, is situated directly across the widest part of Cam Ranh Bay from the Grande Passe, the entrance to the Bay, and is essentially surrounded on three sides by bay waters.

The land area now within the city boundaries is about 369 sq. km. This, plus the water area of 116 sq. km. within the Grande Passe, and the Outer Bay with 47 sq. km. extending to Tagne Island, indicates a total present city area of 532 sq. km.

As an aid in discussing various features and proposals as well as in considering long range planning, the City has been divided into 13 planning areas, shown in Figure 3: Peninsula-Military, Peninsula-Upper, North Highlands, North Central, North Central Fringe, Central, Lower Suoi Tra Duc Valley, South Central, South Peninsula, Tagne Island, Upper Bay, Inner Bay, and Outer Bay. Also noted on the figure are four areas which could potentially become part of the City and which are discussed in the section on "City Boundaries". These are: Upper Suoi Tra Duc Valley, Upper Suoi Cat Valley, Upper Suoi Dang Loi Valley, and North Highlands-West.

Table 1 further describes these areas by size (sq. km., sq. mi., hectares, acres) and by topographic characteristics ("flat to rolling" terrain) that could be potentially susceptible to development.

* All distances are measured from Ba Ngoi.

Physical Features

Topography

The topography of the Greater Cam Ranh Bay area (Cam Ranh City, its adjacent areas, and the watershed areas to the west and south) consists of flat to mountainous terrain. Elevations vary from sea level to an average of 1,000 meters on mountain tops, with some peaks rising to 1,450 meters. Because of the particular city boundary as created in 1965, Cam Ranh City might readily be classed as having a flat to rolling terrain, with only a few local areas being considered steep or mountainous. Approximately 83% of the land area within the City is less than 100 meters in elevation; the more mountainous areas above that elevation tend to be well delineated by abrupt increases in land slope. Table 1 indicates, by planning area, the relative amounts of land above and below the 100 meter contour.

A study of the contours and land slopes on topographical maps suggests the use of this 100 meter demarcation line. Land areas below this contour vary in slope from 0% to 20%, with a predominance of 0-15% slopes (15 meter vertical rise in 100 horizontal meters). The steeper slopes (approximately 8-15%) usually occur within 300-500 meters of the 100 meter elevation. Land slopes above the 100 meter elevation vary from 20% to 100%, with a few isolated areas having slopes of approximately 15%.

Figure 3 defines several areas outside the city limits line. These areas contain a greater percentage of hilly to steep land. Also included in Figure 3 are the major rivers that traverse the area and represent rivers having year-round flows normally. Many lesser streams have not been shown; these either have no year-round flow or flow partially underground. Because of the lack of stream gauging measurements and Intensity-Duration-Frequency data, streamflow magnitudes are not indicated. Additional information is presented in Appendix E, and suggestions for further studies of streams are presented in Chapter VII.

Topographic mapping is available with map scales varying from 1:250,000 to 1:20,000. For general planning purposes, these maps are adequate, and no further field topographic surveys are required at this time. (For design studies of particular land developments, larger scale mapping with a higher order of accuracy would of course be required.)

Hydrography

Figure 3 shows depths (in fathoms) for both the Inner Bay and the Outer Bay. These data were taken from French surveys of 1907, 1909, and 1935. Depths in the bay range from relatively large shallow areas of 1-3 fathoms to 10 fathoms near the Grande Passe. The passage through the Outer Bay (Area 0) has depths of 11 to 15 fathoms and is free of dangers to shipping.

The Directorate of Navigation (Inland Waterways Service of GVN) has recently completed hydrographic surveys for an area extending from the pontoon bridge at My Ca southerly to a point approximately 6 kilometers south of Ba Ngoi. The results of this survey are currently being reduced and plotted at map scales of 1:10,000 and 1:20,000. The U.S. Naval Hydrographic ship "Mauri" conducted some hydrographic work in the Bay for military purposes. The work of GVN is found to be excellent and will be of the greatest use in future planning. As no depth data were discovered in the Upper Bay (Area M), certain additional soundings are suggested for this area in Chapter VII.

Tide levels within Cam Ranh Bay range from a Mean Higher High Water of 5.6 feet to Mean Lower Low Water of 2.3 feet. Spring tides in June occasion a Mean Higher High Water of 7.1 feet, and in December, Mean Lower Low Water of 0.5 feet.* The Mean Tide is 4.0 feet, with an annual Mean variation of 4.9 feet (approximately 1-1/2 meters).

From all indications, the Bay offers almost complete shelter, with ground swells of not more than 2 or 3 feet in height. There is, however, a severe lack of information on tidal current force and direction (see Chapter VII).

Geology and Soils Conditions

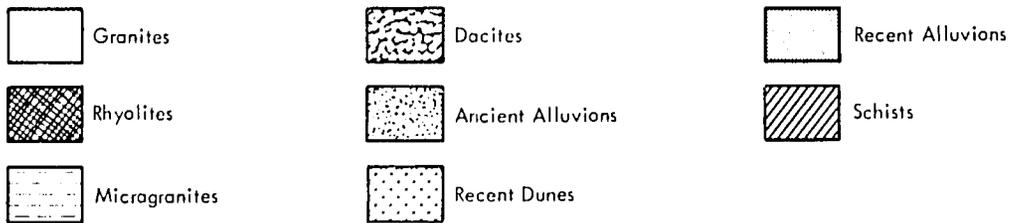
Figure 4 and Figure 5 for the Cam Ranh Bay area have been reproduced from original maps published by the National Geographic Service of Vietnam at Dalat. The geological map was published in 1962 and the soils map in 1961. Except for a few isolated soil borings and well drilling explorations, little definitive work has been done at a scale needed for studies relating to the development of the Cam Ranh Bay area. Both Figure 4 and Figure 5 are based on studies of Vietnam as a whole. Although they offer some inferences on geology and soil formation, more definitive explorations would be necessary to properly plan Cam Ranh City.

The granite outcroppings as well as the alluvial plains indicated on Figure 4 exemplify the nature of the topography discussed previously. The indication of soft bay deposits at the southwesterly end of the Bay suggests a careful analysis of any land developments that may be proposed for this area. Similar deposits of soft bay clays extending to depths of 20 feet were also found in the upper reaches and along the peninsula side of Area N (Inner Bay) by soil borings made in March and April of this year for the military. Earlier test holes at the USOM pier situated on the westerly shore of Area A indicated thicknesses of 30 to 40 feet of soft clays. Two borings to the north for the military second DeLong pier showed a 30-foot thickness. The caissons for the first DeLong pier were some 148 feet in length before sufficiently firm resistance was established; the penetration through soft bay clays was estimated at approximately 50 feet.

* Tidal heights are above datum of soundings.

FIGURE 4

GEOLOGIC MAP - CAM RANH BAY AREA



SOURCE: National Geographic Service of Vietnam, 1962.

FIGURE 5

GENERAL SOIL MAP - CAM RANH BAY AREA



 Undifferentiated alluvial soils.

 Saline alluvial soils.

 Regosols on white and yellow dune sand.

 Gray podzolic soils on old alluvial sediments; plane to undulating topography.

 Complex of mountainous soils, mostly red and yellow podzolic soils and lithosolic soils.

SOURCE: National Geographic Service of Vietnam, 1961.

The "Bottom Sediment Chart--Cam Ranh Bay to Cape Varella," a 1913 Hydrographic Office publication, also indicates "mud-soft smooth bottom" for almost all of the Bay. Coral limestone deposits exist offshore of the mainland, along the westerly and southerly portions of the Bay; 14 test holes drilled there in December 1963 indicated that the average thickness of this coral was at least 1 meter and that the possible reserve might be some 6 million tons. Sands and sandy soils have also been found underlying the Bay immediately offshore of the military peninsula. These sands are currently being dredged for causeway construction. A long strip of silica sand connecting the military peninsula to the mainland is discussed in a later section (Physical Planning to Date).

Because the bay bottom clays possess very little cohesive strength and bottom sands can be expected to "run," proposed future channel or deep-draft turning basins may present a problem. Such factors do not prevent construction, but only affect physical size, cost, and maintenance procedures. Observations of current military dredging may be useful for future planning.

Climatic Features

Cam Ranh Bay, like the rest of the country, is influenced by the two monsoon seasons--two distinct periods of the year when monsoonal air flow from one direction predominates, with the change in direction of air flow occurring in a one-to-two month transition period. The Northeast monsoon runs from early November to mid-March, during which the heaviest rains occur in the northern sections of the country. The Southwest monsoon period lasts from May to late September, causing heavy rains in the southern portion. At Cam Ranh Bay, the 10,000 foot military runway on the peninsula exemplifies the monsoonal airflow characteristics by being constructed in a generally northeast-southwest direction. The prevailing wind at this location occurs in the direction of the runways approximately 90% of the time. On the other hand, some of the strongest winds (occurring in June, July, and August) at Nha Trang to the north occur in a northwest-southeast direction. This phenomenon, of course, is due to topography and local features existing in a particular area--for example, wind conditions at Ba Ngoi will bear their own particular characteristics.

Recorded data at Nha Trang's weather station indicate that typhoons (wind velocities exceeding 60 knots) are infrequent. Eighteen tropical storms have been recorded. The maximum recorded velocity from 1950 to 1961 was 47 knots. The average velocity over 10 years of record prior to 1953 was 7.1 knots. In the same period of record, 305 thunderstorms were recorded in the vicinity of the Nha Trang station, indicating an average of 30 per year, with most of them occurring from June to October.

Local information on wind force and direction will be useful in locating port facilities, small boat harbors, and heavy industrial plants where ship handling, off-wharf mooring, industrial smoke, gases, odors, etc. are important considerations. The lack of available information within the

planning area suggests the need for additional data and is discussed in Chapter VII.

In the case of rainfall data, precipitation has been recorded at Ba Ngoi from 1927 to 1944, and again from 1960 to 1965. These records indicate an average rainfall of 45 inches per year. The minimum year shows less than 11 inches, and the maximum year, 107 inches. The heaviest rainfall occurs from September through December. However, the records at Ba Ngoi reflect conditions at sea level, and the mean precipitation over any of the surrounding higher elevations would be somewhat greater.

As in the case of wind measurements, data on temperature, humidity, pressure, and nebulosity are not available at Cam Ranh Bay but rather at Nha Trang--the closest weather station, 40 km. to the north.

Air temperature at Nha Trang varies from 38° to 103°F, with an average monthly temperature of 80°. Although the extremes of relative humidity range from 22% to 100%, the most significant indication is the average monthly relative humidity of 81%.

As discussed in Chapter VII, certain inferences and extrapolations might be made from the Nha Trang data about weather conditions at Cam Ranh City. The potential future importance of Cam Ranh as a major port city suggests the early installation of its own meteorologic station. Data records on wind, temperature, humidity, pressure, nebulosity, fog, sunshine and storms will be useful for many social, physical and economic purposes--industry; fishing; shipping; commerce; land, air and water transportation; tourism.

Physical Planning To Date

It is apparent to anyone involved in planning for the long term development of the Cam Ranh Bay area that an extensive amount of interest and concern exists for this part of Central Vietnam. Historically, international, national, regional, and local interests--public and private--have all had something to say about developing the region. Yet, however they may disagree regarding their programs and proposals, they all agree that Cam Ranh Bay has the potential of becoming one of the most beautiful and sheltered harbors in Southeast Asia, and of ranking high among worldwide harbors.

The problem is to move from "potential" to "reality," as is discussed elsewhere in this report. The existing national situation involving the military, as well as current social and economic pressures, have created needs that must be met in the shortest possible time. Hence, an up-to-date viewpoint of Cam Ranh Bay, and particularly Cam Ranh City, can bring into focus a wide variety of conditions and restraints which bear heavily on the need for planning throughout the area.

During the past 12 to 15 months, a series of separate planning programs has been prepared for the area. These programs and proposals have been produced as published reports, graphical plans, and budgets; and of course, a few actual construction programs have been carried out under the necessity of military urgency. There has been some attempt at coordination and integration of a few of these various plans, proposals, and projects. By and large, however, the necessary ingredients--coordination and collaboration--have been and are nonexistent, at least insofar as sound, rational, and comprehensive city and regional planning is concerned.

The following paragraphs discuss some of these programs.

Military Buildup

The most significant recent occurrence underlying the impetus to develop Cam Ranh City is the construction by the U.S. Government of a major logistics base and port facility on the Cam Ranh peninsula (Figure 3--Area A). Because of the importance attached to military requirements in the vicinity of the new City, the problem here is to plan and design in such a manner as to prevent Cam Ranh City from becoming more than just a military-based city.

There is no doubt that the military buildup on the peninsula offers exceptional possibilities for the early development of Cam Ranh City, by (1) generating a sizable labor force, (2) creating support services, (3) providing consumer goods, (4) creating physical facilities such as roads and bridges, and (5) possibly creating such joint-use facilities as water systems and sewage treatment plants. Since the current urgency is for completing the work on the peninsula itself as a military base, no immediate advantage can be realized on the mainland side in terms of public works construction. Nevertheless, in the immediate future, various physical works could be undertaken, as discussed in Chapter VII.

Although up to 8 kilometers of distance separates the mainland from the peninsula, which could limit the potential feasibility of joint-use public facilities, consideration of such use at this time cannot be discounted and should be further pursued in Phase II of this study. Much will depend upon where population and/or industrial centers are developed on the mainland side, and the relative cost of alternate piping systems on both sides of the water area.

The foregoing comments are based on the assumption that the military peninsula will, in fact, remain a major military logistics base for the immediate future. Although this assumption connotes an area of highest level decision and policy, some early policy statement is needed before rational and logical long-range comprehensive planning can proceed for the entire Cam Ranh Bay area.

Silica Sand Reserve

Upper Peninsula (Area B) shown on Figure 3 denotes the long slender strip of land connecting the military peninsula to the mainland at the north. It is estimated that this area contains from 400 to 500 million yards of high-grade silica sand. This feature is a major natural resource for both industrial and future recreation use. For many years to come, there seems to be little doubt about the preservation of this area as an extractive industry resource, the potential for which is discussed in other sections of this report. Ultimate uses such as possible beach frontage recreation would have to be made compatible with military activities to the south. It is not too early to indicate that this area's industrial and recreation potential is much greater than its use for residential purposes of any kind; however, the choice among potentials can be resolved in Phase II.

Refugee Areas

A major planning problem affecting the Cam Ranh Bay area is to provide for refugees from areas undergoing military strife. If GVN policy requires refugees to be accommodated in Cam Ranh City, two major questions will have to be answered in the planning program:

1. Where should refugees be located with the least possible complications for comprehensive physical planning?
2. What shall be the standards of physical development (housing and utilities) for the creation of these refugee settlements?

As is the case with several other current planning proposals discussed herein, the answers lie in the development of a comprehensive general plan.

Refugee settlements have been proposed in: areas north of Hon Rang Mountain; an area near My Ca; an area immediately west of the Workers Community Housing Project; an area in the Suoi Cat Valley (Area L); sections of the upper Suoi Tra Duc Valley (Area K). Some refugees have settled on Tagne Island.

Regarding the resettling of refugees now in Cam Ranh City to other areas within the City, it is suggested that this activity be stopped until a comprehensive plan can be developed. The probability of having to be moved twice would certainly not be looked upon with favor. As far as the in-migration of new refugees is concerned, the following might be considered interim measures pending completion of the comprehensive plan:

1. Establish temporary settlements that are substantially removed from the Ba Ngoi area. Temporary roads and services could be provided--mainly to improve the plight of the refugees, and to improve access to employment areas.

2. Protect the entire coastal area against temporary settlements, in order that sufficient study can be made to maximize the great development potential inherent in this unique resource of "land at the water's edge."
3. Provide the following patterns if refugee settlements are located in predominately agricultural valleys away from the Ba Ngoi area and the coast line:
 - a. Agricultural uses could be permitted to remain in the development of the region, with an agricultural labor supply built in from the beginning.
 - b. Agricultural uses could serve as transitional areas and reserves of open space until the population pressure and employment buildup justify encroaching therein. Relocation and demolition programs could then be accommodated with greater study and care, and possibly less cost, than if refugee settlements were permitted to scatter and sprawl throughout the coastal areas where reservations of land are needed for long range development.
 - c. Denser urban settlements of a permanent nature could be encouraged in selected areas, and on a controlled basis at a later date, near the port and the coastline--and into the rolling foothills surrounding the flatlands.

Community Housing Project

Because of the military needs for a large labor force performing both services and construction, and the need to reduce present illegal squatting, a community housing program is currently scheduled for development immediately west of Highway 1 and north of Ba Ngoi. This \$7 million investment is to produce some 2,800 dwelling units, five schools, one or two places of worship, neighborhood stores, and administrative offices on a site some 280 hectares in size. Included in this program would be infrastructure sufficient to accommodate the resident population.

This project is generally referred to as being "temporary" in nature. Considering what has been learned of it to date, coupled with the demands that will continue to be placed upon the City of Cam Ranh, it would appear that this project will in fact be quite permanent, at least for many years into the future when possibly the economy of the area could support an urban renewal and relocation program.

The unarguable need for this project, its urgency, and the extent to which design and location studies have progressed thus far--all indicate the necessity for immediate examination of the long term effects of this project upon the City. (An Interim Cam Ranh City Land Use Plan is discussed in Chapters VI and VII.)

Therefore, before site engineering plans are completed, and construction work begins, immediate and serious consideration should be given to relocating the Community Housing Project away from its present proposed site. The present site has obvious potential for becoming part of a major port-oriented urban complex, complete with governmental and communication services, cultural facilities, large scale commercial enterprises, business offices, entertainment areas, and high quality housing for residents and tourists. This area will be the first view of the new City from the Grande Passe, as ships enter the Bay. If the Community Housing Project is built on the site as proposed, it may never be moved, and will present the future City with virtually immutable, built-in problems of housing and traffic congestion in an area with the finest development potential in the City.

Alternative sites can be studied which would minimize the extension of water and sewer lines into outlying areas. If alternative sites are not feasible at this time, another possibility would be to build the project in phases, with the southern anchor portion being built first. By the time it is completed, the development of a comprehensive city plan should be considerably advanced, and a decision can then be made to extend the project to the north as planned or to extend it to the west up the Suoi Tra Due Valley. An even better course would be to move the housing project farther to the west along the base of Hon Rong Mountain, which would conform to an early French plan for the urbanization of Ba Ngoi.

Architect Ngo Viet Thu's Plan

Because of the present need for worker and civil servant housing, and the in-migration of refugees, an urban design plan was made by Architect Ngo Viet Thu in the latter part of 1965. The plan generally encompasses land areas F and H immediately north and south, respectively, of Ba Ngoi. Some of the ideas advanced in this plan exemplify the urban design possibilities and the exciting potential the area has to offer from a contemporary design standpoint. The plan is primarily conceptual in nature, and since it was not based upon detailed economic, demographic, and comprehensive regional studies, its ultimate merit cannot be determined at this time.

A more detailed urban development map, being a somewhat more precise study of a portion of architect Thu's concept map, was prepared by the Directorate General of Reconstruction and Urban Planning. This work indicates lot and block locations, street widths, types of housing, and density of family units. This plan should be examined in relation to studies of the future form and function of the new City, and in relation to analyses and studies of such developmental features as land use, community facilities, density, highway relocation, major street and road patterns, traffic generation, major sewer collection and outfall lines, major water transmission and distribution points, and flood control channels. At the very least, use of such plans and concept studies as were prepared by Architect Thu and the Directorate General could be held in abeyance until sufficient supporting information and documentation are available as a basis for their review and analysis.

Industrial Center and Harbor Report By Nippon Koei Co., Ltd.

The Nippon Koei report of November 1964 primarily covered the industrial development possibilities of Cam Ranh Bay, in relation to water and power source possibilities to serve potential industry. Although this study is discussed elsewhere in this report, it is mentioned here as another example of "areawide" planning for Cam Ranh Bay carried out in a relatively isolated context. A land-use plan was presented in that report showing suggested housing, industrial, commercial, and port uses.

The plan contained in the report suggests--as does Architect Thu's plan--that industry be placed in the southwestern portion of the bay area. Some evidence has been found about soil conditions that may preclude this area, or at least portions of it, from industrial use because of possible high costs of land reclamation. However, "high costs" are a relative matter, and with sufficient economic impetus in the industrial sector of the economy, such reclamation may well be justified. Nevertheless, this matter cannot be decided until further studies have been made.

Because insufficient knowledge exists with which to properly evaluate this plan, further research and feasibility studies are suggested in Chapter VII. Before any area is set aside for any use, comprehensive studies should be completed which take into consideration all aspects of Cam Ranh Bay's setting; its potential for a diverse physical, social, and economic entity; and its functional, aesthetic, and spatial relationships, both manmade and natural. The Industrial Center and Harbor Plan by Nippon Koei Co., Ltd., might fit well into a General Land Use Plan for the Cam Ranh Bay area, but on the other hand, might be subject to considerable alteration, depending on the assumptions and objectives that will underly the General Land Use Plan.

Harbor Facilities Plan by Daniel, Mann, Johnson, and Mendenhall

Another plan for the development of Cam Ranh Bay, or at least a small segment thereof, was produced by Daniel, Mann, Johnson, and Mendenhall (DMJM) in January 1966. This plan for pier facilities requires the same kind of review--in this case with respect to location and scale--as suggested for the plans prepared by Architect Thu, the Directorate General, and Nippon Koei Co., Ltd., in order to determine its applicability to development of Cam Ranh Bay as a whole. (Chapter VI discusses the economic and physical comparisons with other ports, as reported by DMJM.)

Temporary Causeway and Pontoon Pier at Ba Ngoi

Plans are being made for the construction of an earthen causeway and a pontoon pier approximately 500 meters west of the existing T-pier at Ba Ngoi. At present, it is not clear why this temporary pier is going to be constructed. On the other hand, it would provide a means of attracting coaster traffic as a first step toward renewed port activity on the mainland side of Cam Ranh Bay. The pier should be temporary within

a fixed time limit; an official policy statement about the use, cost, and eventual removal of this temporary facility would help eliminate it as a constraint on future comprehensive investigations.

Highway Planning and General Budget Spending

One area of capital improvement programming, which is directly related to comprehensive planning, is that of budget expenditures for public works on an annual basis. Such funds are being applied to highway and bridge repairs; reconstruction; relocation; drainage works; power facilities; railway system trackage; and other works. This form of activity is necessary and must proceed in an orderly manner if certain important facilities are to be kept operational. However, current work could be limited to those projects which assure ongoing operations, while major new works or relocations could be postponed until they could be better dovetailed into the overall General Land Use Plan.

City Boundaries

The establishment of the city boundary for Cam Ranh City was based more upon political than functional considerations, and should now be considered subject to changes as the planning program proceeds.

Whereas Province lines, District lines, sections of the railway system, and other fixed permanent features such as large bridges are often ideal for city boundary establishment, less permanent features are generally poor boundary delineators. For example, streams can meander, and contours of elevation can be changed by simple excavation. Both types appear to have been used in the establishment of the boundary for Cam Ranh City. Another excellent demarcation of city limit lines are straight line projections from mountain peak to mountain peak. Such demarcations generally offer permanent, long term, visual definition of city boundaries.

Additional areas which deserve consideration for annexation to the City are designated as Areas K, L, P, and Q in Figure 3. They are described as follows:

1. Upper Suoi Tra Duc Valley (Area K) is felt to be logically annexable to Cam Ranh City, because of its logical connection with Lower Suoi Tra Duc Valley (Area G), which is within the present City. This area currently contains people who are closer to Cam Ranh City than Nha Trang to the north. Obviously, the needs, services, and even the complaints of the people in this area would be better met by Cam Ranh City than by areas to the north. Area K could serve as an area for water supply, underground water storage, and surface reservoirs, as well as for irrigable agricultural use.

2. Upper Suoi Cat Valley (Area L) is suggested for annexation primarily for the same reasons as just discussed for Area K. It is a logical extension to the north from Area K and of course to the west from Area F.
3. Upper Suoi Dang Loi (Area P) is annexable primarily because it contains the valley lands upstream from the named river and is in close proximity to Areas D and E. If Area P is not annexed to the City, then Area E should be de-annexed. Area E as now defined by the present city limits line is a long, slender piece of ground with a widened section on both sides of the river at its north end. This land configuration will cause problems in carrying utilities and services across the railroad and river, thereby increasing service and maintenance costs for a small parcel of land and relatively few people. By annexation of Area P to the City, the mountain peaks in Areas P and Q can be used for boundary delineation and thereby include within the City the flatter lands adjacent to the river, as well as the foothill and valley areas to the west.
4. Upper Highlands-West (Area Q) creates an orderly and logical northern boundary of the City, especially when one views its logical extension from Area C. Again, the Grand Summit not only sets an excellent city boundary point, from both a visual and a land survey basis, but also establishes a logical valley crossing over the railroad and Highway 1 to the Hon Not peak northwest of Area B. With the annexation of Area Q, the possible "meandering" city limits line along the Suoi Dang Loi River is eliminated.
5. Areas R and S are logical valley extensions, and Area T may provide a very fine industrial site at a higher elevation overlooking the lower lands and the Bay. Relatively minor boundary changes such as these can be incorporated, as may be required, during the completion of a General Plan.

The municipal boundary of Cam Ranh City may remain the same throughout the development planning program, except where suggested annexations of adjacent territory may be acted upon by the appropriate legislative body. The subcity boundaries have been designated mainly on the basis of geographic and some pre-planning considerations and judgments.

One of the functions of a comprehensive planning effort would be to establish logical units of planning area within Cam Ranh City as a basis for more detailed, larger scale, precise planning and engineering studies. These planning areas may coincide with, or suggest the modification of, currently delineated subareas within Cam Ranh City, and would be derived from studies of geographic, hydrographic, economic, social, and physical planning functions. These areas would become units of statistical area within which demographic and economic data could be collected, documented, compared, and analyzed on a continuing, consistent basis, year in and year

out. This procedure would be similar to the manner in which U.S. Census data are collected and analyzed by Census tracts, enumeration districts, and blocks for comparative purposes on a decennial basis.

Physical Facilities

Roads and Highways

Within Cam Ranh City, 42 kilometers of National Route No. 1 extends in a northsouth direction primarily along the shore line of Cam Ranh Bay. This section of Highway 1 is part of the national highway system, and more particularly, is a link in a major highway loop extending from Saigon, Phan Thiet, Phan Rang, Cam Ranh City, Nha Trang, Ninh Hoa, Ban Me Thuot, and southerly back to Saigon. Cam Ranh City would also be immediately north of another important proposed highway loop--Phan Rang to Dalat to Highway No. 1 north of Saigon, to Phan Thiet, and back to Phan Rang.

Although many sections of these major transport circuits are under the influence of the Viet Cong, the portion in the Cam Ranh Bay area is relatively secure. The 42 kilometers within the City, however, have some very narrow sections (4 to 5 meters) where the passage of two trucks is seriously hampered. This road, generally constructed with a 5-inch crushed rock base and oil treatment surface, is in various stages of disrepair; its condition might be classified as "fair" to "very poor".

Approximately 45 bridges along the route, many of which are of temporary wood or steel construction, are similarly in various stages of disrepair. Also, some sections of the road, particularly in the northerly area of the City, are of such an elevation that they are subject to storm water overflow and damage. Other than the road's narrowness and the low elevation of certain sections, the main current problem affecting its condition is the high use of military traffic over the roadway. Although within the past several months the military has accomplished some widening of portions of the highway, it still has many ruts, chuck holes, and a general washboarding of its surface.

The "10-Year Plan of Highway Improvement" prepared by the Ministry of Public Works and Communications indicates that the section of highway between Nha Trang and Phan Rang will be of Class B type (9 meters of roadbed and 6 meters of roadway). This was based at that time on an estimated 1975 Average Daily Traffic (ADT) of 1,664 vehicles and a 1985 estimated ADT of 2,000. The section as proposed would no doubt carry these relatively low volumes of traffic, but in view of changing times, military build-up, and the potential urban development of Cam Ranh City, the standard should be raised to at least a Class A section (10 meters of roadbed and 7 meters of roadway). Sections that are subject to overtopping or flooding from storm runoff should be raised to provide a minimum of at least 1/2 meter above highest expected flood conditions. Further, as repair and new construction programs go forward, many of the bridges can be eliminated, by stream diversion, ditches, and channel work carrying runoff

waters to single undercrossing points. As pointed out in the prior section on "Physical Planning to Date," expenditures can be limited to keeping this highway operational, while deferring major expenditures until a Comprehensive Development Plan is formulated. The Roads and Highways element of this plan will indicate appropriate roadway sections, locations, relocations, heights, and general standards for a highway-secondary-local road system. A staged construction program would also be included in order that a balance between expenditure and need could be maintained.

A permanent overwater structural bridge is proposed for construction by the military at approximately the location of the existing pontoon bridge. This will be a great advantage to the City because of the need for crossing the Bay, and will thus avoid going around its long, slender portion. Besides the criteria dictated by military urgency and need, the following should be considered:

1. There should be sufficient clearance between high tide and the underside of the bridge structure to allow fishing vessels and barges to navigate under its central portion. This clearance might be determined by (a) a survey of fishing vessel and barge types that have operated in, or are now traversing, the channel way between the Upper Bay and the Inner Bay (Area N), and (b) a review of all similar type boats registered with the controlling agency. A major segment of the applicable boat and barge sampling should be accommodated by the bridge clearance.
2. The width of the bridge should accommodate at least two passing trucks and provide room on both sides for bi-wheeled and tri-wheeled vehicles. The design of the bridge ideally should allow for future cantilevered sections for the ultimate carrying of pedestrian traffic, clear of the roadway.
3. The construction of an overhead clear span bridge would preclude the construction of a saltwater barrier across the Upper Bay, at least from an economic point of view. The bridge would make it unnecessary to construct an earthen barrier that could accommodate a roadtop surface. The possibility of a fresh water lake in the Upper Bay is felt to be infeasible (discussed in the Reconnaissance Water Supply Study included in Appendix E), and therefore such a possible conflict in facility construction is unlikely.
4. Use of the Upper Bay lagoon as an area of possible salt-evaporation ponds depends on several factors: a hydrographic sounding survey; feasibility of industrial desalting; market for the product; export economics, etc. Such a possibility should not influence the proposed bridge construction as these ponds would no doubt be located by small dike construction further north in the Upper Bay.

Harbor and Port Facilities

The only port facilities of any consequence have been, and are continuing to be, constructed by the military, and are all located on the peninsula side of the Bay. With the assumption that the peninsula and its facilities will be used operationally by the military for many years in the future, discussion on the use of port facilities for civilian purposes would be of little value; even if limited civilian use could be realized in the future, military dockage priority as well as military wharf and yard operations would severely hamper efficient and economical port operations as they relate to the future commerce of Cam Ranh City.

On the mainland side of the Bay, an old commercial cargo pier extends approximately 750 meters southerly from the shoreline at Ba Ngoi. The 8.5 meter by 80 meter "T" pier end has approximately 6.6 meters of water alongside and can accommodate most of the coastal freighters; however, it is in such poor condition that vessels using it have been advised that they do so at their own risk. Transit sheds, warehouses or other covered storage, water, electricity, and cargo handling equipment are not available at this pier. The spur track and traveling gantry crane are virtually useless at present because of disuse and lack of maintenance. The spur track from the pier head to the mainline system is 5 km. long; a graded roadway 2 km. long connects the pier head with Highway 1.

Certain navigational aids exist at and near the Grande Passe; however, it is reported that all the lights have been extinguished. Shore to ship radio or visual aids are nonexistent, except, of course, those the military may have in use. Hydrography, tides, and currents are discussed elsewhere in this report.

Mention has also been made of the reports of Daniel, Mann, Johnson, and Mendenhall, and Nippon Koei Co., Ltd., and the construction of a temporary pontoon pier facility at Ba Ngoi.

After the economic study on port-oriented commerce and the Transport Systems Plan is completed, then the location, size, and capacity of the port facility can be reasonably determined. (Interim developments are discussed in Chapter VI.)

Railroad Facilities

Within the city boundaries of Cam Ranh City, approximately 35 km. of the Vietnam railway system traverse both waterfront and foothill areas. This 1-meter gauge railroad is operational in approximately the area between Nha Trang to the north and Phan Rang to the south. On the other hand, a major portion of the system, as it extends from Saigon to the northerly limits of Vietnam, is inoperative today. In Cam Ranh City, other than the spur track to the pier head at Ba Ngoi, little, if any, ancillary trackage or raiiside service exists. As in the case of the highway traversing the City, numerous railroad bridges exist--many of which can be eliminated by relatively simple stream diversions, as repair and reconstruction programs go forward.

Airports

Cam Ranh City has no commercial civilian airports. Air Vietnam provides local air transportation from the Saigon international airport--Tan Son Nhut--to Dalat and Nha Trang, west and north respectively of Cam Ranh City.

The military runway of some 10,000 feet in length (with an additional parallel runway now being constructed) is situated on the peninsula (Area A) and is solely for military use. Again, it is assumed that this situation will not change in any reasonable near term planning period. The military airstrip at Dong Ba Thin several kilometers north of My Ca on the mainland side of the Bay is of the perforated metal plank type. It is understood that runways of more permanent construction, taxiways, and other airport facilities are being constructed at this site. At present, its use is military; if and when civilian air traffic can be accommodated at this field, considerable advantage may accrue to the development of Cam Ranh City. In any event--whether it remains under military operation, becomes a joint-use facility or possibly even converts to all-civilian aviation--care must be exercised to ensure proper planning of the areas surrounding the field and of appropriate clear zones and approach zones within current and projected flight paths.

A small airstrip, possibly 1,700 feet in length, is situated west of the railway tracks 5 kilometers southwest of Ba Ngoi. Apparently this is an abandoned strip, and no immediate advantage is envisioned. In the longer range, however, depending upon its physical condition, the improvement of the runway for possible executive/industrial aircraft might be considered. This consideration would depend on the potential of locating industry in the area--a prerequisite that would be overriding.

Pipelines

Pipelines, as one form of transport system (not including water and sanitation), are nonexistent in Cam Ranh City today. Pipelines functioning as industrial carriers--whether of raw material or of finished products--are general considerations in the industrial economics and industrial siting requirements that are covered by certain research studies proposed in Chapter VII.

Water Supply and Distribution

Cam Ranh Bay has no planned and integrated water supply system, and therefore no distribution system. Water is drawn from relatively shallow local wells along the mainland side at the points where aggregations of population exist; similarly, local wells provide water on the peninsula side. There is no treatment of the water for civilian use; it is understood that self-contained treatment units are being used by the military

for filtering, flocculation, and chlorination. The nearest water quality control and testing laboratories are at Nha Trang.

Cam Ranh City, with its approximately 45,000 inhabitants; the increase in refugees to the area; the increase in military demands; and the potentially gigantic health and sanitation problem--all necessitate the most urgent attention to water supply and distribution. Potential industrialization, agricultural expansion, and to some degree port commerce are three more reasons for early emphasis on water. The Reconnaissance Water Supply Study is reported in Appendix E; a recommended Water Systems Plan is considered in Chapter VII.

Sanitation

In Cam Ranh City, there are no sanitation facilities (collection, treatment, disposal, etc.)--a deficiency that creates a major environmental and health problem. Chapter VII discusses a recommended Sanitation Systems Plan Study that includes the collection, treatment, and disposal of sanitary sewage; the collection and disposal of garbage; the abatement of mosquito infestation and rodents; and water pollution considerations.

The development of a sanitary system and a domestic water program offers health and environmental advantages, creates jobs, bolsters the economy, and offers the attraction necessary to bring industry and commerce to Cam Ranh Bay.

In the public health sector, it is reported that Vietnam has more rat infestation (and therefore rat fleas) than anywhere else in Southeast Asia; however, Cam Ranh Bay has no reported cases of plague to date, no doubt because as yet there is no large population base. If Cam Ranh City does in fact become a major shipping center, special health controls such as quarantine, inspection, and dock control must be maintained to prevent the incidence of plague.

Cam Ranh Bay has no malaria problems, which mainly occur in the more mountainous areas. Yellow fever is nonexistent, primarily because there is essentially none in the country as a whole. Cholera, typhoid fever, infectious hepatitis (all waterborne diseases) have not been problems in the past, and should not be problems in the future, provided that proper precautions are taken to improve the water supply system. There is no reported problem from beetles, bugs, snakes, or other ground crawlers.

Flood Control and Drainage

Storm drainage waters emanating from the hundreds of square kilometers of watershed areas surrounding Cam Ranh Bay are carried through the City to the Bay by several relatively large streams and by numerous minor ones. These same streams also carry the storm waters that fall directly on the City's lands; drainage of local built-up areas is generally by overland sheet flow to the nearest creek or stream, or when the rainfall is not severe, by direct percolation into the surface soils.

The problem of adequately and safely handling surface runoff has possibly not been fully appreciated because of the low density of development--i.e., a low economic benefit factor meaning that the cost of damage to property is much less than the cost of preventing such damage by the construction and maintenance of flood control facilities. On the other hand, the loss of human life, as was reported in the December 1964 floods, could well justify the installation of certain flood control works, even though the value of damage to real property may be relatively low. In any event, as the in-migration of more and more people expands the population base and thereby stimulates great increases in building and facility construction, flood control and drainage facilities must be considered in the near future. For these reasons, a plan for a citywide system of flood control and local drainage is a logical necessity within the framework of the General Land Use Plan and the other public facility planning programs.

Electric Power

Located at Ba Ngoi is a 600 KW generator, the only power source within the City. This generator operates primarily to meet the demands of the public and administrative buildings at Ba Ngoi. Domestic power demands, which may be on the order of 4,000 to 5,000 KW, are currently unsatisfied.

The single large source of electric power with the most potential for the City of Cam Ranh is the Da Nhim hydroelectric plant near Dalat on the Phan Rang road. This plant was constructed in two phases-- (1) 80,000 KW capacity completed in late 1963 and (2) 80,000 KW capacity completed at the end of 1964. A third stage project at the Da Nhim plant would increase this present 160,000 KW capacity to 320,000 KW. A downstream project called Da Nhim No. 2 is proposed to yield 80,000 KW of installed capacity. Because of sabotage of the 230 KV line running from the Da Nhim plant to Saigon, the transmission of power, and therefore the operation of the plant, has been out of service since May 1965.

In the meantime, a 33,000 KW thermoelectric plant has been completed at Saigon, so that when the Da Nhim plant is again put in operation, approximately 200,000 KW of installed capacity would be available in the Saigon area, not including some 55,000 KW of local steam and diesel sources. In view of an estimated 1970 load demand of 200,000 KW for metropolitan Saigon, capacity would only slightly exceed demand. Accordingly, other major sources of power generation should be considered at an early date, either for central coastal areas or for replacement of a portion of the supply to Saigon from Da Nhim. The 80,000 KW Da Nhim project No. 2 mentioned above, 82,000 KW of power generation in the area of Ban Me Thuot, and the upper Se San project potential of 100,000 KW--all are possibilities for additional power. Major sources of power emanating from the Mekong River, which are now being considered, will in time give tremendous impetus to national power development.

Although power supply to Cam Ranh City, even considering heavy industrial build-up, is not envisioned as a major problem, it generally takes

4 or 5 years to add a major hydroelectric or steam plant to a system. It may be expected that developing Mekong River power would take many years longer.

Communications

A telephone system exists between all major provincial towns and autonomous cities, except for Cam Ranh City where there are no facilities. The International Telephone and Telegraph Company is completing installations at Nha Trang to the north, Phan Rang to the south, and Dalat to the west, but is doing nothing in Cam Ranh City. A teletype system connects Saigon with Nha Trang, Phan Rang, and many other chief towns, but again no facilities are located at Cam Ranh City. The City does have side band radio facilities, although reception is generally poor, sometimes being totally inoperative. There is no formal post office or mail service. An ARVN radio relay system exists between Nha Trang and Dalat, and between Dalat and Phan Rang. A submarine telecommunications cable between Nha Trang and Manila was scheduled for completion by 1965; the status of this link is unknown at present.

Cam Ranh City cannot long endure this gross deficiency of being excluded from the overall communications network of the country. As with so many other required public facilities, the demands to be placed upon the communication system by industry, commerce, and the general population must be satisfied by prudent and logical long-range planning and development.

Amenities and Services

Cam Ranh City has a small commercial section in Ba Ngoi, including a variety of shops, a public food market, quite a number of tailoring enterprises, and other small service establishments. Laundering services are being extended rapidly, many on contract with the armed forces.

The City has about 30 office buildings, about 20 administration offices, about 10 churches, and 65 pagodas of various sizes. A local inn, managed for years by the same family, provides good food and limited accommodations for travelers. Fishing, boating, and swimming at excellent beaches are available to the residents and visitors. At present, amenities and public services in Cam Ranh City are poorly developed. The City is without any fire and police protection. There are no satisfactory schools in the area.

Population and Labor Force

Changes of major dimensions are taking place in the City of Cam Ranh. Many workers, with and without dependents, are being attracted to the community by the employment and business opportunities created by the huge

construction program and the growing number of troops being established at this major military base. The population census of November 1965 provided an official estimate of 31,000 people, compared with 24,000 in 1964 (unofficial estimate) for Cam Ranh City. The rapid in-migration began with the initiation of the construction program about June of 1965 and has continued ever since. As of November 1966, the population of Cam Ranh City could easily be 50,000 persons.

In August 1966, a downtrend in construction employment on the Cam Ranh Peninsula appeared to be developing. However, employment in the area was not necessarily declining as a whole, since growing employment opportunities were being created by the expansion of military base personnel. Construction contracts of the RMK-BRJ consortium are due to end the middle of 1967, but one may expect that these will be extended to provide the facilities required for properly establishing troops on the base. Thus, total employment at Cam Ranh Bay--particularly on the Peninsula--may remain approximately at a peak level through the 1966-1967 fiscal year, and perhaps from that point on, a gradual decline in employment could take place.

The influx of workers does not provide a clear indication of total in-migration to Cam Ranh Bay. It is not known how many family dependents are normally associated with every construction worker. It is understood that absenteeism at the construction sites is also very high, amounting to about 17%, so that more workers are required in the area than are actually working. Also, many others are coming in who are providing services to the base personnel and the rest of the community. Only a good demographic study would provide answers to these questions, which need to be known if suitable planning is to be carried out for properly settling, or perhaps resettling the many squatters currently moving into Cam Ranh City. So far, about 200 refugee families, including a total of about 850 persons, have also arrived. Over the next year, perhaps a total of 500 refugee families may be established in different locations at Cam Ranh City to be engaged in agriculture or in working on the construction sites.

Prior to construction of the Cam Ranh Bay military base, the community was devoted principally to agriculture and fishing--about 60% of the people being employed in agriculture, and about 30% in fishing. Another 6% were engaged in commerce, and the remainder in professional handicraft and governmental activities.

Currently, the fishing industry is becoming much less attractive because of better alternative economic opportunities, and is declining rapidly. Some fishermen have gone into construction directly. Many of those that own boats, especially boats equipped with motors, have become ferry-men between the mainland including Ba Ngoi and the Peninsula or the islands in the mouth of the Bay.

Conceivably, as a result of present lucrative economic opportunities, the fishermen may be able to modernize their boats and equipment so that eventually the fishing industry may achieve a resurgence.

There are very few skilled workers in Cam Ranh City. A few repair shops exist, such as watch repairing and bicycle repairing, but apparently hardly any automobile repair shops. Such repair facilities could be used to a substantial degree in servicing the Armed Forces and the construction companies at the base.

Present economic opportunities are attracting a certain amount of entrepreneurship. About seven lumber mills were set up in the area between May and August; and perhaps 10 or more small laundry facilities have been established, some operating under contract to the Armed Forces. Also, quite a few service shops and retail shops selling a limited variety of goods are being established in Ba Ngoi and other areas of concentration.

Administration and Land Ownership

The Government of Vietnam anticipated some of the social and development problems that would arise from the huge construction program at Cam Ranh Bay; and in the middle of 1965 established Cam Ranh City as an autonomous municipal government. A Mayor was appointed who reports directly to the General Commanding Region II. The Mayor is responsible for the urgent problems associated with this burgeoning community, and has a small office staff. Since May 1966, the U.S. Agency for International Development, through its Provincial Operations Division, has provided an advisor to work closely with the Mayor in dealing with community problems.

The Government of Vietnam also foresaw that land speculation could become a problem associated with the growth of the community; and the sale of land to private persons was prohibited. As far as can be determined, most of the land in Cam Ranh City is in government ownership, excluding the farm land in the nearby agricultural valleys. Under French colonial rule, the Railway Corporation owned some land in the town of Ba Ngoi. However, the railway, through one way or another, had alienated some of this land; and the ownership of this land, now in private use through delegation from the railway corporation, is not clear at this time. This applies particularly in the village of Ba Ngoi, where many people established themselves on the railway property. The railroad, meanwhile, has become a government corporation, and it may be that the government has really no control over the land within the village of Ba Ngoi. Another difficulty is that procedures regarding land titles have varied between the two provinces that formerly divided the Cam Ranh City area. In the northern section, formerly in Khanh Hoa Province, there apparently was less freedom in giving clear titles; but in Ninh Thuan, the title situation was much clearer.

In any case, Central Government ownership and control of the land and prohibition of its sale are creating one of the major problems in Cam Ranh City today. It is estimated that about 1,000 houses have been located illegally in recent months by squatters on land owned by the government. Many of these people apparently would be willing to buy the land, but because of the freeze, have been unable to do so. At the same time, the absence of a land-use plan obviously prevents the squatter housing

from being established in properly designated residential areas. This activity inevitably creates future resettlement problems with all the attendant hardships and difficulties. There is thus the need for (1) an early designation of a suitable land-use pattern for residential and other economic and social uses of the land in Cam Ranh City, and (2) an early decision in regard to land sale policy.

The Hinterland Region: Communication and Resources

The presence of the railway link and National Highway No. 1, connecting all important coastal urban centers, places Cam Ranh Bay in good communication with supplying and demanding communities to the north and south on the coast of Vietnam. Cam Ranh Bay is blocked to the west by a massive plateau with an altitude generally topped at 2,000 meters. The mineral resources of this area are virtually unknown. However, the forest resources centering around the Dalat region are very extensive and could be exploited to an even greater degree if the area was eventually made physically secure. This area contains a major resource of significance to the development of the hinterland region and of industrial opportunity at Cam Ranh Bay.

In addition to timber resources, the Dalat area has become noted for the production of vegetables and fruits for the Saigon market, an activity which will no doubt be resumed after the cessation of hostilities.

The other major resources in the Cam Ran Bay regional hinterland are represented in the agricultural valleys surrounding the communities of Phan Rang to the south and Nha Trang and Ninh Hoa to the north. The Phan Rang irrigation valley is currently in process of being developed. Conceivably, agricultural improvements, including greater diversification, can also be undertaken in the agricultural valleys immediately to the north.

Access to these agricultural valleys will be comparatively economical from Cam Ranh Bay, after the area is secure and highway and railway transportation facilities are improved.

Access to the hinterland region to the west is available via a northerly route on Highway 21 from Ninh Hoa to Ban Me Thuot, not far from the Cambodian border, and via Highway 11 from Phan Rang to Dalat. Poorly developed sections of Highway 21 connect Ban Me Thuot to Dalat.

The TCI report gives high priority to the development of an interior highway, and makes special reference to the route between Ban Me Thuot and Saigon, consisting of Highways 21 and 20. High priority is also given to improvement of Highway 11, where the road, on the escarpment from Dalat to Phan Rang, particularly, appears to need vast improvement if it is to carry a heavy truck traffic of timber and agricultural commodities.

These projected improvements would complete the circular highway linkage of the Greater Cam Ranh Bay area, joining the urban communities of

Nha Trang, Ninh Hoa, Ban Me Thuot, Dalat and Phan Rang, plus many points of lesser importance in the western highlands, to Cam Ranh Bay.

Although the movement of commodities internationally between Laos and Cambodia to Cam Ranh Bay may not be particularly relevant today, this future linkage nevertheless may eventually become of some importance, enabling these countries to obtain access to world markets by the route through Cam Ranh City.

IV THE ECONOMY OF VIETNAM--STATUS AND PROSPECTS

This chapter presents a review of the current national economic situation, and offers some previews of the future economy. The purpose is to show the national economic setting in which Cam Ranh Bay may develop, and to provide perspective from which to view that development.

The description of the current economic situation is essentially a secondary review which leans heavily on the work by Transportation Consultants, Inc. (TCI).^{*} This description is admittedly sketchy, because of the same limitations which TCI and other investigators have encountered--namely, basic economic information is not satisfactory as to completeness, accuracy, or description of normal conditions. The future possibilities are given as a range of conditions that might arise, reflecting the relationship of present and future military affairs in Vietnam to economic change in the country.

The Current Economic Situation in Vietnam

The Overall National Economy

South Vietnam comprises an area 173,000 sq. km. (about 67,000 square miles, or three-fifths the size of Arizona). Present political and administrative delineations show 46 Provinces which are further subdivided into a total of about 240 Districts; the National Capital (Autonomous Prefecture) of Saigon; and five Autonomous Cities (Hue, Danang, Dalat, Vung Tau, and the recently established Cam Ranh City). There are about 2,500 villages and some 12,000 hamlets.

The total population of Vietnam in 1965 was about 16.5 million. That figure can be only an approximation, for several reasons. First, the extent of the "controlled population" (persons considered to be under effective control of the Government) is difficult to assess; it may be one to two million less than 16.5 million. Second, the substantial movements of refugees from North Vietnam into and within Vietnam make it further

* The analysis and forecasts of the Vietnam economy made by Transportation Consultants, Inc. were especially valuable in this study. Much of this present chapter, especially the first section on Current Economic Status, has been derived directly from the TCI work, and acknowledgment of this benefit is here made.

difficult to assess the number and geographical distribution of people. About one million persons entered Vietnam from North Vietnam in a relatively short period following the 1954 Geneva Agreement. Although in-country movements may have been confined principally to the same or contiguous Provinces, the extent of this dislocation compounds the population census problem. Third, the prevailing military and political conditions do not permit much statistical precision.

Total 1964 economic output (gross domestic product GDP) of Vietnam was valued (in current prices) at 115 billion VN\$† (approximately 1.6 billion US\$ at the then current official rate of 74 VN\$ per US\$). That output amounted to about 6,400 VN\$ or 86 US\$ per capita in terms of 1960 price levels. The recent growth of these measures is shown in the following tabulation:

<u>Year</u>	<u>GDP</u> <u>(current</u> <u>prices in</u> <u>VN\$ billion)</u>	<u>GDP Per Capita</u> <u>(constant 1960</u> <u>prices in</u> <u>VN\$ billion)</u>
1955	VN\$ 65	VN\$5,800
1960	82	5,800
1964	115	6,400

While the South Vietnam economy may be barely holding its own, at least it has not declined in broad terms: GDP per capita at constant prices remained unchanged from 1955 to 1963, and even rose about 10% from 1963 to 1964.

† Unless otherwise indicated in this chapter, all economic data are either official data published by the National Institute of Statistics and the National Bank of Vietnam, or by USAID and its contractors.

Economic Affairs by Geographic Regions

Population distribution by regions of Vietnam has been as follows:

Region*	Population (millions)†					
	1943	%	1956	%	1964	%
South Vietnam	5.6	58%	8.4	63%	9.4	65%
(Saigon)	(0.5)	(5)	(1.8)	(14)	(1.3)	(9)
Central Highlands	0.4	4	0.6	5	0.5	4
Central Lowlands	3.6	38	4.2	32	4.3	31
Total	9.6	100%	13.2	100%	14.3	100%

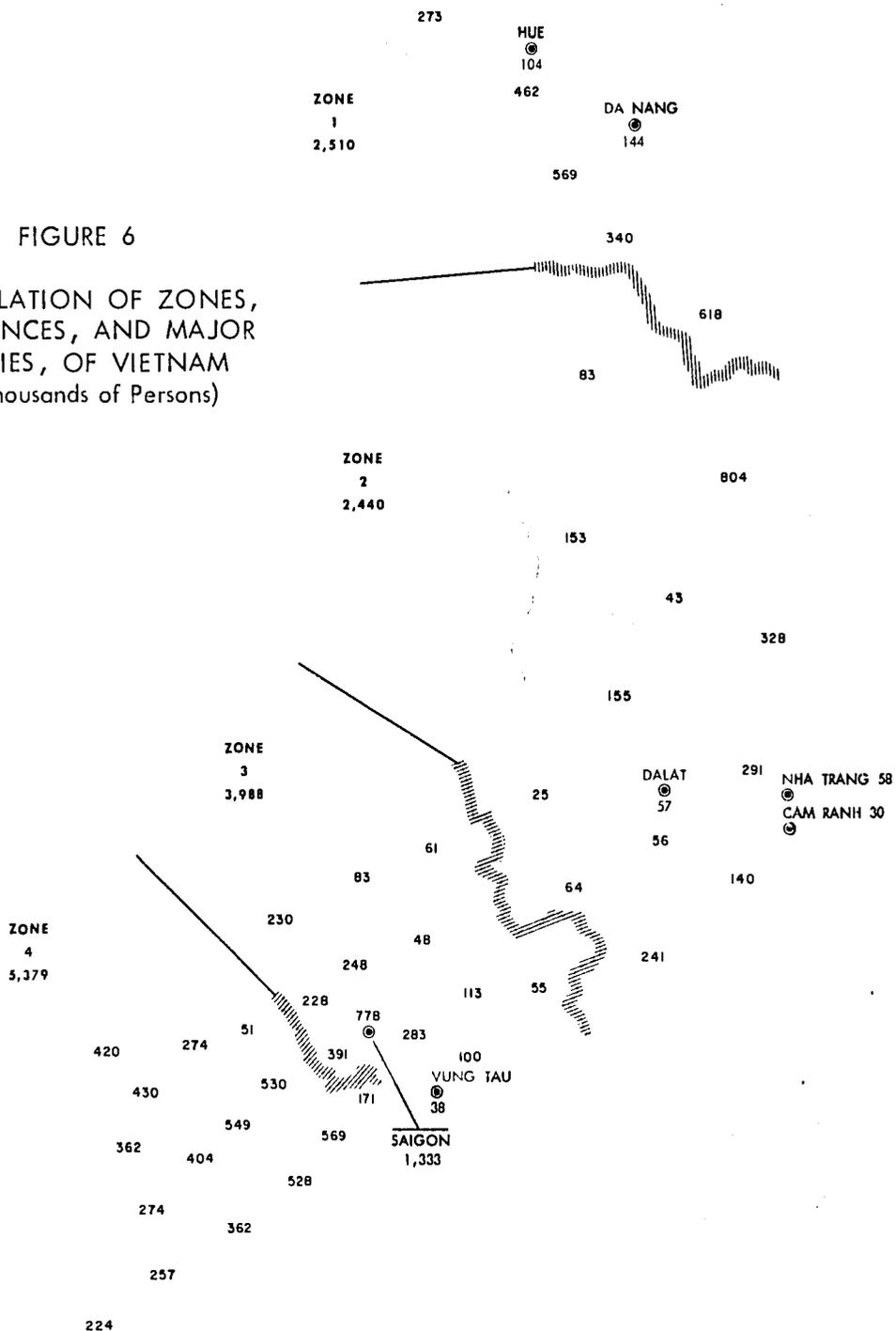
While the accuracy of total population estimates for Vietnam is open to some question, the above data suggest that the population of Vietnam has been concentrating in the South Vietnam Region, particularly in the Saigon metropolitan area. While population in the Central Lowlands has continued to increase in absolute terms percentagewise, the data show a decline in the proportion of the population in this area--from 38% to 31% over the two decades 1943-64. This concentration of population in the southern region holds important implications for the future, especially for the Central Lowlands Region; the subject is further discussed below.

* For purposes of military and political administration, Vietnam is divided into four Military Zones or Corp Areas (I-IV), each containing a number of Provinces and District Chief levels, i.e., most Province and District Chiefs are military personnel. Both U.S. military and AID activities follow that delineation. However, most of the national statistical data collected by the National Institute of Statistics and the National Bank of Vietnam are classified under a 3-region division of the country, namely: Central Lowlands, Central Highlands, and South Vietnam. These regional boundaries practically coincide with the boundaries of the Military Zones (see Figs. 6 and 7).

† For 1964 data, Vietnam Population Census, 1964, 227 pp., National Institute of Statistics, 1965. Vietnamese, with English translations of tabular headings provided by Mr. Nguyen Phi Bang of Private Investment and Industry Division, USAID, Saigon.

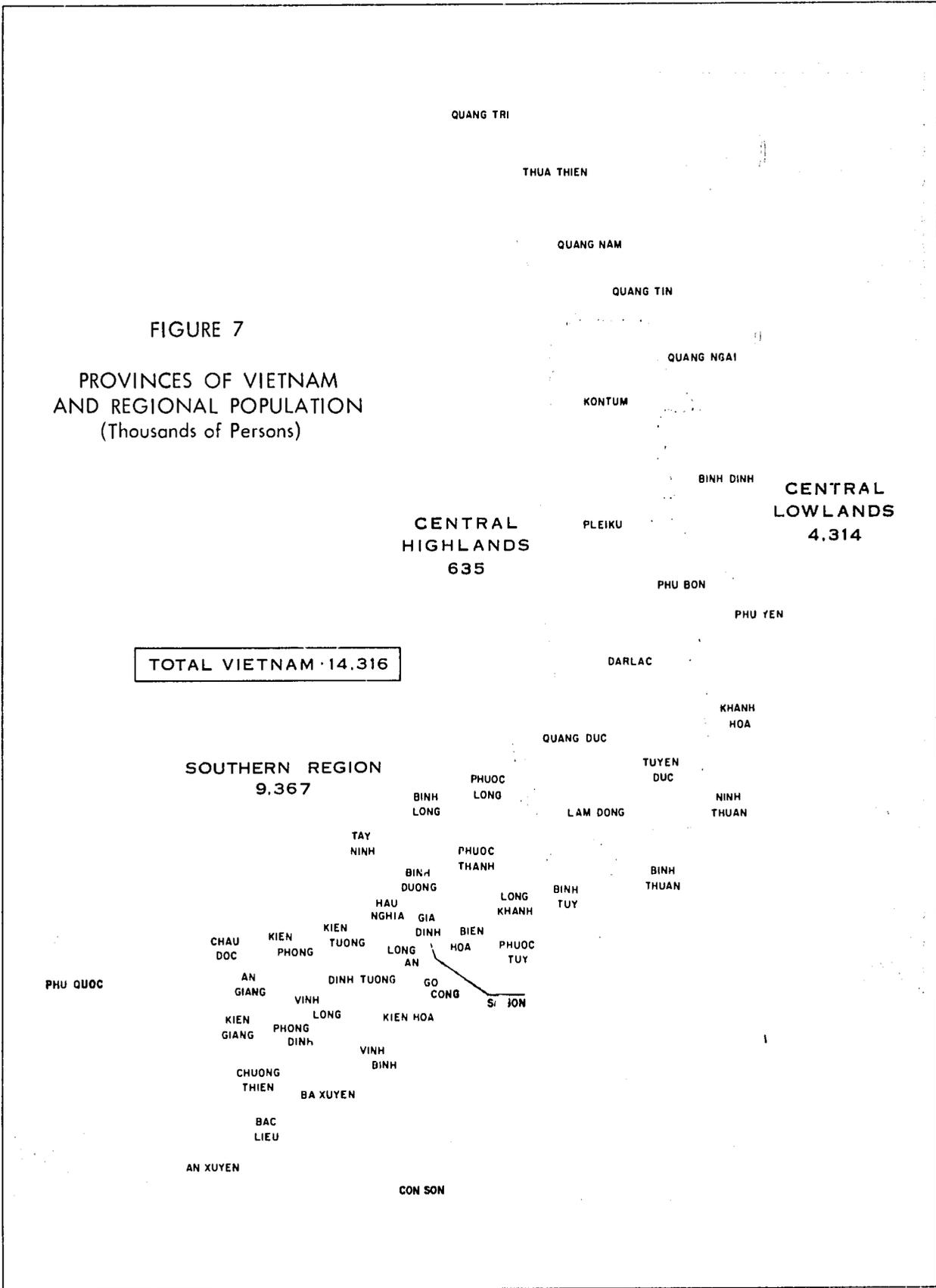
For 1943 and 1956 data, Annual Statistical Bulletin, No. 8, August 1964 (data through 1964), Economic and Financial Planning Division, USOM Vietnam, 150 pp., English.

FIGURE 6
 POPULATION OF ZONES,
 PROVINCES, AND MAJOR
 CITIES, OF VIETNAM
 (Thousands of Persons)



1/ Population included in Kien Giang.

FIGURE 7
 PROVINCES OF VIETNAM
 AND REGIONAL POPULATION
 (Thousands of Persons)



Data on the customary measures of economic activity are only fragmentary at the regional or subregional level. The following tabulation indicates the disparity between rural and urban per capita incomes.

<u>Location</u>	<u>Per Capita Income, 1964 (current VN\$)</u>
South Vietnam Region	
West (Delta)	VN\$3,600
East	4,200
Coastal Lowlands Region	2,500
All above regions*	3,100

From such data, it has been further estimated that 1964 urban per capita income was 16,000 VN\$; and that roughly half the national income was earned by the urban 20% of the total population of the country.

In Vietnam as in other countries, the geographic distribution of national economic output does not follow the geographic distribution of population, essentially because rural per capita incomes are usually considerably below the incomes of urban people. The disruptions arising from the military situation in Vietnam make it risky to even guess at the geographic distribution of total economic activity. It is more useful to examine the available data on economic activity by the several classifications which follow.

Economic Functions and Sectors

There are a number of ways (other than regional) in which total national economic activity may be classified for purposes of analysis and review. Two are presented here: by economic functions, meaning the composition of national expenditures and income; and by economic sectors, meaning the kind of economic activity.

* The Central Highlands Region was not included in this 1964 Rural Income Expenditure Sample (RIES) study by USAID.

A limited picture of the current national accounts and the private consumption expenditure pattern is revealed by the following tabulations:

Composition of Gross Domestic Product, Vietnam, 1964
(Current Prices)

Category	GDP-VN\$ Billion	
	Unit Amounts	Subtotals
Private consumption		
Transportation and communication	VN\$ 8	
Other	84	VN\$ 92
Public consumption		
Civil administration	13	
National defense	12	25
Gross domestic fixed capital		
Equipment	6	
Construction	3	9
Increase in inventories		4
Net exports		<u>-15</u>
Total		VN\$115

Composition of National Income, Vietnam, 1964
(Current Prices)

	VN\$	
	Billions	%
Compensation of employees	VN\$48	51%
Income from unincorporated enterprises	36	38
Income from property	6	6
Savings of corporations	3	3
Direct taxes on corporations	1	1
Statistical adjustment	<u>1</u>	<u>1</u>
Total	VN\$95	100%

National Income and Employment Originating in
Principal Economic Sectors, Vietnam, 1964

Item No.	Economic Sectors	National Income, 1964		% of Total Employment 1960
		Current Prices (in VN\$ billion)	%	
1	Agriculture, livestock, fishing, forests	VN\$31.2	33%	88%
2	Extractive industries	0.2	nil	nil
3	Manufacturing industries	10.3	11	} 8*
4	Construction	1.4	2	
5	Electricity, water, and gas	1.2	1	
6	Transportation (water and rail: 0.1; other, 3.6)	3.7	4	
7	Wholesale and retail trade	11.7	12	
8	Banks and insurance	1.1	1	
9	Residential rent	6.2	7	
10	Government service	21.4	22	2
11	Services	6.4	7	2†
12	Statistical adjustment	.6	—	—
	Total national income	VN\$95.4	100%	100%

* Pertains to "Industrial and commercial establishments including services", and corresponds to Items 3-9, above.

† Includes domestics.

Detailed data on individual economic sectors appear to be very scanty. Concerning the most important sector, agriculture, the following partial data are illuminating because they show that the production of the three major agricultural commodities is concentrated overwhelmingly in the Southern Region and the Central Lowlands.

Regional Production of Agricultural Commodities, 1964
(Thousand Metric Tons)

<u>Commodities</u>	<u>Central Highlands</u>	<u>Central Lowlands</u>	<u>Southern Region</u>	<u>Vietnam</u>
Rice (paddy)	69	911	4,205	5,185
Rubber	1	0.1	73	74
Sugar cane	2	274	780	1,055
Total population (mil- lions)	0.6	4.3	9.4	14.3

Concerning manufacturing industry, little except sample data appears to be available. It can be seen from the above tabulation that manufacturing income currently accounts for about 11% of total economic activity. Moreover, manufacturing activity tends to be unusually concentrated; it is estimated that 90% of Vietnam's manufacturing facilities are in the Saigon-Cholon area. This high concentration of industrial activity suggests that a general governmental policy of decentralization may need to be considered to spread the benefits of industrial activity geographically in Vietnam. Such a policy holds great implication for development of the Central Lowlands Region in general, and for the Cam Ranh Bay area in particular. Cam Ranh Bay could be one focal point for expanding industrial development in Vietnam, which thus could lead to a desirable broadening of Vietnam's general economic base.

Current Economic Problems

Another way of appraising the present status of the Vietnam economy is to examine its major current economic problems. It is, of course, no revelation to suggest that virtually all of Vietnam's economic problems emanate from the condition of war. But it is worth emphasizing that the military origins of Vietnam's economic problems go back a quarter of a century. Moreover, this period has been marked by an added economic complexity, inasmuch as North Vietnam possessed the bulk of the industrial resources of Vietnam.

Vietnam is encountering the usual economic problems of a nation at war, with several additional facets which reflect the unusual nature of Vietnam's circumstances.

Inflation. This most common of all consequences of war is indeed a problem in Vietnam. The following tabulation gives some indication of the magnitude of inflation in the recent past, 1955-64.

Price Index (or Implicit Deflator)

<u>Class of Goods</u>	<u>1955</u>	<u>1960</u>	<u>1961</u>	<u>1962</u>	<u>1963</u>	<u>1964</u>
Private consumption	94	100	106	109	117	121
Public consumption*	90	100	105	109	115	117
Imports	88	100	109	121	127	134
Exports	92	100	84	86	94	91
GDP	93	100	104	106	112	115
Total resources †	93	100	106	109	116	120

Beginning in mid-1965, coincident with the acceleration in military activity, and continuing into 1966, a severe inflation has occurred in the price of consumer goods. The problem of inflation apparently was a major concern of the International Monetary Fund Mission which visited Vietnam in May 1966. In June 1966, the currency was devalued officially from 74 to 118 piasters to the U.S. dollar.

Military Expenditures. Expenditures for military affairs are intimately associated with present and future economic well-being, and generally this corresponds roughly with the proportion of economic output devoted to military activities. It will be recalled from the tabulation above that national defense expenditures in 1964 amounted to about 12% of gross domestic product in Vietnam. At that time, civil administration comprised an equal proportion. While it is impossible to say how much of the civil administration expenditures was directly attributable to the current military and political situation in Vietnam, it probably was no small part, and thus the effective proportion of defense expenditures in the economy at that time was somewhere between 10 and 20%. It is clear that as long as the present war continues, the diversion of resources to national defense will severely restrict the public and private investments in the infrastructure and industrialization.

The aggregate of national defense expenditures in Vietnam for the period 1960-64 was 38.3 billion VN\$, while the aggregate of fixed investment expenditures for the same period was 35.6 billion (all in constant prices). It is clear that as long as the present war continues, the diversion of resources to national defense will severely restrict the public and private investments in the infrastructure and industrialization.

* Includes much of the military expenditures.

† GDP plus net imports.

Economic Effects of Dislocation. Military expenditures have a reasonably measurable effect upon economic welfare; the amount of resources which they absorb at the expense of other economic consumption can be calculated. But while the indirect effects of military expenditures are not so calculable, the indirect economic effects of the military situation are numerous and doubtless large. Each one results in some foregoing of economic output and income that would otherwise be available for economic sustenance and growth.

Among these indirect social and economic effects, the dislocation of people is probably the greatest. One can only conjecture about the magnitude of the economic loss from population shifts and refugee movements, but it doubtless has involved many more than the million persons who migrated from North Vietnam after 1954. Another effect, even less measurable, arises from the 1954 separation of the nation into two parts. The Republic of Vietnam was and is essentially an agricultural economy, while North Vietnam retained the industry and the natural resources which might have become the basis for economic diversification of the nation. Instead of developing on the basis of this complementarity, it has been necessary to undertake industrialization of Vietnam at great economic cost.

Other Economic Problems. The remaining outstanding economic problems are all war-originated. They include:

1. Declining rubber production with consequent reduction of the export market from a previous major source of foreign exchange.
2. The major disruption of the transportation system. The railroad is now virtually useless except in isolated local areas, with a consequent burden falling on highway traffic generally, and a substantial though incalculable loss of economic production.
3. The capital restrictions placed on private and public investment which could result in enlarged economic output.

While the specific economic problems of the Cam Ranh Bay area are treated at length elsewhere, one example is germane to the present discussion. Until recently, the almost solitary nonmilitary industrial activity at Cam Ranh Bay was mining of the high grade silica sand deposits at the northern end of the Bay. However, for about the past year, the Japanese customer has declined to send in freighters, in part attributable to lack of security in the area.

Current Economic Strengths

While the several potentialities for the future are discussed in the following section, some economic strengths are evident in the current context.

1. It is probably an element of economic strength that Vietnam has long held a prominent position in rice production. In normal

times before the current war, Vietnam was one of the rice baskets of the Far East, and at one time was one of the world's major exporters of rice. The present reasonably high production of rice continues to be an economic mainstay (especially in the face of the present decline of rubber production).

2. Another economic strength, although exceedingly intangible, springs from the economic attitude of the South Vietnamese people. It is not the place of this report to dwell on the condition of popular or political morale in Vietnam, yet it may properly be observed that the "economic morale" is remarkably good, considering the circumstances. Entrepreneurship seems to be particularly high.

Future Economic Possibilities

The Relation of Military Activity to Future Economic Affairs

Economic policy decisions cannot become the ultimate guidelines for economic affairs until hostilities decline. One is forced to the conclusion that as long as the war continues, economic welfare in terms of per capita income will at best stand still and probably will decline, even assuming the continuation of substantial economic aid.

Future Economic Prospects

For the reasons discussed earlier, the following summary of future economic affairs does not represent original work by this study. Rather, they convey the results of other investigations, which in turn are based upon an inescapable requirement to limit any forecasts to the period beginning with the end of hostilities, whenever that may be, and however that may be defined.

The National Economy. Vietnam's population of 1985 has been estimated at 28.4 million (with 5.9 million in Saigon) by Doxiadis Associates, assuming a growth rate of 3.2% to 1975, declining to 2.4% by 1985. Using a 3.5% growth rate, Nippon Koei Co., Ltd. shows a 1985 population of 33 million.

At that time, national economic output would be as follows:

1. "Total income" for Vietnam: 280 VN\$ billion (1962 prices) (Doxiadis Associates).

2. While no direct forecast is made, the TCI report shows that it would take 23 years (to approximately 1985) for the present per capita GDP to double, assuming a per capita GDP growth rate of 3%. (At that time, "Vietnam's per capita GDP would be comparable to that of Turkey in the 1950s.")

Geographic Regions. Future economic prospects by geographic regions are extremely difficult to foresee, largely for the same reason that makes the current situation so difficult to appraise--namely, the absence of basic information. Nevertheless, the following broad range of possibilities seems likely.

1. The Southern Region will continue to hold the bulk of the population. It will account (even at 1985) for the bulk of the nation's economic output. It is logical to expect this region to continue its emphasis on agriculture, and specifically, rice; through the growth of this region, the nation will doubtless resume its prior position as a major exporter of rice. While rice will continue to be the dominant commodity in this region, other crops will become important as the nation's general policy of diversification takes effect.
2. In the Central Highlands Region, some diversification may be expected in agriculture, and some industry may be established in the area. Even in twenty years, however, this region is not likely to make significant contributions to national economic output.
3. The Central Lowlands Region shows great promise for an expansion of diversified agriculture. Industrial growth is dependent on a policy of decentralization based on local or imported raw materials.

Future Economic Problems. While virtually all of Vietnam's current economic problems have arisen from the military situation, the cessation of military action will by no means bring a corresponding reduction in economic troubles. Many war-induced economic difficulties are difficult to attenuate even when their originating causes are removed. Indeed, some become aggravated in the absence of controls permitted by the war; for example, U.S. inflation from 1945 to 1949 was far greater than in the war period 1941-45.

1. Inflation. While this will persist as a problem for many years, it should be amenable to government policy. Fortunately, the Government is determined to control inflation and is obtaining the material help to do so under the U.S. economic assistance program.

2. Economic dislocations. For a long time to come, Vietnam must struggle with the economic consequences of the dislocation and disruption of its human and material resources. The initial economic burdens of resource dislocation are large and reasonably calculable. But the longer range burden of reassimilation and emergence of new patterns of resource utilization is doubtless larger, even though it is less discernible and measurable.
3. Economic reconstruction. During military operations, many damaged resources are reconstructed only under a policy of military priority. As a consequence, much damage remains almost hidden or at least unrecognized until the cessation of hostilities. Similarly, other "damage" cannot be given recognition at the time of occurrence, such as that which arises from overloaded or malfunctioning facilities. Still other "damage" takes the form of postponed aspirations forcibly held in abeyance by the military environment. At war's end, all these things emerge and assert themselves. The result is a severe competition for the funds released by the reduction of military expenditures.

The evolution and execution of a wise public investment policy will be both a problem and an opportunity for Vietnam in this future period. The TCI report urges "a minimum target growth rate for the economy of Vietnam of 4%; at present rates of population growth, that would allow for a net 1% increase in per capita living standards," assuming a 3% population growth annually. Considering the energy of Vietnamese enterprise and assuming sufficient foreign economic assistance, this would appear to be a modest target in the period immediately after the cessation of major hostilities. For a long time to come, pressures to increase living standards will compete with the need for reconstruction of many physical facilities, such as bridges destroyed on a large scale during the war. The development of a port and industrial center at Cam Ranh Bay is an example of the kind of effort on which construction for general national "reconstruction" efforts can be expected to provide real meaning to the national development program.

4. Economic strengths. Once hostilities have ended, elements of present economic strength discussed above can be augmented by things both tangible and intangible.
 - a. Reduction of military expenditures. This will doubtless be the most apparent economic gain of all. In addition to the substantial shift of total economic output from public to private consumption, there will be salutary secondary effects accruing from the release of military manpower and other resources to more socially and economically productive pursuits.

- b. Release of new energies. There is apparent in the country a growing disposition to put modern technology to work in agriculture by the introduction of new techniques of production using increasing inputs of fertilizer and pesticides, new varieties of plants, and improved animal breeds. A real upsurge of industrial entrepreneurship, alive to new opportunities and improved technology, also appears in prospect, developed out of the stresses of the war. If encouraged and made more widespread, this disposition to push the barriers of enterprise holds promise of substantial future benefits as the economy shifts toward peacetime activity.

- c. Increasing governmental administrative capacity. Experience as an independent government engrossed with the challenges of planning and fighting a war, pacifying rural areas, and building the economy for the future, is giving the government increasing capability in public administration. This capability will stand in good stead if the government is called upon in the future to execute large scale projects such as the development of a significant regional industrial complex and international port facility for Cam Ranh Bay.

V DEVELOPMENT PROSPECTS OF CAM RANH BAY

First Phase Study Conclusion

It is the conclusion of this first phase study that the prospects of developing Cam Ranh Bay successfully as a combined deep water port and urban industrial complex appear favorable--provided that proper planning is coupled with a commitment of adequate resources applied in a determined manner. This conclusion is, of course, tentative, being based on the methods of a broad survey rather than on an in-depth analysis. The prospects considered in this chapter have been based on general knowledge of the economics of industrial location, on interviews with knowledgeable individuals in Vietnam, on a review of the available literature, and on impressions gained about the character of the Vietnamese economy. A more intensive analysis of prospects must be the main objective of the Phase II research program in order to define the prospects as clearly as research can define them. However, it is believed that research in-depth will not negate this tentative conclusion, although development methods and details will probably be changed--a consequence to be expected.

The first phase study has proceeded on the assumption that the Government of Vietnam is justified in taking the position that it is good for the nation to decentralize economic activity. Development of a major seaport city and industrial nucleus in Central Vietnam can become the chief instrument of such a decentralization effort. With the acceptance of this approach, this first phase study nevertheless has had to address itself to the question whether Cam Ranh Bay can be the site of the seaport and urban-industrial complex through which the process of economic decentralization, or more precisely, the process of dispersing manufacturing activity, should be achieved in Vietnam.

Need for Industrial Dispersal

The discussion in Chapter IV on the national economic framework has pointed out the high concentration of both population and economic activity in the Southern Region, particularly in Saigon: 81% of the rice crop, the major food, and the major export commodity in normal times; 66% of the population (10% in Saigon-Cholon, and 56% outside this metropolis); and 90% of the industrial employment (Saigon-Cholon). Increasing concentration of the population in the Southern Region has been accentuated in recent years by the influx of migrants from other parts of the country during the war emergency (Table 2). This trend brings up the question whether some of the future migration can be drawn away from Saigon by creating industrial employment opportunities elsewhere. Officials of the Government of Vietnam are becoming increasingly aware that measures may need to be taken to intensify the development of the Central Region of

Table 2

DISTRIBUTION OF POPULATION OF VIETNAM, SHOWING PERCENT CHANGE IN REGIONS
(Thousands of Persons)

Year	Total Vietnam	South Region						Central Regions			
		Total Region		Saigon-Cholon		Outside Saigon-Cholon		Highlands		Lowlands	
		No.	%*	No.	%	No.	%	No.	%	No.	%
1943	9,610	5,578	58.0%	49.8	5.2%	5,080	52.8%	432	4.5%	3,600	37.5%
1956	12,366	7,642	61.8	1,794	14.5	5,848	47.3	530	4.3	4,194	33.9
1960	14,072	9,111	64.7	1,400	10.0	7,711	54.7	604	4.3	4,357	31.0
1964	14,316	9,367	65.4	1,333	9.3	8,034	56.1	635	4.5	4,314	30.1

* All percentages are % of total Vietnam population.

Source: Annual Statistical Bulletin, No. 8, August 1964 (data through 1964), Economic and Financial Planning Division. USOM Vietnam.

Vietnam as a way of raising per capita income levels and reducing the disparity that now exists between levels of living in Saigon and the levels in the outlying areas. The Government of Vietnam may want to examine how its industrial policies affect industrial location, and whether a change may be desirable to avoid the problems that are plaguing other countries, where wide disparities in income levels exist between different regions. These economic disparities soon become reflected in political and social tensions which in the end can have a divisive effect upon national political life.

The most effective technique for achieving economic decentralization is to use the mechanism of industrial dispersal. The location of industry is more easily manipulated or directed than other forms of economic activity, since wherever the jobs are, that is where people with little or no income will migrate, regardless of how contented they may otherwise be with their original environment. The industrial dispersal mechanism establishes complexes of sufficient size at selected locations that the attraction of business and population can have a multiplier effect. Thus the industrial estate for medium and large scale industry established at Bien Hoa, about 30 kilometers northeast of Saigon, conceivably will reduce population concentration in Saigon below what it would otherwise be over a period of time. The same kind of approach may be effectively used to achieve new centers of industrialization in selected favorably situated locations where the creation of economic impact is desired.

In time, the creation of such new centers will also affect non-urban populations, as people move out of agriculture and desire employment in nonagricultural pursuits. This process will reduce the migration into the Southern Delta area by providing increasing opportunities for non-agricultural employment in the Central Provinces of Vietnam.

Social Problems from Urban Over-concentration

A decision on industrial dispersal policy in an economy should also seriously consider the political and social consequences of not pursuing a policy of decentralization. Many developing countries of the world today are experiencing the phenomenon of unusually high population concentration in one or very few of their major cities. Economic activity is generally even more concentrated--over-concentrated--in large urban agglomerations, as evidenced by such indexes as industrial employment, the number of industrial establishments, electric power consumption, etc. Such over-concentration seems to be typical in many less developed countries.

The concentration of population and economic activity in these large urbanized centers means that their per capita income is usually several times the per capita income level elsewhere--such as in the smaller centers of urbanization, and especially in the rural areas. With few exceptions, the disparities resulting from over-concentration cause political factionalism and the placement of too much economic decision-making in the hands of the power structure in the major heavily populated city.

The economic forces normally at work encourage the tendency for development to concentrate on industry, commerce, and services in the metropolis largely because the infrastructure is the most extensive there, and because the market is available at the door. Frequently, the local tax structure also encourages metropolitan concentration. Moreover, better schools, finer homes, cultural amenities, and the governmental decision-making organization--all will probably also be found in the largest city. When industry continues to agglomerate in the single metropolis, eventually a point will be reached at which the authorities will be unable to meet all of the increasing demands on the infrastructure. Hence, housing facilities, water and sewage systems, amenities--all become inadequate for the growing urban population. And again, social tensions arise which may have political repercussions.

For these reasons, the political results of over-concentration cannot be ignored. These tensions grow up between the metropolis and the rest of the country, and also between the prosperous segment and the under-privileged segment within the metropolis, with consequences that affect national political stability.

Comparison of Infrastructure Needs

From the socioeconomic influences discussed thus far, an alternative for Vietnam can be presented: (1) Would it be better to solve the problem of over-concentration in Saigon, by simply expanding the city's infrastructure to accommodate the influx of people? or (2) Would it be better to provide work opportunities and infrastructure elsewhere--specifically, by establishing urban-industrial complexes in other areas? A tentative answer can be offered by examining the purely economic costs of the infrastructures required at both locations.

Two approaches can be considered in dealing with Saigon's population problem: internal and external. The internal approach would locate industry inside Saigon or immediately on the outskirts and would expect the employees to be accommodated by the existing housing, public utilities, educational systems, and transportation, as well as the commercial services already built into the metropolitan community. In this case, the social costs of making these infrastructural investments would not be apparent; they would be hidden, they would not be counted as a cost of development because the services are there, inadequate though they may be. However, as more increments of new industry are added, eventually additional capacity would have to be built into the Saigon infrastructure to take care of the new population. These costs would then become a part of the costs of the Saigon government, but would not appear in the budgets of the private concerns making the industrial investment decisions.

On the other hand, the external approach would establish satellite communities some distance outside Saigon--e.g., at Bien Hoa, where a large industrial estate is being established. In this case, all the costs of the infrastructure required for the working population in the new industrial establishments become known explicitly, since the projects have to

be planned for and paid for by the industrialists or by the public authorities before the industry can get into operation. The satellite community would presumably be far enough away from Saigon that it would be out of the question to consider bus transportation from the city to the satellite community, as the commuting time would be too long.

From the standpoint of infrastructure costs, the satellite approach is similar to the dispersal approach exemplified by Cam Ranh Bay, where all the investment costs are part of public knowledge, planning, and investment. The costs of developing specific industrial enterprises, of course, are known and provided by private or public enterprise. But in addition, the public authorities have to take explicitly into account the cost of providing all elements of the basic infrastructure required in Cam Ranh Bay. Thus the building-in of the infrastructure at Cam Ranh Bay from an economic standpoint is, by and large, little different from the creation of a new satellite community near Saigon.

It is possible that the cost of the basic infrastructure required by the complex at Cam Ranh Bay could be less than the cost of the infrastructure for the same increment of population in the Saigon area. In addition, some savings should result at Cam Ranh Bay from the civilian use of military constructed facilities.

Possibility of Other Dispersal Points

As time goes on, it will be apparent that the Government will have to consider the creation of new complexes in other places in the country. Since about 90% of industrial employment is in Saigon today, this choice cannot be delayed too long. It would appear that the creation of dispersed industrial communities will need to be provided for in national policy, not only as satellites but also as nonsatellites considerably removed from Saigon.

There is also the undoubted fact that in time, it will be necessary to tap and process resources close to their origin in other parts of the country. In this case, feasibility will dictate that industrial establishments may well have to be located close to the resources and not in satellite communities near metropolitan areas. The Government will then wish to consider the desirability of undertaking a policy of decentralization to extend economic activity to selected resource areas of the country with the intent to create a specific impact.

Before proceeding, it is appropriate to examine the question whether it would be preferable from a number of standpoints to develop a combined port and industrial complex at some location other than Cam Ranh Bay. While the main task of this report is addressed to the problem of planning for the development of the port and an industrial center at Cam Ranh Bay, the problem of an alternative location is a question of such importance that it must be considered. But it should be noted that the decision to undertake this study arose out of the fact that a tremendous military base

was going to be established at Cam Ranh Bay, at a site with perhaps the finest natural harbor in Southeast Asia.

The basic question here is two-pronged, as the port and the industrial complex need not be developed together. If the question is that of developing another industrial complex away from Saigon--since 90% of industry is already located in this metropolitan center--then one is free to speculate about a much broader geographical area in Vietnam within which such an industrial center might be established. On the other hand, if emphasis is on the development of an industrial center associated with a significant port in Vietnam, then the limitations geographically are much more restricted.

The argument has been made that a port and industrial complex might best be located in the Delta region because it contains half the population of Vietnam. However, the answer to this is comparatively simple, for the DMJM* report demonstrates convincingly that there is no site suitable for a deep water port anywhere in the Delta. At no point in the Delta area is there a deep enough channel, nor could a channel be dredged and kept open with sufficient economy to make it a reasonable proposition.

The Bassac and Mekong rivers deposit silt up to 20 kilometers on the continental shelf where the water is only two to three meters deep. Navigation to Can Tho, the largest port in the Delta on the Bassac River, is limited to junk, barge, and coaster vessels not exceeding 5,000 tons and about 5 meters draft.

What must be recognized is that the port of Saigon serves the Delta area, which is its hinterland. The cross-delta waterway system is criss-crossed with a multitude of canals that connect with the Bassac, the Mekong, and finally the Saigon River to the port of Saigon. The port of Vung Tau is an extension of the port of Saigon, and serves the same hinterland. Thus, suggested improvements and extensions in the capacity of Saigon, and the building-in of deep water facilities at Vung Tau, will mean essentially an improvement of the port facilities to serve the Delta region.

As far as the creation of industrial complexes is concerned, it may be noted that the cities of the Delta are all very small. Can Tho has a population of only 77,000, and Rach Gia, the next largest, has 48,000 (Table 3). The Delta has not created the circumstances that have thus far encouraged the growth of cities and the development of industry. This is not to say that some efforts might not be desirable or would not be productive over time in achieving some industrial growth in a few of the major urban centers.

* Daniel, Mann, Johnson, and Mendenhall, Development of Harbor Facilities (Vietnam), Los Angeles, California, February 1966.

Table 3

POPULATION OF REGIONS, PROVINCES, AND MAJOR CITIES
AND DISTANCES OF MAJOR PORTS FROM SAIGON

Regions and Provinces	Population (thousands)	Major Cities	Population (thousands)	Distance of Ports from Saigon - Km.
Region I	2,728			
Quang Tri	292	Quang Tri	12	
Thua Thien	483	Hue	113	1,140
Quang Nam	629	Danang	162	1,050
Quang Tin		Tam Ky	11	
Quang Ngai	701	Quang Ngai	10	
Region II	2,707			
Kontum	93	Kontum	20	
Binh Dinh	862	Qui Nhon	52	715
Pleiku	183	Pleiku	15	
Phu Bon	51	Hau Bon	3	
Phu Yen	349	Tuy Hoa	25	535
Darlac	149	Ban Me Thuot	33	
Khan Hoa	309	Nha Trang	57	430
		Cam Ranh	50 (1966)	390
Ninh Thuan	150	Phan Rang	25	350
Tuyen Duc	75	Dalat	60	
Quang Duc	34	Gia Nghia	3	
Binh Thuan	262	Phan Thiet	62	160
Lam Dong	68	Bao Loc	11	
Region III	4,392			
Phuoc Long	67	Phuoc Binh	2	
Long Khanh	136	Xuan Loc	17	
Binh Tuy	62	Ham Tan	11	
Binh Long	85	An Loc	14	
Binh Duong	272	Phu Cuong	31	
Tay Ninh	242	Tay Ninh	20	
Hau Nghia	246	Khlem Cuong	2	
Long An	407	Tan An	23	
Bien Hoa	345	Bien Hoa	43	
		Saigon	1,641	
Phuoc Tuy	103	Vung Tau	42	
Region IV	5,901			
An Giana	467	Long Xuyen	27	
An Xuyen	226	Quang Long	35	
Ba Xuyen	402	Khanh Hung	45	
Bac Lieu	314	Vinh Loi	20	
Chau Doc	474	Chau Phu	11	
Chuong Thien	273	Vi Thanh	3	
Dinh Tuong	591	My Tho	67	
Go Cong	183	Go Cong	18	
Kien Giang	403	Rach Gia	48	
Kien Hoa	618	Truc Giang	18	
Kien Phong	296	Cao Lanh	5	
Kien Tuong	64	Moc Hoa	7	
Phong Dinh	426	Can Tho	77	
Vinh Binh	568	Phu Vinh	20	
Vinh Long	594	Vinh Long	33	
Vietnam	15,728			

Source: USAID/Saigon, Public Administration Division (unofficial estimates).

The resource situation in the Delta is very meager, and the potential for the development of local industry based upon raw materials in the region is limited. The production of cement clinkers at Ha Tien is an example of the kind of industry that could be fostered in the area if more resource potential existed there.

Fishing is a very important industry in the area; and with motorization proceeding quite rapidly, the potential is conceivably expanding. The Delta is, of course, the major rice producing area of Vietnam, and about 45% of the rice mills are located there. The agriculture is being diversified to other crops, including fruits and vegetables, and animal products. Conceivably, agricultural and fish processing industries should eventually represent a potential for development.

Other than these quite obvious possibilities, industry in the Delta will require essentially the importation of raw materials that may have been imported through Saigon or shipped in from other parts of Vietnam for processing. In time, it should prove desirable to introduce manufacturing into the Delta for the production of certain consumer goods and agricultural inputs to take advantage of the large market that obviously exists. So far, Saigon has preempted the position of supplier to the Delta, and because of proximity, a built-in infrastructure, and economies of scale, will continue a competitive advantage in supplying goods to the area.

As will be pointed out below, the traffic of the Delta ports is very small and has shown slower growth than that of the other ports of Vietnam. Traffic projections by DMJM show a continuation of this slower rate of growth.

In Central Vietnam, a number of cities, partly because of their location, and access to a hinterland, have a greater potential for industrial development at the present time than the small cities of the Delta.

Danang, in Region I, with a population of 154,000, is the second major port of Vietnam. Obviously, it represents a center of considerable importance with good resource development potential in the hinterland, good prospects for a deep water port, and service to a populous hinterland area. The city of Hue with a population of 117,000 is also part of the Danang service area. Other cities, approximately the size of Can Tho, are Qui Nhon, Nha Trang, and Dalat, all adequately functioning cities in Region II. The City of Cam Ranh is rapidly reaching this size level, but the infrastructure has so far been lacking. The resources of minerals and forests are found principally in Regions I and II of Central Vietnam.

With the exception of Dalat in the Central Highlands, each of the four cities just mentioned has port development potential as well as possibilities for the establishment of industrial complexes. The population to be served in Central Vietnam represents 35% of the total in the country. Central Vietnam will require industrialization and economic

diversification in order to bring higher incomes and employment opportunities to the region. Manufacture of commodities in the industrial complexes of these Central Coast port cities could be distributed economically to the Southern Region, especially if produced in or around the Cam Ranh Bay area, and particularly if deep water port facilities are built in. Commodities could be shipped to the Delta by deep-draft vessels from Cam Ranh Bay to Saigon or by coaster vessels from Cam Ranh Bay directly to Delta ports, especially on the Mekong and Bassac Rivers, from which distribution through the canal system could be economically achieved. Thus, by the use of coaster traffic, Cam Ranh Bay might well be able to compete quite reasonably with Saigon in serving the Delta area. In this respect, Cam Ranh City is located much more strategically for serving the Delta than any other contending port on the northern portions of the Central Coast.

Reasons for Developing Cam Ranh Bay

The next logical question to ask is why Cam Ranh Bay should be selected for development as a port and urban-industrial complex, since perhaps some other port in Central Vietnam might be a better prospective location. There are essentially two answers to this question: (1) Cam Ranh Bay is a good location in an economic sense, with fine natural assets established in an excellent setting; and (2) the enormous military investment in the establishment of the base on the Cam Ranh Bay peninsula has provided the occasion, which furnishes a more favorable near term prospect of success than has hitherto been available at Cam Ranh Bay or any port other than Saigon.

The first answer is very important because the military investment in a port located much more remotely would not possibly have the potential for an extended major impact in the future as is conceivable at Cam Ranh Bay. In the geography of the Vietnam economy, Cam Ranh Bay is so favorably located that a development of major proportions there probably has a better chance of creating a viable future community with a potential for economic growth and a regional impact than any other port except Danang.

The location of Cam Ranh Bay must be viewed from the standpoint of its prospects for rapid future economic growth. These prospects are based on its future capability of competing effectively with other ports and industrial complexes, in the Central Coastal Lowlands of Vietnam. The superior economic location may be judged to be the overall result of the following combination of factors:

1. The Cam Ranh Bay harbor has physical characteristics superior to any other ports along the Central Coast, including a natural setting unequalled in Vietnam.

2. The port has a favorable location with respect to a hinterland population, and sources of raw materials, being flanked in the immediate area by Phan Rang in the south, Dalat in the west, and Nha Trang and Ninh Hoa to the north.
3. The port is favorably located with respect to land and water distribution of inshipped goods to markets for some distance to the north and south, in competition with the principal ports of Saigon to the south and Danang to the north.
4. The port and industrial complex could compete favorably with Saigon in the heavily populated Delta region through the use of coaster transportation.

Factors Favoring Development Today

The fact that Cam Ranh Bay was not developed into a major commercial port can be better understood in the light of Vietnam economic history. Historically, Hanoi, the capital of Tonkin, has been the most industrialized city. It provided industrial goods to Indochina in the south and received rice from the Mekong rice bowl. Major sea traffic moved between the port of Saigon and Haiphong, the port of Hanoi. The major poles of development were Hanoi and Saigon, the trading centers for their respective areas. Danang was the major port, not far from Hue, the capital of ancient Annam. Cam Ranh Bay was located in an area with a low population density and little development in the vicinity.

The central fact currently favoring the development of Cam Ranh Bay is the construction of the immense military base and the subsidiary infrastructure on the peninsula and the adjacent mainland areas. This tremendous construction program may be viewed as an opportune vehicle, especially since some past barriers to Cam Ranh Bay development are being removed. Thus the population scarcity of the past has been eliminated by the influx of both military construction workers and refugees, and the presence of the military forces is extending the area of physical security. Finally, the construction program and other military requirements are stimulating the development of commercial services and amenities on the mainland side of the Bay.

Comparative Position of the Port of Cam Ranh Bay

This section examines the position of the port of Cam Ranh Bay (Ba Ngoi) within the constellation of Vietnamese ports with special reference to the ports of the Central Vietnam Coast north of Saigon (Figure 8).

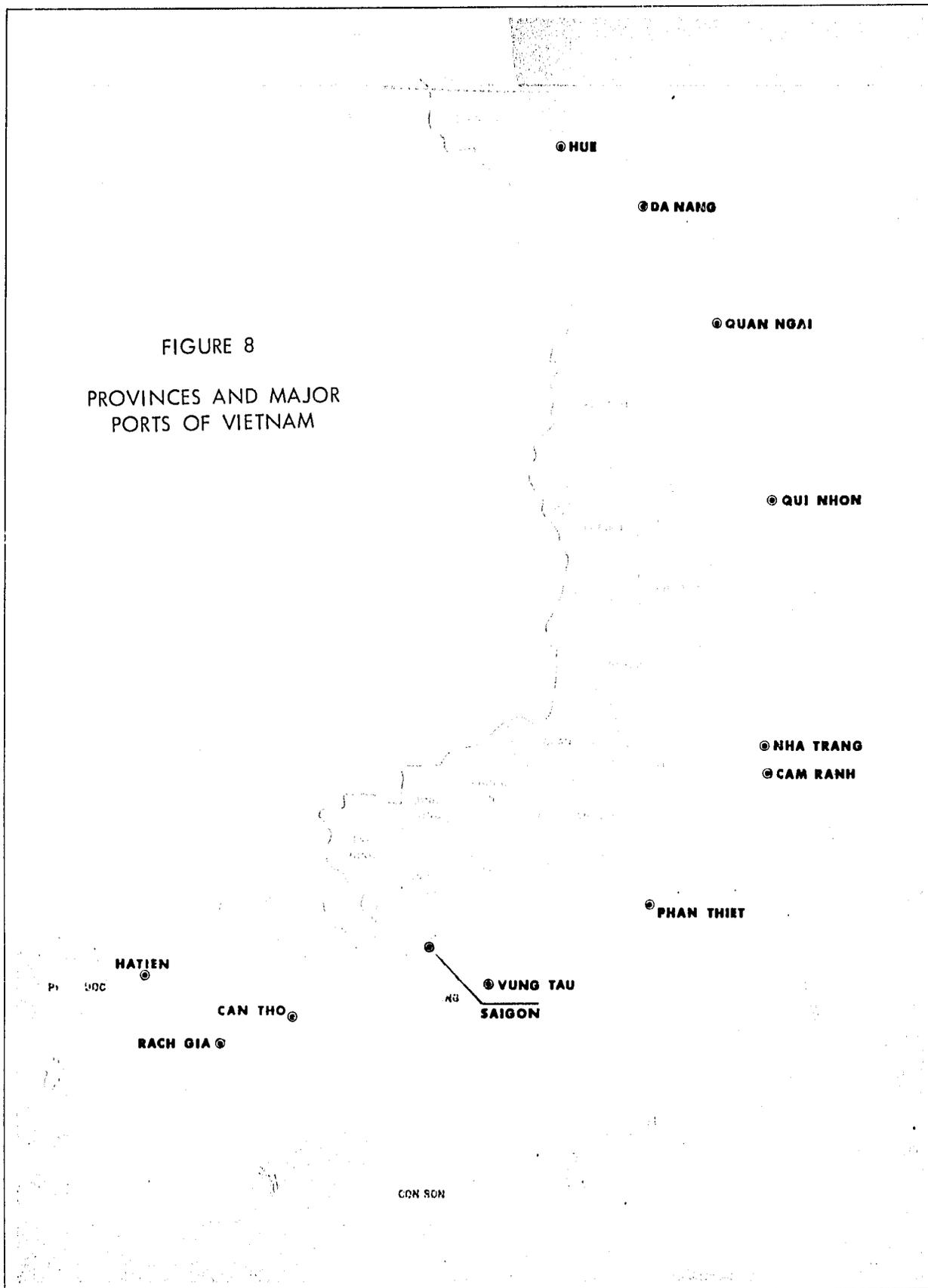


FIGURE 8
 PROVINCES AND MAJOR
 PORTS OF VIETNAM

In 1964, total sea traffic through these ports amounted to 750,000 tons compared with a volume of 2,750,000 tons* through Saigon, and only 81,000 tons through the ports of the Delta. Five years before in 1959, total traffic in the Central Coast ports was about half the recent volume--384,000 tons, compared with 2,400,000 tons in Saigon and 26,000 tons in the Delta ports. Some increase in all ports may have been caused by military related shipments, but practically all the traffic in Cam Ranh Bay--over 230,000 tons--was attributable to silica sand exports. The silica sand exports accounted for over two-thirds of the increase in the Central Region traffic over the 1954-64 period (Table D-2, Appendix D). At the time of the Geneva Agreement in 1954, sea traffic was completely dominated by the port of Saigon, which then had a traffic volume of 2,215,000 tons. Traffic in the Delta ports was only 9,000 tons, about 11% of the volume 10 years later. In the Central Coast, Danang dominated traffic with a volume of 218,000 tons compared with a total of 312,000. At that time, Ca Na was next in importance with shipments of 54,000 tons, presumably salt. Hon Khoi had a volume of 24,000 tons, and Cam Ranh Bay, 15,000 tons. Nha Trang showed no shipments in 1954; while this may be due to lack of data, the tonnage must have been very small.

The traffic tonnage at Danang, Qui Nhon, and Nha Trang has been about equally balanced between ocean and coastal volume, whereas the Cam Ranh Bay tonnage, principally exported silica sand, has been predominantly ocean-going cargo (Table 4).

This brief description emphasizes the rapid growth of sea traffic in the Central Region over recent years. Some of this may have been due to interference of the Viet Cong in coastal rail and truck movements, causing a diversion to coastal traffic. It also includes the impact of some military traffic. The major ports in this area are Danang, Qui Nhon, Nha Trang, and Cam Ranh Bay (Ba Ngoi).

In the DMJM port study, cargo projections have been made for the major ports of Vietnam (Table 5). The cargo traffic through the port of Saigon is projected to 6,600,000 tons by 1985, approximately three times the "adjusted" 1964 volume of 2,167,000 tons.† Traffic in the Southern Region ports of Rach Gia, and Ha Tien is expected to increase only from 14,000 to 31,000 adjusted tons. Tonnage projections for other small ports in the Delta are not available but these ports feed Saigon port and are not likely to become an important factor.

The DMJM study projects a large increase (over five times) in traffic through the various ports of Central Vietnam between 1964 and 1985--an increase in adjusted tonnage from 772,000 to 4,113,000. The two ports

* In this report, "tons" means "metric tons."

† All tonnages referred to are metric tons. "Adjusted" tonnage figures differ from actual data, according to what traffic would have been, under assumptions defining certain conditions of stability.

Table 5

PROJECTIONS OF TOTAL TRAFFIC THROUGH MAJOR VIETNAM PORTS
(Thousand Metric Tons)

Ports	1959	1964		1970	1975	1980	1985
		Actual	Adjusted				
Saigon } Vung Tau }	2,403.8	2,750.5	2,153.0	3,280.0	4,400.0	5,500.0	6,600.0
Rach Gia	5.7	7.4	11.0	14.0	16.0	18.0	20.0
Ha Tien	<u>3.2</u>	<u>2.1</u>	<u>3.0</u>	<u>5.0</u>	<u>8.0</u>	<u>9.0</u>	<u>11.0</u>
Southern Region	2,412.7	2,760.0	2,167.0	3,299.0	4,424.0	5,527.0	6,631.0
Hue	3.5	2.3	3.0	6.0	11.0	16.0	21.0
Danang	231.4	301.6	350.0	900.0	1,300.0	1,700.0	2,100.0
Quang Ngai	2.1	3.9	6.0	9.0	11.0	13.0	15.0
Qui Nhon	35.0	77.3	80.0	100.0	125.0	150.0	175.0
Nha Trang	9.2	85.9	85.0	95.0	110.0	125.0	140.0
Cam Ranh (Ba Ngoi)	0.1	232.0	240.0	610.0	1,000.0	1,300.0	1,600.0
Phan Thiet	<u>21.1</u>	<u>5.0</u>	<u>8.0</u>	<u>32.0</u>	<u>42.0</u>	<u>52.0</u>	<u>62.0</u>
Central Vietnam	300.4	708.0	772.0	1,753.0	2,597.0	3,356.0	4,113.0

Source: Development of Harbor Facilities (Vietnam), 17 Volume Report by Daniel, Mann, Johnson, & Mendenhall, Los Angeles, Calif., February 1966.

of Danang and Cam Ranh are expected to account for 90% of this eventual tonnage, with volume growing more than six times over the period--from 590,000 tons to 3,700,000 tons. Danang is expected to continue as the major port in Central Vietnam, with a 1985 projected volume of 2,100,000 tons--equal to nearly a third (32%) of Saigon traffic compared to the 1964 level of about 16%. Cam Ranh port traffic is expected to increase at a more rapid rate than Danang--nearly seven times--rising from 320,000 tons in 1964 to 1,600,000 tons by 1985, reaching about a fourth (24%) of Saigon port traffic by that time.

The projection of Cam Ranh Bay traffic assumes that 75% of the tonnage will consist of silica sand, and this in turn assumes that a way can be found of resuming the exports of this resource. Still, the rest of the commercial traffic projected represents a volume in excess of any other Central Vietnam port except Danang. The DMJM study projects the traffic of Qui Nhon port at a slightly faster rate than that for the port of Nha Trang. The traffic prospects of both ports are projected only to double approximately over the 21-year period, thus conceding the superior competitive position of the ports of Danang and Cam Ranh Bay.

In reviewing the information available, one must conclude that considerably more intensive work needs to be done in analytically assessing the future competitive position of the position of the port of Cam Ranh Bay among the ports of Central Vietnam. Additional research is therefore proposed for Phase II, as discussed in Chapter VII. The work of DMJM and TCI shows the difficulty of obtaining traffic flow information. Consequently, it would appear that in further work on the problem, traffic flow data may have to be estimated by projecting future commodity supply-consumption relationships. Such projections would be made as part of an economy-wide study relating demand, supply, and transfer costs between points, for the purpose of testing the effects on the port system of introducing another well-equipped port at Cam Ranh Bay. This study must necessarily also take into account assumptions about the size and nature of the future industrial complex to be established at Cam Ranh Bay.

To appreciate the comparative position of the port of Cam Ranh in relation to the major ports in Central Vietnam competitive with it, a brief description of these port cities and their hinterland is warranted.*

Port of Danang

The port city of Danang has separate municipality status, and is next to Saigon in size. Danang has a population of 154,000, and is the capital of Quang Nam Province, which has a population of about 575,000.

* Most of the subsequent description is based upon the comprehensive port and harbor studies by Daniel, Mann, Johnson, and Mendenhall.

The nearby provinces are also heavily populated. The city is a major distribution center serving a tributary area ranging from the 17th parallel, at the northern boundary, to about the 15th parallel in the vicinity of Quang Ngai, about halfway to Qui Nhon. In terms of traffic volume, Danang is the second most important port in Vietnam. The harbor of Danang is subject to considerable silting and would require substantial maintenance costs to maintain an open channel for deep-draft vessels.

Volume moving in and out of the port of Danang in 1964 amounted to about 300,000 metric tons, representing a steady increase from about 200,000 tons in 1954. Recent traffic was divided about equally between ocean and coastal tonnage, and consisted mainly of imports. The total out-movement of about 10,000 tons in 1964 entered coastal traffic only. The DMJM study projects a large increase in cargo traffic, assuming conditions of stability, to 2,100,000 tons by 1985.

The hinterland of Danang appears to be rich in resources, but most of these still remain to be developed. Deposits of several minerals have been found or reported in the area, but the prospects for commercial exploitation are not clear.

The resource that currently has perhaps the best prospect for development is the major coal deposits located at Nong Son, about 45 kilometers southwest of Danang on the Thu Bon River, which empties into the sea below Hoi An (Faifo). The proposed An Hoa industrial complex is to include a series of chemical plants with the principal end products to consist of 42,000 tons of urea and 48,000 tons of ammonium sulfate fertilizer annually. A 25,000 KW coal-fueled thermal power plant, planned about 10 kilometers above the site of the complex on the Thu Bon River, is to be integrated with this facility.

The coal deposits could also be used in the production of cement or clinker based on the limestone deposits at Van Xa just north of Hue. Limestone deposits apparently suitable for the manufacture of calcium carbide and for agricultural lime are found in a number of sites not far from Danang, at Vinh Phuoc, at Quang Nam, and at "Marble Mountain." Mineral deposits of hematite, laterite, lead, zinc, gold, graphite, silica sand, and mica are also reported near Nong Son.

An important fishing industry operates at Danang and various agricultural possibilities are present. These considerations add up to the fact the Danang area has an important future potential for an industrial complex that could have a substantial impact upon traffic through the port of Danang.

Danang is connected with the coastal railway that runs from Saigon to the north. It is also served by Highway 14 leading to the southwest to Kontum and Pleiku, as well as Highway 1, which parallels the coastal railroad.

Danang is the natural outlet for the landlocked country of Laos, which would thereby have access to world trade. A project is being considered for the improvement of a 400 kilometer westerly route from Danang to Laos, which would provide improved connections with Savannakhet through Hue. Both the Mekong Delta Committee and the Pan Asian Highway Committee of ECAFE have assigned the highest priority to highway improvements between Danang and Savannakhet, and both organizations have included this project in their five year plans. This would give Laos an effective outlet to the sea within some 400 kilometers compared to a proposed 800 kilometer highway to Bangkok, which has been assigned a lower priority by these two organizations. Construction in South Vietnam was scheduled to commence in 1966. Under stable conditions, it can be expected that this project would add significantly to Danang's port traffic. While Danang is not directly on the world trade routes, it is much better positioned than the port of Bangkok in Thailand, which takes a vessel at least two days off its course.

Port of Qui Nhon

Qui Nhon is a city with a population of about 52,000. It is the capital of populous Binh Dinh Province and one of the most important coastal ports in Central Vietnam. Qui Nhon is served by Highway 1 and the coastal railway, and is directly connected by Highway 19 with the important inland city of Pleiku. At this point, Highway 14 continues from Pleiku to the Cambodian border. Qui Nhon is about 350 kilometers south of Danang and about an equal distance north of Nha Trang. The Province of Binh Dinh has a population of about 804,000, principally engaged in farming. Heavily populated tributary coastal provinces include Quang Ngai with 657,000 people and Phu Yen with a population of 823,000.

Forestry products represent a possibility not yet exploited. Fishing is a major industry, but it has not produced significant export tonnages so far. Some mineral resources are reported but their presence is not properly substantiated and prospects are not known.

The entrance to the port of Qui Nhon is very narrow, only 17 feet deep, and deeply silted at the present time, so that it can only take very shallow-draft vessels. The U.S. military, however, are dredging the entrance to a depth of about 30 feet, which should substantially increase the potential of the port for coastal and overseas traffic. Though the harbor of Bong Qui Nhon is shallow, it is one of the best protected harbors on the Central Coast of Vietnam.

Starting from nothing in 1954, the port of Qui Nhon had a 1964 tonnage of 77,000 metric tons, of which 27,000 consisted of ocean traffic. Movement consisted principally of in-shipments amounting to 49,000 tons. Five satellite ports in the area with a highly variable volume moved more coastal tonnage out than Qui Nhon, primarily salt with an aggregate of somewhat less than 10,000 tons, most of it moving to Saigon.

Traffic volume, under conditions of stability, is projected by DMJM to reach 175,000 metric tons by 1985. This excludes petroleum products, which we assume will continue to be handled by the petroleum companies. A good fraction of the increase is expected to come about through overseas trade. It is estimated that half of the future increase would be import-export ocean-going traffic. This assumes that more local products, such as forestry products, will be developed, and that in-shipments, particularly of fertilizer, will increase.

Port of Nha Trang

Nha Trang, the capital of Khanh Hoa Province had a recent population of 57,000. It is one of the few cities on the Central Coast with a concentration of population and adequate transportation to the interior hinterland. Nha Trang is located about 430 kilometers from Saigon and 285 kilometers south of Qui Nhon. It is about at the center of gravity for traffic on the South Central Coast of Vietnam.

Nha Trang is one of the great fishing ports of Vietnam. Fishing is the major industry with considerable expansion possibilities. Fish is shipped out principally to Saigon. Other agricultural products include cattle, rice, sugar, tea, and coffee, as well as rubber in the hinterlands. Salt is produced at Ninh Hoa just to the north of the city. Nha Trang, located on Highway 1, is connected with Ban Me Thuot via Highway 21 via Ninh Hoa. Some rubber estates operate in the vicinity of Ban Me Thuot.

Coastal traffic through the port of Nha Trang reached 85,000 metric tons in 1964 after starting from zero in 1957. Of the total, 26,000 tons represented ocean traffic, practically all consisting of in-shipments. Three other small ports with considerable traffic fluctuations operate in the vicinity of Nha Trang.

Cau Da is the existing port for the city of Nha Trang. Access to the port is by way of city streets or a narrow back road, a distance of about 8 kilometers from Highway 1. Cau Da is fairly well-protected from excessive wind and wave action by natural land features. However, during the winter monsoon months, long period swells frequently present a problem and require a halt in loading and unloading operations at the dock as well as offshore. Water draft at the face of the short pier is little more than 4 meters, accommodating only smaller coastal vessels at all tides. The pier is short so that most vessels overhang at both bow and stern, which sometimes permits the working of only one hold at a time. According to the DMJM study, the port of Nha Trang should be considered in the role of a coastal port, and in addition should be planned as the site of a limited deep water port to receive and ship overseas cargoes.

The DMJM study recommends an expansion of existing facilities at Cau Da, after examining several other alternative sites in the Nha Trang area. More than the other sites, this one appears to have the natural

geographic and oceanographic features that indicate good possibilities for development. After weighing the matter, the DMJM study concluded that the advantages considerably outweigh the disadvantages, and recommended that expansion be undertaken at this site to meet the future port needs of Nha Trang and the nearby areas. The scheme proposed consists of a marginal wharf-type dock and dredging of land fill in the same general location as the existing pier. Alternative development plans are proposed.

One plan is to provide a two-berth coaster facility with a 6-meter channel adequate to handle the 95,000 tons expected to move through Nha Trang by 1970. A freighter facility would provide a single 182-meter berth which would be usable by two or even three coaster vessels. Or, with the existing pier still in place, it could handle an ordinary freighter and one coaster. The depth of the entrance to the channel is to be 11 meters. To protect vessels in the harbor area from the swells and wave action of strong northeast monsoons, a breakwater about 300 meters long would be required to protect the coaster facility. Necessarily, a much deeper channel would have to be created for the deep water berth. The study states that a single deep water berth would be adequate at Nha Trang to accommodate the handling of approximately 200,000 tons annually. However, in a second phase, it may be necessary to build additional coaster berth space if the deep water vessels should tend to crowd out the coasters.

Considerations in Locating Deep Water Port Facilities in Central Vietnam

Viewed in comparison with the three other ports discussed, the problem of development then revolves around the issue of where and how much deep water port capacity should be added on the Central Coast of Vietnam. The question is that of locating one or more deep sea ports of entry in Central Vietnam on the coast north of Saigon, ports with sufficient draft to accommodate ocean-going vessels in a situation where a high proportion of ocean traffic is involved.

One principle to be considered in deciding on the location of deep sea ports in this area is that overseas traffic should arrive at a sufficient number of ports of entry so that the costs of in-country transportation for assembling and distributing goods are held to a minimum. However, this principle argues in favor of a proliferation of ports which would create diseconomies in two respects. First, the establishment of a large number of ports of entry would result in heavy capital investments for port and harbor development. Second, a proliferation of ports would result in the handling of a small volume at each, and would make it uneconomical for larger vessels to carry cargo to these ports. Since the volume of traffic in the central coast ports of Vietnam is comparatively small anyway at today's levels, there is already considerable disinclination for the usual ocean-going freighter to stop at any of these ports. Consequently, the economics of the case favors a small number of deep sea ports so that sufficient traffic may be available at any one of them

to make it a financially worthwhile port of call for the ocean-going freighter. Facilities at the port must also be great enough so that cargo may be discharged and loaded with little delay, to avoid high costs of waiting.

It can be assumed that within certain limits, a deep sea freighter can call at any port anywhere along the coast at the same price per ton for a given set of commodities. The differences in cost will come about because of discrepancies in the waiting time and in the cost of loading and unloading cargo. It may be of interest to note the rates established for handling cargo by the U.S. Pacific Westbound Conference for each of the ports in Southeast Asia. The "arbitrary" rate for Saigon is \$6.50 per ton versus \$5.60 per ton in Singapore and \$5.50 per ton in Bangkok. The Bangkok rate is lower than the rate for Saigon despite the fact that it is a two-day round trip on the Saigon River, and the additional charges are attributable probably to waiting time, which has been very substantial. Excluding Saigon, the "arbitrary" charge is \$20 for all other ports of Vietnam. Additional surcharges applicable to all ports are \$3.75 per ton for war risk and \$8.25 for congestion. Manila, in contrast, has a congestion surcharge of \$5 per ton. The "arbitrary" port rates have to do with the problems of bulk breaking and lower draft--characteristics which differ between ports.

Conceivably, if efficient deep water facilities could be established at selected large volume ports along the Central Coast, there is the possibility that entry could be achieved at an "arbitrary" port charge comparable with Saigon's, assuming that on-loading and off-loading tonnages could be sufficiently large. Without deep water port facilities in Central Vietnam, tonnage unloaded at Saigon will have to be transshipped by highway, railroad, or coaster to the northern cities at additional expense. Thus, some additional deep seaport facilities would appear to be necessary somewhere along the coast so that intracountry haul of overseas cargo can be reduced.

For competitive reasons, a coaster port must be close to the center of gravity of traffic covering a significant service area, meaning that it should be possible to transport the good by truck or rail without too much additional charge to the destination. An overseas traffic port must also be near the destination of the cargo, but the service area may cover the hinterland of several coaster ports, and the center of gravity would preferably be at one of the coaster ports. Thus, if Vietnam needs eight more deep water berths over the next ten years in addition to the nine deep water berths already in existence in Saigon, then the additional deep water facilities should be built where they will achieve an optimum economic solution. This requires the most economical collection of goods from their source for export, the most economical distribution to their destination, and a minimization of the costs of loading and unloading, including vessel waiting time. In addition, the calculation must take into account the amortized costs of building berth capacity--costs which must be justified by the added annual savings in handling and distribution costs. Conceivably, every harbor that can draw sufficient trade

to make full use of a complete deep water berth should have as many berths as it can fully use in the interests of overseas transportation, assuming that berths cost the same at different ports. However, this is not necessarily true because some harbors require an expensive access channel or a breakwater. Assuming an efficient operation, the DMJM report estimates that a single deep water berth 182 meters in length could handle about 150,000 metric tons, and would be justifiable from the standpoint of transshipment cost savings from Saigon up the coast.

One possibility, which is the most expensive for the population of Central Vietnam, is to let the area be served entirely by truck, railroad, and coastal vessel, carrying commodities moving through the ports of Saigon or Vung Tau, assuming that all additional capacity required would be added in these ports. With deep water facilities concentrated on or near the Saigon River (Saigon and Vung Tau), coastal traffic up the Central Coast would consist of lightering in the shorter distances and coaster vessel for the longer routes. Somewhere up the coast, perhaps in the vicinity of Cam Ranh Bay, coaster traffic rates become more economical than land transport. All goods originating from abroad or destined for export would be subject to the high freight costs required to move them along the entire coastal area. This would represent the highest cost solution.

Since Danang already has some deep water port facilities and the prospect of the greatest traffic volume of any port on the Central Coast, Danang is a logical port for further deep water berthing capacity. If no other deep water berths were constructed on the Central Coast, deep sea traffic would be divided between Danang and Saigon. Assuming that equally good deep water handling facilities exist in each, the handling and freight rates per ton might be considered identical if traffic through Danang would be in sufficient large volume. Thus each port would handle deep sea traffic destined to or originating about halfway between the ports, or a distance of about 550 kilometers. This two-port solution would be better than the Saigon/Vung Tau pattern--essentially a one-port solution--because it would result in lower total transport costs. The reason is that per ton costs of freight increase directly with distance, and use of only one port means that a high proportion of the goods would have to be moved at higher per ton charges beyond a distance of 550 kilometers.

Another alternative is to develop a second deep water port, in addition to Danang, on the Central Vietnam Coast. Here the choice is affected by the distances from Saigon and Danang, and the hinterland potential, assuming that other considerations are equal. Thus one possibility is the port of Qui Nhon, which is closer to Danang, and the other possibility is a port in closer proximity to Saigon; and here the choice is between Nha Trang and Cam Ranh City, which are only 40 kilometers apart. For the purpose of this presentation, Cam Ranh Bay may represent this second port alternative. Under the assumption that equally good facilities exist at either location, it would appear that Cam Ranh Bay would have a somewhat more favorable situation. This is based on the fact that the length of the longest haul would be less, and on the assumption that traffic volume is

related directly to the size and distribution of the population in the hinterland area to be served. Also, it should not be overlooked that the port of Cam Ranh City would have a much more advantageous location than Qui Nhon for distribution of industrial commodities, including fertilizer as a possibility, which would eventually have an outlet in the large market of Saigon and the Delta.

The introduction of a second deep sea port on the Central Coast has the effect of reducing the traffic at each port, which in turn could increase the cost of loading and unloading. There could also be a possible reduction in the incentives for ships to call at the port, but this is dependent on the volume to be loaded or discharged. The building of a deep water berth at a third port on the Central Coast could easily become uneconomical from the viewpoint of attracting ocean vessels, although internal distribution would become less costly than under the various alternatives presented.

The analysis thus suggests that a deep water pier sited at Cam Ranh Bay or Nha Trang would provide a slight edge over Qui Nhon, on the basis of the economics of location. However, the physical advantages are definitely in favor of Cam Ranh Bay. While the channel at Qui Nhon will be about 30 feet deep after the dredging by the military is completed, the well-sheltered bay is comparatively shallow. To make a satisfactory deep water berth plus adequate standing and turning space at Qui Nhon would require additional deep dredging plus higher annual harbor maintenance costs. Since Nha Trang would require investments to get a year-round well-sheltered harbor and deep draft facilities, Nha Trang does not provide an advantage over Qui Nhon from a physical standpoint. Qui Nhon is in the heart of a dense concentration of population on the Central Coast comprising Binh Dinh and Phu Yen Provinces on the coast. On the other hand, Qui Nhon is farther north than it should be, economically, counting the transportation costs to be incurred in serving the area centered around Cam Ranh Bay.

In a choice between Nha Trang and Cam Ranh Bay, the latter is obviously the ideal site from the viewpoint of the natural deep harbor, which is well-protected and permits more economical construction of berths and other essential facilities. While Cam Ranh Bay requires channel dredging, it does not require breakwater construction, whereas Nha Trang requires both. The port of Nha Trang is clearly not an ideal site. The existing pier provides only about 4 meters depth alongside at the present time. During the monsoon season, the northeast swells give trouble, so that a breakwater is needed for an all-year-round port. Nha Trang has been the largest city on this section of the coast, with considerable built-in infrastructure for the support of a port, and with an adequate labor supply. In contrast, until recently, Cam Ranh Bay has lacked a population and an infrastructure, but a labor supply has been growing rapidly since mid-1965, although supporting facilities like those that exist at Nha Trang are still needed.

The DMJM study was written before the rapid population growth of the past year had become a fact at Cam Ranh Bay. Another point is that no reliable means of testing the commercial traffic potential has been possible, since only the condemned decrepit T-pier exists at Cam Ranh Bay. The prospective installation of the pontoon pier late in 1966 should provide a means of attracting coaster traffic. If the response is good, the basis for a decision on the development of a deep water berth should become much clearer.

If Cam Ranh Bay is not developed as an industrial complex, it could become an important customer of the port of Nha Trang. On the other hand, if a program of industrial development is encouraged at Cam Ranh Bay, it could completely eclipse Nha Trang and provide a strong reason for locating a deep water berth here within the next few years. Eventually, development of irrigated agriculture in the Phan Rang area, and of forestry operations and industry in the Dalat area, could create much more traffic (which would have an obvious outlet at Cam Ranh Bay) than appears in prospect in the immediate Nha Trang hinterland. All this argues that in the future, Cam Ranh Bay is likely to be a better and cheaper outlet to the sea than Nha Trang, if the source and destination of prospective traffic are taken into consideration. All these conclusions are supported by the DMJM traffic projections.

Port Improvements Suggested

The question of port and harbor facilities and suggestions that have been made for their improvement are important aspects of the case for Cam Ranh Bay port development.

In all of Vietnam, only the port of Saigon functions as a fully equipped deep water port, although deep water military piers are being installed at Cam Ranh Bay, Qui Nhon, Danang, and probably at Nha Trang.

Coastal steamers regularly serve Nha Trang, Qui Nhon, and Danang, and travel a considerable distance up the Mekong River to Long Xuyen on the way to Can Tho on the Bassac River.

Smaller craft, consisting of junks between 10 and 20 tons capacity, operate in all the ports on the extensive waterways system of the Delta area, and frequently sail in the open coastal waters north of Vung Tau.

The major ports in the Delta Waterways System are Ha Tien, Rach Gia, and Can Tho, all of which are served by shallow draft vessels. The extensive Delta Waterways System is closely integrated with the principal port, Saigon. In the port study by DMJM, consideration was given to the possibility of establishing a Delta seaport on the Bassac River, but it was rejected on economic and engineering grounds, since the task of taming this river was considered too expensive. For export, commodities need to be transshipped at Saigon port. Rice mills are mostly located

at Saigon-Cholon. A central rice mill to serve the Delta, and proposed for Vung Tau, would permit direct loading on ocean freighters at that point.*

The DMJM report recommends the establishment of a transshipment facility at Vung Tau for traffic from the Delta and small lots traffic from Saigon. It is reported in the DMJM study that the port of Saigon, if assisted by better facilities at Vung Tau, should be able to manage over several more years with the existing installations, including the military facilities just completed, since it is believed that throughput could be increased by 50% or more with recommended operating improvements.

Yet the capacity of Saigon port appears to be reaching a limit. Tidal constrictions on the channel from the sea are increasingly handicapping the port's capacity. The 30-foot (9.2 meter) draft is being exceeded by a growing proportion of ships. But dredging near the mouth of the Saigon River is recommended to achieve some improvement in the situation. Saigon has the equivalent of 9 deep water berths, and no additional capacity of this type is proposed. However, in addition to the rice mill berth, three ocean berths are recommended for Vung Tau. The data for the various ports, including the existing situation and recommended additional facilities are summarized in Table 6.

The DMJM study recommends coaster berth facilities for the ports north of Saigon as follows: Hue, one; Quang Ngai, one; Qui Nhon, two; Nha Trang, two; and Phan Thiet, one. Of these ports, Hue and Quang Ngai at present have none, and Qui Nhon and Nha Trang have partial coaster berths. Danang currently has five coaster berths and Cam Ranh Bay has one. To improve the situation with respect to deep water berths in the ports of Central Vietnam, several additional ocean berths are proposed--three for Danang, and one each for Nha Trang and Cam Ranh Bay.

The report recommends a total investment of \$44,343,000 in port facilities and improvements, of which \$28,110,000 are allocated to the ports of Central Vietnam and \$977,000 to the ports of the Delta. Proposed investments to improve throughput capacity in the Saigon area are \$3,900,000 in the port of Saigon and \$11,356,000 in Vung Tau. These proposed expenditures are related to future nationwide projected traffic movements.

About 50% of the investments in the ports of Central Vietnam are proposed for Danang--namely, \$12,812,000 out of \$28,110,000--all for three deep water berths.

While an investment at Phan Thiet of \$1,270,000 is proposed for a coaster berth, the DMJM study finds that rail competition to nearby Saigon, limited tonnage potential, and the cost of controlling the mouth

* DMJM, op. cit., p. 251.

of the Muong Man River militate against significant port improvement measures. A similar situation exists at the port of Hue, where river estuary and mouth stabilization would be very expensive and traffic potential low, making it more economical to supply Hue through the port of Danang.

Investments are proposed in Quang Ngai--a new port suggested in the DMJM study--which has no facilities today, but for which a coaster berth is proposed. This planned new port is about halfway between Danang and Qui Nhon.

Danang, as the most significant port in Vietnam next to Saigon, already has five coaster berths. The DMJM report proposes construction of three deep water ocean berths, which will also accommodate additional coaster traffic. Danang has an entrance channel silting problem that raises maintenance and operations costs, but apparently this is not prohibitive. The port of Danang should also be the future port of entry for ocean traffic to serve Hue and the area extending to the 17th parallel boundary. To the south, its service area would extend perhaps to Qui Nhon, where it would be in competition with oceanborne goods entering or destined to leave via Nha Trang or Cam Ranh Bay.

The ports of Cam Ranh Bay and Nha Trang need to be considered together because of their proximity and access to the same hinterland. The DMJM report proposes two coaster berths at Nha Trang and one at Cam Ranh Bay, plus an ocean berth in each, in addition to half a coaster facility currently existing at Nha Trang and a full coaster facility at Cam Ranh Bay. As noted below, the details of the proposal favor Nha Trang in the immediate future, although the traffic potential of Cam Ranh Bay is expected to exceed that of Nha Trang after 1970. Nha Trang port has a considerably larger current traffic volume than Cam Ranh Bay, but the future volume of the latter is projected to reach much higher levels.

In proposing plans for the development of these ports, the DMJM study recommends that no port facilities should be built at Cam Ranh

"until the potential annual overseas tonnage (less sand, petroleum, and military supplies to the Peninsula) reaches about 25,000. At that level a lighterage receiving facility could be amortized. If the potential is 40,000, a deep water berth could be amortized, but if Nha Trang has a deep berth that should be used to about the 80,000-ton level, with transshipment from Nha Trang would fund a new deep water approach and facility at Cam Ranh. Also, the single berth at Nha Trang would be approaching its capacity."*

"Development of Cam Ranh should include planning for a deep water port if for no other reason than to assure

* DMJM General Report, p. 254.

prospective investors of ocean transportation in sufficient volume if they have need of it.

"The port of Nha Trang could immediately use more tonnage capacity to handle intra-country traffic, but there is real doubt that water transport could do the job as well as the railroad might when it is restored. Nha Trang's future as a port city, however, need not depend entirely upon coastal traffic for which the railroad can offer sharp competition on short hauls.

"Nha Trang can gain more, and do more for Vietnam, as a port of entry for overseas trade. Such trade, because of discriminatory rates charged to small inadequate ports, has moved through Saigon; the added cost of transshipment was still less in many cases than the cost of shipment nearer the destination.

"The overseas tonnage for the combined Cam Ranh-Nha Trang hinterland is difficult to evaluate, but would justify a full deep water berth. An efficient port of entry pays off well; cargo delivered direct saves the entire cost of transshipment from the nearest transshipment port. There is no competition for overseas tonnage, except by transshipment from some other port which also must build both overseas and coaster additional capacity. The railroad can drop freight almost anywhere.

"A single 182 meter deep water berth at Nha Trang will for some years serve both overseas and coastal tonnage and, to a point, would economically serve Cam Ranh, if and as it builds up to support a berth of its own."*

For the port of Cam Ranh Bay to be competitive with other ports, particularly with Nha Trang, a pier with a deep water berth for ocean-going vessels is required. The problem involved in making the Bay port capable of handling ocean-going vessels centers on the feasibility of recovering the cost of constructing a deep water berth (annual capacity estimated at 150,000 tons) in the early years of operation. The DMJM studies accordingly suggest making these improvements initially at Nha Trang (at the Cau Da port), and proceeding cautiously in testing the Bay port's potential to handle ocean-going traffic. The weakness of this approach is that all deep water traffic in this area of the Central Coast would go to Nha Trang, and the "potential" of Cam Ranh Bay would never really be tested.

Thus, the following approach could be employed at Cam Ranh Bay. The pier facilities could be improved at an early date. One could exercise

* DMJM General Report, pp. 254-255.

a reasonable amount of caution by introducing phased construction which provides for an initial project of modest dimensions allowing for a testing of the port's potential without the building in of too much extra capacity. It would seem that one deep water berth would have to be built in the near future, and the decision should be based on the argument that Cam Ranh Bay should become the deep water port also for Nha Trang, rather than the reverse. If it is wise to develop Cam Ranh Bay as a deep water port in preference to Nha Trang--and this first phase study considers that it is wise--then limited subsidization of the investment for a limited period could be justified for construction of the deep water berth as part of the pier infrastructure. In this way, the future competitive position of the port of Cam Ranh Bay--the superior port--would be assured from the start. The other approach would perpetuate investments in basically an inferior harbor and port at Nha Trang.

Cam Ranh Bay, without doubt, has the best deep water and sheltered harbor in Central Vietnam. It has lacked a rich hinterland, it has lacked the population and the amenities of a developed and urbanized community, and it has lacked the well-built facilities of an adequate port. The foregoing remarks have indicated the presence of opportunities for bringing this era of underdevelopment to a close.

The installation of an adequate infrastructure essential to the operations of a port capable of handling ocean as well as domestic coastal traffic should make a tremendous difference in attracting traffic competitively with other ports north and south of Cam Ranh along the coast.

The absence of an infrastructure will then no longer act as an obstruction preventing the use of Cam Ranh Bay. The question of how much and what infrastructure naturally depends upon the time period being considered--at the initiation of service, or later when growth is being demonstrated. Although the cautious and the realistic way to proceed is to start with minimum facilities and build them up as warranted by expanding traffic, minimum facilities should nevertheless be sufficiently adequate in scale to avoid a situation whereby the important traffic is forced to go to other ports. The requirement of adequate scale means that dredging must be deep enough for most ships likely to use this harbor. The pier must be long enough with sufficient berths to accommodate ships without limited queuing. Stevedoring services must be available. Warehousing must exist for goods that require it. There must be easy access to railway and truck transportation. Repair facilities capable of handling at least minor to moderate repairs should be available for ships. Hotel accommodations and restaurant facilities should be available for ship crews and visiting businessmen concerned with international trade.

The quality of port facilities, service, and the harbor will be a large factor in determining the competitive position of Cam Ranh Bay compared to other ports along the coast.

VI STRATEGY OF AN ACTION PROGRAM TO DEVELOP CAM RANH BAY

Development of Cam Ranh Bay Not Inevitable

Decisive action will be essential if Cam Ranh Bay is to be developed into a significant urban community based upon a thriving regional industrial complex and a significant international port. Without such action, it is not inevitable that an important international port and an industrial complex providing numerous jobs should grow out of the \$200,000,000 program of construction now under way in the creation of a military base at Cam Ranh Bay. Certainly this project is bringing many workers to the area and is affecting in a profound way the lives of the people residing there. But one cannot guarantee that the effects will be lasting or will generate any momentum of development, especially since the military construction has a foreseeable end.

A peak in employment of Vietnamese workers may occur late in 1966, when perhaps 10,000 to 12,000 may be employed. From that point on, employment on construction at the base will decline and could well cease by about the middle of 1968. Labor requirements at the base will then settle down to a complement of perhaps several thousand civilians required to operate the base, in addition to the military personnel. The question is whether the thousands of remaining workers are going to find employment in other fields. Are they going to remain at Cam Ranh Bay and eke out a living in agriculture or other activities that may develop in the meantime, or are they going to return to their places of origin?

If Cam Ranh Bay is to be developed into a community with growth potential, an attempt could be made to find employment for as many immigrants as possible, without requiring them to return to their places of origin where they could become an additional social problem. Therefore, if Cam Ranh Bay is to be developed, the government authorities need to take some bold and decisive planning steps, so that there may be a quick transition over the next two to three years from a large military base construction program to a program creating civilian employment opportunities in Cam Ranh Bay.

Failure to take advantage of the present opportunity may mean a great opportunity missed forever, one that offers the greatest possibility that has ever come along for developing Cam Ranh Bay into a significant regional industrial center and an important international port under the most favorable conditions ever likely to occur.

Government Commitment Essential to Develop Cam Ranh Bay

As a prerequisite to any further steps, it will be necessary for the Government of Vietnam to undertake a public commitment to develop a significant port and urban industrial complex at Cam Ranh Bay. This commitment might be associated with a broad policy statement that the Government wishes to promote the national interest by carrying out a program for the dispersal of industry, and that the development of Cam Ranh Bay would be a first concrete step toward this objective. The commitment could also be announced within a framework of national development focused upon the task of postwar reconstruction.

At some stage, it would be appropriate for the government to state the means by which an industrial dispersal policy might best be carried out. However, this statement can wait until the matter is examined more carefully in the next phase of this research project.

It will undoubtedly be necessary, concomitant with the commitment by the Government of Vietnam, for the U.S. Agency for International Development to consider, and to take a position on, the extent and manner of its future commitment and support to the Government of Vietnam in following through on the development of Cam Ranh Bay.

Suggestion for Cam Ranh Bay Development Authority

The Government of Vietnam has been aware of the need for creating an institutional structure that would facilitate the development of Cam Ranh City and of the Cam Ranh Bay Region. A governmental decree of October 25, 1965 established Cam Ranh City as the fifth administratively autonomous city in Vietnam. The boundaries of Cam Ranh City were defined, and a mayor has since been appointed by the central government, with responsibility for administrative matters concerned with the development of the City. At that time, this action was timely in view of the decision to establish a large military complex on the Cam Ranh Bay peninsula, and many liaison problems with the civil authorities were naturally involved.

The mayor of Cam Ranh City, who under the present system is a military officer, reports directly to the Commanding General of Zone II. In status, the mayor of Cam Ranh Bay is equivalent to a province chief who is normally a military officer under the presently constituted government.

The Government of Vietnam's great interest in the development of Cam Ranh Bay is evident also in the formation of the Cam Ranh Bay Committee. The chairman of the Committee is the Director General of Planning, the rapporteur is the Assistant for Commerce to the Minister of Economy and Finance, and the membership is from a number of key government agencies. However, the Committee is a temporary body, and has felt the need for establishing a permanent agency concerned with the development of Cam Ranh Bay. A request to this effect went to the Prime Minister in April.

Considering the needs of the situation, the time appears opportune for the Government of Vietnam to create a permanent body with single-minded responsibility for promoting the development of Cam Ranh Bay. This agency could be designated as the Cam Ranh Bay Development Authority. There are several ways of organizing such an agency, but the main objective should be to obtain an effective development entity. The preferred approach might be to establish a Board of Directors of perhaps six members, some of whom could be chosen from the essential ministries concerned, plus some representation from the public, possibly some respected citizens from the business community. It may be well to include on the Board the Mayor of Cam Ranh City also. The Board's responsibility would be to make policy, and the Chairman of the Board would have sole responsibility for executive action. It may be appropriate to have the Cam Ranh Bay Development Authority report to the Minister of Economy and Finance.

The Cam Ranh Bay Development Authority would focus responsibility on the development of the infrastructural facilities of Cam Ranh City, the creation of an industrial complex, the construction of an international port, and the development of the surrounding region insofar as it relates to the development of Cam Ranh City. The Authority should maintain a broad view of its task that carries it beyond the boundaries of Cam Ranh City and takes into account the development of the contiguous Cam Ranh Bay Region. The Region might be designated to include (1) the coastal area stretching from Ca Na to the south of Cape Varella to the north, and (2) the hinterland stretching into the Western Highlands.

The Cam Ranh Bay Development Authority would emphasize developmental activities, and it should not want to get involved in the political and administrative problems of Cam Ranh City. On the other hand, it would seek to give whatever aid it could to advance effective and rational development of the City and make the City a fine community in which to live. The Authority could provide guidance to the City officials in the planning of the community by assisting technically and financially with the building of the infrastructure, and by attracting and promoting the commercial importance of Cam Ranh Bay as an international port.

The Cam Ranh Bay Development Authority would operate principally through the programs of the action agencies of the Government of Vietnam, and through fostering private initiative in the development of Cam Ranh Bay. It may be desirable to give the Authority the right to acquire, to own, and to manage property. For example, this could include port facilities and the establishment of industrial estates to attract industry to Cam Ranh Bay. In any case, the Authority should have a sufficiently large budget and staff to (1) plan a program for the development of the region; (2) conduct studies (on its own or via contracts) that would investigate economic opportunities and development needs of Cam Ranh City and the larger region; and (3) conduct a program to promote the sound development of the region through a coordinated governmental and private enterprise effort.

The Cam Ranh Bay Development Authority would focus its promotional effort on establishing a viable international port and industrial complex at Cam Ranh Bay, but it would take a larger view also, and support the development of industry and agriculture in the region nearby and in the

exploration for mineral resources in the hinterland. The development of the hinterland region to the north, to the south, and to the west in the highlands should contribute materially to the development of industry at Cam Ranh Bay itself, and to the activities of the port for expanding domestic and international commerce.

As the Cam Ranh Bay Committee has wisely pointed out, in its report of August 1965 to the Prime Minister, the development of Cam Ranh Bay "should not be separate, but rather, within the framework of the national economic development program and the policy for territorial development" of Vietnam.

Liaison Responsibility in USAID/Vietnam

To center attention on the importance of Cam Ranh Bay in terms of future development, and to reflect the commitment that may be anticipated on the part of the USAID Mission in Vietnam, it is suggested that an important officer in USAID reporting at a high level be charged with responsibility for liaison with the Government of Vietnam in coordinating and handling all planning and action projects concerned with the development of the Cam Ranh Bay area.

Local Government in Cam Ranh City

After the decision has been made to develop the Cam Ranh Bay area, certain additional steps might be considered regarding possible changes in the local government, under the assumption that the development program would be affected by, and in turn would affect, the local human environment. Since the present city government is admittedly temporary, some thought should be given to ways and means of establishing a more permanent administrative milieu.

Guidance in this matter can be provided by research, as suggested in Chapter VII in the section titled Studies of Administrative Needs, and perhaps the best procedure is to wait until such studies are completed. However, if some initial action was considered necessary, without waiting for research results, steps might be taken to form an advisory council representing the community, thus at least laying the groundwork for local community participation in the development efforts. In any case, local cultural background, custom, and other social factors should be considered before deep-seated changes are initiated in the administrative pattern.

Whichever type of administration would be operating at any given future period, an important base for the planning and development effort would be a framework of regulatory codes and ordinances for consideration and adoption.

The Physical Security as It Relates to Development

Security and Resource Exploration

The theme of this discussion is that planning for the development of Cam Ranh Bay need not wait at this time until full knowledge is available

about the resources existing in the hinterland, particularly in the highlands to the west. It should be demonstrated in time that there is the possibility of establishing at Cam Ranh Bay an impressive number of manufacturing and commercial enterprises which are not dependent upon any resources from the hinterland region. Later in this chapter and in Chapter VII, suggestions are made for undertaking certain industrial feasibility studies which would probably uncover a number of enterprises with a good chance of becoming successful at Cam Ranh Bay or in the nearby region. Enough is known to justify embarking upon development of the Bay area itself without the need for complete knowledge concerning the resources that might possibly be in the Western Highlands.

At a later stage, when the hinterlands are free of Viet Cong activity, and perhaps after some progress has been made in the establishment of industry at Cam Ranh Bay, resource exploration studies should be conducted in the hinterland region via aerial photography and field work on the ground. The emphasis should be placed particularly on the existence of mineral and forestry resources, and on a determination of the reserves available for development and as inputs for industrial enterprises.

Security in the Bay Area

The problem of security should not delay the conduct of physical investigations of the area in and around Cam Ranh Bay, because the military, in connection with its own planning and development projects, is interested in establishing conditions allowing research and planning workers to conduct their activities without hindrance and in safety. The presence of the military in strength at Cam Ranh Bay and the needs of the military for a local water supply mean that the military authorities will have to assure security of the area in and around Cam Ranh City, so that the planning and research studies essential for the rational development of the area can be properly carried out when they are needed. Some security problems may arise in searching for water supplies and in measuring streamflows around the Suoi Tra Duc Valley and at other streams in the nearby western mountains overlooking the Bay. It is understood that recently established Nung villages, together with older villages in the Suoi Tra Duc Valley, are militantly anti-Viet Cong and possess strongly organized militia units. However, the support of the military authorities in the area is required for adequate protection of planning and construction teams.

In the construction of certain industrial and infrastructural projects, thought should be given to how inviting these projects might be as Viet Cong targets and how well they can be protected. Particularly high investment projects such as the refinery and some plants in the petrochemical complex (discussed later) could be in this category. Thus lack of security could be a factor serving to delay construction of such plants unless adequate steps were taken to eliminate the likelihood of sabotage.

Insufficient security is currently restraining the flow of truck traffic between Cam Ranh Bay and Phan Rang except with armed convoy support,

and railway traffic is at a standstill. However, traffic moves freely to Nha Trang. Movement of freight by rail or highway is wholly blocked in certain sections of the coast between Saigon and the border at the 17th parallel. It is assumed in this study that progress of the military campaign will have the effect of permitting truck and rail traffic to move with little interference along the north-south coastal route of Vietnam between the middle and end of 1967. On this assumption, certain projects of the infrastructure may be undertaken early, in view of the essential lead-time necessary in planning, designing, and constructing major projects--e.g., construction of the pier at Cam Ranh City.

Joint Use of Military Constructed Facilities

Early advantage should be taken of the involvement of the military authorities in the construction of the base and related facilities now under way at Cam Ranh Bay. It is urgent, first, to get the attention of the military at a critical point when the greatest advantage can be taken of the work now going on; and second, to assist them in the plans for works to be constructed in the future so that opportunities for joint use of facilities by the civilian population or for commercial use are given due attention.

The military authorities in charge of construction can be expected to appreciate any assistance they might obtain from outside sources that would aid them in effective planning for the needs of the Cam Ranh Bay civilian community. The military authorities are aware that they are not building for themselves alone, and that the impact of their work on the community should be given proper attention.

For example, it is understood that the Army base under construction on the mainland side at Dong Ba Thin will require water on that side of the Bay. This immediately raises the possibility of joint procurement of water for military and civilian requirements. The military authorities are necessarily concerned with the water requirements of the civilian construction workers and of the permanent community to be established in Cam Ranh City. For proper planning, the military authorities need better information on the size of the future population and its concentration before they will be in a position to move ahead decisively in finding the water supply necessary and in constructing the works essential for their own and civilian requirements, including the construction of transmission and distribution facilities.

There are instances where the U.S. military forces in the Pacific have built entire city water supplies for combined military and civilian use, and water is made available on a long term basis to the civilian community. Guam and Okinawa are examples of such situations where the urban communities obtain their water supply from military installations.

Since the military authorities also appear to have funds for investment in projects of this type, possibly permitting more flexible use than

the funds of USAID, it would make sense to move ahead quickly with planning of facility requirements and their location so that advantage may be taken of this fact.

A number of facilities installed by the military authorities on the base could eventually have civilian as well as military uses. The military authorities obviously have first claim upon the facilities essential for the protection of Vietnam, and nothing must be done to interfere with their military purpose. However, as time goes on, it would be well for the military to consider allowing civilian utilization of certain facilities insofar as such use is compatible with the primary objective of the military authorities to protect and safeguard the physical security of the country.

Chapter III has discussed the planning aspects of the military buildup on the peninsula as they might relate to the development planning of Cam Ranh City. Many facilities such as roads, piers, air fields, bridges, and open and enclosed storage areas have been, and are continuing to be, constructed. Some of these would readily lend themselves to eventual civilian use; others would be subject to the practicability of joint civilian-military use; still others may be too far removed from future core activity areas to have any anticipated large scale civilian use.

With the assumption that the military peninsula will remain for the immediate future as a major military logistics base, the following military projects are discussed from the viewpoint of joint military-civilian use.

1. National Route No. 1 is being improved at two segments for current military purposes: (a) between My Ca and the new military facilities at Phan Rang, and (b) between My Ca and Nha Trang. These road improvements offer civilian advantage to Cam Ranh City.
2. There is the possibility of extending a railroad drill track from the Vietnam Railway System at a point north of the present city limits line, southerly around the upper bay, down the upper peninsula to the military peninsula. This extension may offer a transportation mode for the movement of materials and products to be produced by the plants and industries of Cam Ranh Bay.
3. A permanent bridge will replace the pontoon bridge now crossing the Bay. Such a bridge, of course, offers the long term permanent connection necessary between the mainland and the peninsula side of the Bay.
4. The runways at Dong Ba Thin and the two 10,000-foot runways on the peninsula side would offer considerable advantage to Cam Ranh City for eventual commercial air traffic. Of the two, the runways on the peninsula side would be better from the standpoint of having clear zones over the Bay on the southwest and over the South China Sea on the northeast approaches. However, the existing buildings and facilities near the Dong Ba Thin runways offer

advantages to this location. In any event, the prospect of having a commercial airport at Cam Ranh City would be subject to a detailed study of traffic control and potential air freight and air passenger demands. Such a study is suggested in Chapter VII.

5. Two steel DeLong piers and an adjacent concrete pier near the village of Cam Ranh--together with the associated wharfage facilities and equipment, storage areas, and warehousing sheds--offer considerable fixed and permanent facilities. However, before civilian use can be considered, several questions must be answered. Would the military relinquish these facilities early enough to accommodate initial Cam Ranh Bay commerce? Would military activity preclude any civilian use of these facilities? Assuming that joint military-civilian use was allowed, would military priorities for use of pier space, or military activity in and around the wharfage and storage areas, preclude effective use of the facilities for commerce? (This question of priority might still be the problem even if one or two of the piers was specifically designated for civilian use.) Assuming that some form of partial civilian use was allowed, would industrial and shipper use areas be so located that higher costs or inconvenience would preclude use of the peninsula as the port for Cam Ranh Bay? At present, the position in this report is that a single port facility, primarily constituted to accommodate civilian commerce, should be located close to major industrial concentrations and next to major rail and road facilities, all of which contribute to the efficiency and operational economy of a major port facility. For this reason, the military pier facilities on the peninsula are excluded from serious consideration at this time.
6. Although domestic water facilities (wells, small treatment plants, and some distribution lines) are local to the military peninsula and offer little advantage to the mainland side of the Bay, serious consideration should be given to joint participation in a military-civilian water supply and major transmission system on the mainland. This major supply system could consider installation of one major permanent treatment plant to service all of Cam Ranh City. It could be designed as a staged plant in order that its capacity could be increased over the years as the demand for water increased.
7. As is the case on the mainland side, the peninsula has minimal sanitary-sewage facilities. As time passes and development activity builds up, the greatest care must be exercised to ensure that the Bay, the seaward shoreline, and the underground water supply not become contaminated. A joint use military-civilian sanitary sewage treatment plant may well offer economy and efficiency. However, as discussed earlier in this report, the separation of the peninsula from the mainland by Bay waters up to 8 kilometers wide may preclude such a possibility. The economy of various system designs on both the mainland and the peninsula sides (with considerations for one or more treatment plants) may well tend to establish the economic feasibility of a joint facility.

Emphasis on Development Through Private Investment

In developing Cam Ranh Bay industrially, the Government of Vietnam should rely primarily on the encouragement and support of private investment and enterprise, both domestic and foreign.

Making Cam Ranh Bay development attractive to private investment will require substantial emphasis on the planning and construction of the physical-social infrastructure. Initially, it is essential for the Cam Ranh Bay Development Authority to provide the basic infrastructural facilities required for the operation of the port--pier accommodation, docks, and warehouses. Communications with Saigon and with cities and nations on the outside need early improvement--e.g., the postal service. Local transportation, especially in the connections to the port facilities, will require early development.

In building for local services, the development program must give special attention to the business and social requirements of an entrepreneurial class expected to be attracted to Cam Ranh City.

The quality of the schools where the children of this group attend, especially in the lower classes, may have to be given particular emphasis. Banking and commercial services and suitable hotel accommodations and restaurant services should be given high priority. These services should be provided by private enterprise also, and are essential if outstanding business enterprises and management personnel are to be attracted to Cam Ranh City.

Since the funds of the Government of Vietnam for investment in industrial, commercial, and service facilities are necessarily limited, it must do all it can to introduce the amenities needed locally, as a means of encouraging as much high level private enterprise as possible for the development of Cam Ranh Bay to make it a viable, growing, and high standard community of the future.

In attracting entrepreneurship of a superior type in the industrial and commercial spheres, the Government will probably want to look particularly to these interests now established principally in Saigon-Cholon, and perhaps to some other major cities. Special inducements for them to establish new entities in Cam Ranh City, some possibly as branch plants of existing establishments, may need to be considered. This matter should be examined carefully in the Phase II research program. Attention should be given also to the possibility of attracting American, Japanese, and European industrial firms to invest in the development of Cam Ranh City and the Region.

Role of Foreign Economic Assistance in the Development of Cam Ranh Bay

The future importance of U.S. economic assistance in the development of Cam Ranh Bay is already obvious, as the Government of Vietnam in the postwar period is not likely to have the financial resources essential for the development of a program of this magnitude. However, the Government of Vietnam may also wish to turn to other countries for assistance

in financing industrial feasibility studies and in encouraging their nationals to invest in such enterprises. The liberal policy of the Government of Vietnam in encouraging private foreign investment is the mechanism by which hopefully substantial foreign assistance can eventually be channelled into the development of this important region so significant to the future of the country.

An International Port and Industrial Complex - Key to Development

The key to the development of the Cam Ranh Bay area is the creation of a substantial industrial complex related, if possible, to the founding of a major port handling international and coastal domestic commerce. The action to achieve this objective must be decisive, both in terms of initial commitment and in terms of follow-through with an effective program. The follow-through must be well-timed so that the economic and psychological impact of the present huge construction program is channelled and the impetus of the present situation is carried into future development.

The Cam Ranh Bay Development Authority should seek to create an industrial complex of medium and large scale industry at Cam Ranh Bay within a deadline of the next few years. This complex should be sufficiently large to act as both magnet and catalyst, in attracting and nurturing a diverse industry and commerce to Cam Ranh Bay. The establishment of a number of fairly large industrial enterprises at Cam Ranh Bay should be designed to have an impressive demonstration effect upon potential entrepreneurs, particularly those interested in establishing branch plants out of Saigon-Cholon, and possibly upon foreign investors interested in establishing manufacturing enterprises at Cam Ranh Bay.

The industrial complex at Cam Ranh Bay should be related as much as possible to the development of a port, emphasizing international commerce, based upon the tremendous asset of Cam Ranh Bay as a deep water harbor. Typifying the concept contemplated here is the port of Kaohsiung in Taiwan, currently being created by the Republic of China.

Steps in the Creation of a Port Industrial Complex

Certain steps can be taken to provide directed action for creating a port industrial complex. Some of these steps will require data from the studies proposed in Chapter VII, but other steps can be started, at least in a tentative way, and can be revised as more research data are available.

Export of Silica Sands

One of the first steps that should be taken in the development of Cam Ranh Bay is to obtain an early movement again of the highly pure silica sands into the international market. Security was probably not the

only reason for the cessation of silica sand exports in early 1965, and it appears that economic reasons may well have been the real cause. Precisely what the economic reasons were should be determined, through research proposed in Chapter VII. This proposed research is a short low-investment study, which would provide the basis for government decision and action designed to resume the marketing of this resource as a benefit to the Bay area and the country.

Advance Data Collection Projects

It would be appropriate to begin immediately with the collection of data concerning the Cam Ranh Bay environment to permit use of the results in the planning studies, and for the use of business in planning industrial facilities. These projects are concerned with the collection of hydrologic, meteorologic, hydrographic, and soils data. Chapter VII contains proposals for the conduct of these four data collection programs.

Establishment of a Chemical Industry Complex

While judgments of Cam Ranh Bay's development prospects must be only tentative at this stage, there are real grounds for consideration of a chemical industry complex at Cam Ranh Bay. To achieve such a complex would mean a unique contribution to the Vietnam economy since today there are almost no facilities of this type. Since chemical plants have a high degree of interdependence and tend to locate close to one another, the location of the fundamental units of the industry will be a major factor in choice of location for other units. For this reason, a complex might best serve the needs of the economy if it is located centrally in the country such as at Cam Ranh Bay, but with due consideration to availability of raw materials and location of the ultimate market. A deep water location would be desirable for receiving imported raw materials and for moving products into world markets if care was taken to ensure that the complex would be competitive.

The key investment for attaining this objective is the location of the proposed refinery of the Vietnam Refining Company at Cam Ranh Bay instead of as now contemplated at Nha Trang. Arguments point toward the location of the refinery at Cam Ranh Bay in accordance with the notion of building port-related industry there. The chemical complex should be located in close proximity to the refinery for economic transfer of input products derived from the refinery. This means that it can be a major economic mistake from the viewpoint of regional development if the refinery location and the chemical industry location are determined independently, and if these enterprises together represent an essential nucleus of a regional industrial complex.

The Esso Corporation's feasibility study of 1962, after examining Vung Tau, Cam Ranh Bay, and Nha Trang, came to the conclusion that Nha Trang was the best location for the refinery. Land was subsequently purchased and cleared, and preparations were under way in 1965 to establish

the refinery there. At this point, Viet Cong sabotage became more acute, and the large expansion of the U.S. military involvement in Vietnam occurred in the middle of that year, with the result that the land for the refinery site was taken over by the military authorities for the period of a year, or possibly longer. Depending upon the military situation, the military use of the property conceivably could run beyond the one year period. At the same time, the military forces also occupied another of the sites mentioned in the Esso feasibility study, a location at Cam Ranh Bay on the southern tip of the peninsula close to the recently constructed Navy pier.

The earlier decision to locate the refinery at Nha Trang was based primarily on two disadvantages presented by the Cam Ranh Bay location. The predominant disadvantage was the lack of amenities at Cam Ranh Bay; no housing available for the staff, whereas housing could be bought or rented at Nha Trang. It was estimated at the time that the installation of sufficient housing for the accommodation of the staff would run as high as \$3.5 million.

The other disadvantage had to do with the higher cost at Cam Ranh Bay for installation of underwater pipelines, compared with the cost at Nha Trang. The underwater pipelines were to go from deep water broys to the refinery sites. One proposal was for an underwater pipeline approximately 1 kilometer in length from a buoy at a deep water discharge point to the site on the coast just south of Nha Trang city. This was preferred. The peninsula site at Cam Ranh Bay required an underwater pipeline of the same length, but the selection of the site at that point would have entailed other costs to the refinery corporation--for example, transportation of workers from the mainland to the peninsula, and a possible railroad spur for hauling petroleum products to the main north-south railway line through Ba Ngoi. A third site was on the mainland side, to which a submarine pipeline approximately 8 kilometers in length from a deep water discharge point would have been necessary. The laying of a submarine pipeline 1 kilometer in length has been estimated at about \$50,000. The difference between an 8-kilometer pipeline and a 1-kilometer pipeline is approximately \$350,000, which would be the additional cost of locating the refinery on the mainland side at Cam Ranh Bay next to the railway.

Considering the logic of that immediate situation, the decision favoring Nha Trang over Cam Ranh Bay appeared to be reasonable. Yet if other factors are considered--such as use of the refinery as the nucleus of an industrial complex--the decision might well favor Cam Ranh Bay over Nha Trang. Chapter VII contains a proposed study to determine just such factors, especially since construction of the military base has drastically changed the situation in the Bay area.

The AID-financed housing projects at Ba Ngoi, where the construction of about 2,800 homes accommodating 10,000-14,000 people is contemplated, would presumably eliminate the argument that housing facilities would have to be created completely fresh by the refinery corporation. Other services associated with urbanization are also going to be built into

this housing project; in this respect, then, the lack of amenities at Cam Ranh Bay is now being remedied, thereby eliminating the previous major disadvantage of Cam Ranh Bay as the refinery location. Thus, the direct additional cost of establishing the refinery on the mainland at Cam Ranh Bay would be the cost of the additional pipeline plus the cost of some executive housing, or perhaps \$500,000.

However, the Vietnam Refining Company may still be concerned about this \$500,000 additional cost. Yet, since it appears to be in the public interest (at this point in the study of the problem) to establish the refinery at Cam Ranh Bay as the first element of an industrial complex, the Government of Vietnam may wish to consider some compensation for this additional cost. One form of compensating subsidy might include provision of a free industrial site adequate for the needs of the refinery and related facilities. Justification for locating the refinery on the mainland at Cam Ranh Bay would lie in the fact that it will represent a key investment to which many subsequent investments in this industrial complex could eventually be linked.

In Chapter VII, a feasibility study is proposed to examine all locational and technological aspects, and to seek answers not only for the refinery question but also for the An Hoa-Nong Son question, as discussed below.

The An Hoa-Nong Son Complex versus a Petro-chemical Complex

A chemical complex based upon products of the petroleum refinery would be more practical than the An Hoa-Nong Son coal-based project, which is planned to produce ammonia, urea, and ammonium sulfate fertilizers, and calcium carbide. Not only would a petroleum-based fertilizer complex be more economical in both capital and operating costs, but the many problems associated with operation of a coal-based facility strongly suggest that choice of the latter, especially in view of the many uncertainties associated with operation near the North Vietnam border, would lead to failure of the project.

The coal mine at the present time is surrounded by the Viet Cong, operations apparently are at a standstill, and plans to continue the establishment of the An Hoa industrial complex are therefore in abeyance. The tentative position of this report, based on preliminary findings, is that it is probably more economical, based on modern technology, to produce the proposed fertilizers from petroleum rather than from coal, and to use the coal for fuel purposes only. It is strongly indicated also that a sophisticated facility, such as an ammonia plant, should be located where the prospects for uninterrupted operation are greatest, and where there is the advantage of being more centrally located relative to the market area.

This position naturally raises the question of whether the equipment brought to Vietnam for the establishment of these several chemical plants

could be adapted or modified in order to produce the same end-products from petroleum instead of coal. It is therefore suggested in Chapter VII that a study be made which would evaluate the feasibility of a chemical group of industries, including those already proposed for the An Hoa industrial complex, and to evaluate their economics based upon either coal or petroleum products. This study should also investigate the best location for this chemical industries complex, focusing particularly on the question of how the economics would be affected if these chemical industries were indeed located at Cam Ranh Bay. Another possibility is to consider establishment of another major industrial complex at Danang, where substantial local resources exist for development.

As indicated earlier, a chemical industry based upon the refinery would be the nucleus of a chemical industries complex unique in the present Vietnam industrial structure. A location such as Cam Ranh Bay, which is more central than An Hoa, would appear to be preferred, from the viewpoint of serving the major market area in the Southern Region of Vietnam.

Manufacture of Salt, Caustic Soda, Chlorine, Soda Ash, and Glass

Consideration might be given to establishment of a caustic soda plant at Cam Ranh Bay based upon electric power and the solar-produced salt of Ca Na, a product now being exported principally to Japan. Co-products of this industry would be hydrochloric acid, or hydrogen and chlorine. The caustic soda or its successor product, soda ash, could be used in refining or in the production of a host of useful materials such as soap, detergents, bleaching powder, water purification tablets, sodium silicate adhesive, and chemicals for other uses. The hydrochloric acid would be useful as a chemical or for metal cleaning; hydrogen could be used in oleomargarine production or as ammonia plant feed; chlorine would be a valuable raw material for chemical production or could be used in municipal water purification.

The availability of the high purity silica sand deposits at Cam Ranh Bay suggests that it could become an excellent raw material for manufacturing certain glass products required in Vietnam. Some sand is already being shipped to Saigon to a glass plant for this purpose.

In the interest of overall economy, it may be found economical to bring the salt from Ca Na to Cam Ranh Bay, a distance of about 60 kilometers, for processing if all the other elements of the chemical industries complex can most economically be located at the Bay. A study of the feasibility of producing these products from the salt and silica sand of the Bay region is suggested in Chapter VII as part of an effort to create an industrial program for the development of Cam Ranh City.

Another study suggested in Chapter VII would investigate the feasibility of developing solar salt evaporation ponds in the lagoon of upper Cam Ranh Bay and the lagoon, Dam Nai, located near Phan Rang Bay. At the moment, it appears that Phan Rang Bay is the most likely candidate for the

salt-producing project, but of course, the proposed research would provide definite answers.

Cement Manufacturing

The suggestion is proposed concerning the possibility of establishing a cement plant at Cam Ranh Bay using limestone from various possible sources nearby.

A great deal of cement is being imported for the vast construction activities, many of them military-related, now going on. Thus it might be profitable to supply the needed cement locally, and a study is proposed in Chapter VII to determine the feasibility of establishing a clinker production plant at Cam Ranh Bay, the product of which could be shipped to the Thu Duc plant near Saigon for crushing and blending into the finished product. Another possibility is to produce calcium carbide from the limestone as a by-product of the cement process. The calcium carbide, in turn, could become the basis for the manufacturing of acetylene and polyvinyl chloride. These possibilities have been suggested in the Nippon Koei report.

If the feasibility studies determine that these various industrial possibilities, principally based upon local or not-too-distant resources, are economically sound enterprises, they could lead to the creation of important chemical industries which could become an important base for the development of a fairly large industrial complex at Cam Ranh Bay. Once a few chemical products are being produced locally, there will be increasing opportunities to add other plants for the production of by-products, many of which will become inputs to the production of other products. Such an interlinked system of chemical plants could be significant to the development of Vietnam. By following these steps, the industrial complex at Cam Ranh Bay could become an important chemical industry complex--the most important to the Vietnam economy.

Construction Materials

Materials for the construction program in progress on the Cam Ranh Bay military base are obtained from a number of local sources. For example, laterite is quarried along the mainland side of the Bay south of Ba Ngoi. Gravel and other construction materials are available in quantity in various places of the area. Materials in large quantities will be required in the future for highway and port construction and other infrastructural works. Rock crushing, concrete block making, and related activities should provide enterprise and employment on a substantial basis in the future.

Processing of Forest Products

A good look should be taken at the possibility of exporting timber products, particularly plywood and veneer, from Cam Ranh Bay to Japan and to the United States. The Philippines are exporting a large amount of plywood and logs for plywood to Japan. Considerable plywood is also exported directly to the United States, and some Japanese plywood, manufactured out of Philippine logs, finds its way to the American market. The study proposed in Chapter VII could investigate whether the Vietnam timber industry can compete with the Philippine industry.

Another important objective of the proposed study would be to examine the feasibility of establishing forest products industries at Cam Ranh Bay to turn out such products as plywood, plywood veneer, and boxes for domestic and export markets, with the additional possibility of establishing chip board or particle board plants if the waste products from the other processes become sufficiently large.

The forest resources in the Dalat area are very extensive and easily accessible to Cam Ranh Bay. The distance from Dalat to Cam Ranh Bay is only about 65 kilometers, and if Highway No. 11, between Dalat and Phan Rang at the highland escarpment is adequately improved, there may be good economic reasons for transporting raw timber to Cam Ranh Bay.

The Dwyer Mission has suggested establishing several timber processing plants in the interior of the Central Highlands. Further study, as suggested in Chapter VII, may show that some of these plants could be competitively located at Cam Ranh Bay and would contribute toward development of the proposed industrial complex.

Expansion of the Fishing Industry

Improvement of the fishing industry along the coast from Ninh Hoa to Cam Ranh Bay should be given special attention. There is a major fishing fleet in Nha Trang and one of considerable size at Cam Ranh Bay. However, because the boats are too small, or not motorized, or inadequately motorized, the fishing is limited to shallow waters. Although many fishermen want to expand and modernize their equipment, they cannot get the needed financing. With larger motorized boats, fishermen could proceed farther out to sea in order to enlarge their catch of fish. A larger catch should also result in a more diversified supply of fish as the fishing grounds are extended. The increased supply and variety of fish, in turn, should then become a more satisfactory supply basis for establishing fish processing enterprises.

A study is proposed in Chapter VII to investigate ways and means to improve and expand the fishing industry. The study should also explore the potential of various fishing grounds in supplying kinds and quantities of fish. Attention could be given to the supply of inedible fish and wastes in sufficient supply to be used for the preparation of fishmeal

and fish oil. The fishmeal could eventually be used in the preparation of animal feeds or fertilizer. Processing may turn out to be on a lower priority at present and to be dependent on a larger catch of suitable species than is now available.

Expansion of Irrigated Agriculture

It appears that certain studies need to be undertaken to develop the Phan Rang irrigation project to its full potential. A number of problems and unknowns exist which will hinder the full scale development of this project. So far, only the major canals have been constructed, and no provision has been made for secondary canals and local ditches to individual farms. Also, the runoff from the western hills is likely to create floods, and may not only damage the farms, but possibly damage the irrigation works now constructed, largely because no provision has been made for the construction of flood control facilities to catch excess runoff. Therefore, additional works could be built to catch the runoff and use it for irrigation or other water supply purposes.

Since power production at the Da Nhim plant diverts water from the Da Nhim river system to the Phan Rang Valley, rotor power production directly determines the amount of water that flows through the penstocks and that becomes available for irrigation purposes. It is consequently necessary to inquire into the additional works needed to allow the water to bypass the penstocks when the plant is not in full operation, so that the additional water from the project can be put at the disposal of the Phan Rang irrigation project.

As pointed out in a proposed study given in Chapter II, further studies are needed of the total supply of water likely to be available and the annual and seasonal water requirements for the Phan Rang irrigation project. A related question is how much excess water from these sources--namely, the Da Nhim power project and the Song Cai River--is available for transport to meet the requirements of Cam Ranh City for civilian and military purposes. The cost of making these imported supplies available is an important factor for comparison with the cost of producing supplies locally from underground water or from dammed streams.

In conjunction with the investigation of the water supply situation, in and around Cam Ranh Bay, another study is proposed in Chapter VII to investigate the feasibility of additional irrigation in the Suoi Tra Duc Valley immediately to the west of Ba Ngoi. This small valley is presently being irrigated to some extent from small diversion dams by the farmers in the area. An expansion of the agriculture of the area would extend agricultural employment opportunities for refugees and others in the valley. It would provide an additional food and fiber supply, some of which might be available for agricultural processing industries set up at Cam Ranh Bay, based upon supplies from the Phan Rang irrigation project and the coastal agricultural lowlands around Nha Trang and Ninh Hoa.

Establishment of Industrial Estates

In planning the layout for industry at Cam Ranh Bay within an industrial zone, it would undoubtedly make sense to think in terms of establishing industrial estates or parks. Or, one industrial park might be established separately to accommodate comparatively large scale enterprises, and another industrial estate might be reserved for the development of medium and small scale industry. The industrial estate for smaller enterprises could include certain service enterprises as well as those based upon manufacturing and processing. These two estates should be located near each other to permit easy economic linkages between large and small enterprises. Certain external economies for small enterprises should become quite evident and could grow out of the facilities and services performed by the large scale enterprises. The presence of the industrial estates with the built-in infrastructure of electric power, water supplies, sewage disposal, drainage, and roadways should provide an important inducement for the establishment of new or branch plants by Saigon-based entrepreneurs or even by foreign investors interested in investing in Vietnam.

A study is outlined in Chapter VII concerning a projection of the demand for industrial space for large, medium, and small scale industry at Cam Ranh Bay. This study will necessarily include interviews with industrialists elsewhere in Vietnam, particularly in the Saigon-Cholon metropolitan area, to determine the interest of industrialists in undertaking investments at Cam Ranh Bay.

Such a study should also particularly explore the attitude of the Saigon business community toward making manufacturing and commercial investments in Cam Ranh Bay. It may be anticipated that the commitments and actions of the Government will be carefully watched by businessmen to assess the sincerity of the Government's attitude. To encourage business investment in an area of unproven industrial potential, the Government may have to undertake special inducements such as have been found effective in encouraging underdeveloped regions. Examples are the success in industrializing Northeastern Brazil and Puerto Rico.

Manufacturing Based on Nonlocal Resources

The discussion so far has considered manufacturing enterprises principally based on resources derived from regional or not too distant sources. Developers of Cam Ranh Bay should, however, take the view that the only matter important in the selection of candidate industries for investment is their competitive viability and profitability when located at Cam Ranh Bay, irrespective of whether the resources originate in the area, elsewhere in Vietnam, or abroad. Nor should resources for processing be confined to "natural" resources. A study is proposed in Chapter VII to screen a selected number of industrial possibilities coming within the above description for apparent feasibility if established at Cam Ranh Bay. Special attention should be accorded to export possibilities.

Boatbuilding Industry

Nha Trang appears to have the major fishing fleet on the Central Coast of Vietnam; and the Cam Ranh Bay fleet, while it has been important, has recently declined in significance because of currently more profitable opportunities available to the fishermen. Nevertheless, one may expect, after the present emergency, that the fishing fleets in these two neighboring ports will become modernized to an increasing degree--in terms of a higher proportion of motorized and larger boats, equipped with larger motors and with better fishing gear--so that the boats can go farther out to sea and can return with larger catches. Such a more promising outlook for the fishing industry should have some impact on supplying industries, e.g., the manufacturing of nylon fish nets and boat construction. Either Nha Trang or Cam Ranh City could have the qualifications of a future boatbuilding industry which conceivably could build for the fishing industry on the Central Coast. The necessary timber required could be found in the Central Highlands. Later, after experience, the possibility of extending to the construction of coaster vessels could be a natural development.

Services and Production for the Local Market

An immediate project in planning for the development of Cam Ranh Bay, should be a short study, as outlined in Chapter VII, to determine whether matters of policy would permit the military authorities at the base to extend procurement from local sources. Such services might include bakeries, tailor shops, laundries, repair shops, and similar services. Procurement by the military would assure a steady and large volume market that should be very encouraging to small enterprise investment in the area. Once built up, these businesses could also provide services to the growing civilian community.

Development of a Free Trade Zone

One method of attracting manufacturing industry to Cam Ranh Bay and of achieving the objective of a port based on manufactured exports is to establish a free trade zone. This device would enable approved enterprises established there to import duty-free any raw or semifinished materials used in the manufacture of goods subsequently exported. By encouraging the production of exportable goods, a free trade zone could have the effect of counterbalancing imports with exports, for without this approach, imports to meet the commodity needs of the interior could well predominate. A good balance between exports and imports should make Cam Ranh City port more attractive to tramp vessels serving Asian ports. Manufacturing enterprises operating on this basis could be concentrated on an industrial estate, which would be designed as the port free trade zone where control over appropriate utilization of the duty-free imports could be properly exercised. Shipments from the zone into the domestic market would be subject to the normally existing import taxes. Obviously much care should be exercised in the selection of industries located in the free trade zone with stress on competitive viability in the international market.

Future Employment in Cam Ranh City

The immediate and short term strategy for the development of Cam Ranh Bay should focus attention on the problem of maintaining the present impetus derived from the huge military base construction program.

The situation may be elaborated by reference to local employment prospects and the problem of planning for maintaining employment at a high level in the future. The consortium construction program apparently reached an employment peak in the middle of 1966 and is declining from that point. While existing construction contracts are due to end in June 1966, it may be anticipated that follow-on construction associated with getting the troops established on the base will require continuing employment probably on a declining basis for about a year later, say, through June 1967. Simultaneously, with construction by the engineering company consortium, the U.S. Army, Navy, and Air Force have been conducting their own construction program using hired Vietnamese personnel, and employing perhaps as many workers as the consortium. With growth of the numbers of military base personnel, an increasing number of Vietnamese workers are needed for a variety of tasks to carry on the functions of the base. The personnel engaged in construction and base activities have created a demand for the development of various commercial and personal services. The numbers of such base service personnel will continue to rise as construction employment declines. Perhaps a total employment plateau can be maintained into the middle of 1967, so that a transfer of workers from construction to service functions can be anticipated from this point on, and a decline in total employment might be postponed until the middle of 1967.

The important question is the level at which local employment and commercial services can be sustained into the future. It would be desirable, naturally, if means could be found for maintaining employment opportunities in the future at a high level in Cam Ranh City. This would sustain the momentum of development attained so far, and would reduce the social problems incident to the rise of local unemployment or the return migration of workers to their home communities.

An energetic, well-timed, and well-thought-out program for the development of the Cam Ranh Bay area would take advantage of the presence of a large labor pool and would aim to achieve a close phase-in of the several aspects of a development program when employment opportunities start to decline on military-related construction activities.

The first positive step in this direction should logically be the initiation of a public works construction program especially focused on the development of Cam Ranh port, and the second step should be the construction of industrial facilities.

It cannot be assumed, even on rather optimistic assumptions, that these construction projects plus the induced commercial activity can take up all the unemployed released from base construction. Some downturn in

overall employment may be expected, though the problem will be principally one of reducing its dimensions.

The public works construction program could include a series of projects essential to the development of the port, Cam Ranh City, and transport and communications connections--in essence, the construction of the physical infrastructure required by the growing community. This program could include a series of construction projects such as: the planned low-cost housing project; a coaster berth; a deep water berth; in-transit storage and warehousing; dredging of the Bay for deep water access to the piers; internal roads and streets; water supply and distribution system; sewage collection, treatment, and disposal system; commercial airport facilities; public administration buildings; schools; hospital and clinical facilities; railway yard improvements; and rehabilitation of highway and railway connections with neighboring towns, especially Phan Rang, Nha Trang, and Ninh Hoa.

Naturally, these projects should grow out of a well-planned program which includes time phasing related to the needs of the urban community.

Regarding the construction of industrial facilities that will eventually become the nucleus of an industrial complex, one cannot be as explicit in identifying projects. A number of possibilities are discussed later. Choices are dependent on the outcome of feasibility studies and interest of industrial entrepreneurs. A petroleum refinery could be the basic unit upon which a petro-chemical complex could be founded, including fertilizer plants urgently needed in Vietnam. Other chemical plants based on locally available resources could follow. In addition, other plants could be interlinked with these or related to the needs of Vietnam and based on imported raw materials. It may be assumed that investment of such good-sized units as described will have the effect of stimulating additional industrial and commercial investment and creating the concomitant employment.

Physical Planning and Urban Design

Physical planning, both immediate and long term, is greatly needed in Cam Ranh City, where decisions are now being made on a piecemeal basis, regarding the location of the housing project, the location of refugees, and the construction of various infrastructural elements. A comprehensive physical plan is needed to coordinate the physical growth and to control the location of facilities now being established or planned independently by the military, by governmental agencies, and by private individuals. Without such coordination, haphazard growth will eventually result in an inefficient and unaesthetic use of the land, evidenced as future slums, congestion, health hazards, and other problems associated with unplanned or ill-planned urban-industrial expansion.

With the advantage of history research in urban planning and design, engineering, and socioeconomics, Cam Ranh City development can seek to avoid the past mistakes of other communities. All too often, cities

have built what were considered adequate and even over-capacity facilities, only to be faced, in the span of a few years, with unforeseen population demands that rendered existing facilities inadequate or obsolete. Even fairly young cities have had to face problems of urban renewal; slum clearance; badly placed or poorly constructed infrastructure; drastic scarring of natural hillsides; desecration of natural vegetation and beautiful open spaces; polluted water; contaminated air. Because of insufficient or short-sighted planning, cities are confronted with formidable problems requiring essential reconstruction--roads become too narrow, pipelines cannot handle demands, parks and open spaces are too few or too small to accommodate increased population, and metropolitan growth is reduced to the random pushing called "urban sprawl." Problems such as these could burden Cam Ranh City with future difficulties greatly exceeding in intensity the problems of today.

Historical and current knowledge can help formulate prospects--the foreseeing of economic, social, and industrial needs for many years ahead, and making plans now to accommodate those needs. Of course, it is recognized that socioeconomic projections are fallible, since such forecasting is an art and not an exact science. Admitting this limitation, the planner for the future nevertheless knows that without some form of careful urban design plan, new cities as well as old will be handicapped in coping with future problems.

Specific urban designs, complete with as many component plans as necessary to cover all economic, social, and industrial needs, will be prepared in Phase II of the development program for Cam Ranh Bay. Therefore, it is not within the scope of this Phase I study to discuss particular designs, but only to suggest broad viewpoints which may be helpful in orienting decision-making functions of the development program.

The broad objective of urban design effort is to integrate all component plans and shape them into an image that will give a "character" to the city--an atmosphere or subjective reaction, on the part of the people who live there, that this is their city and they are proud of it. Such a character consists of more than physical structures, since human intangibles are always operative, but at least up to a point, the physical environment can be considered as a medium to be shaped by conscious urban design effort.

Another basic view, so obvious that it can be easily overlooked, concerns those characteristics of architectural products (structures) which distinguish them from the products of other arts. Structures are large, relatively permanent, expensive, immobile, ever-present. Once built, the structures are there to stay, for good or ill, over many years. They cannot be summarily changed or removed. One of the reasons why many people today flee a city is aesthetic dissatisfaction: the city's "character" has a negative effect. Structures have to be visually appealing to the citizens and visitors. Cam Ranh City's architecture should be so conceived that the relationships of space inside and between buildings or groups of buildings are appropriate to the surrounding

natural features as well as to the general populace that must live and work in these spaces.

A basic point that can be important in long range planning concerns the role of open spaces--parks, recreation areas, vistas--in the complex of structures. According to urban history, these park lands and open spaces, if not set aside early in a city's life, are difficult, expensive, or perhaps impossible to acquire after a city is built-up. Farsighted city officials acquire or reserve such areas years before the demand for them becomes evident.

If the relationships of open space to structures can be considered a tool or technique for planning, authorities might consider such relationships in other aspects of planning for the future needs of a city--5, 10, 15 years or longer. Authorities can seek imaginative yet practical ways and means of accommodating future increases in demand and growth. Thus, while over-capacity design seems an easy solution, other solutions are possible. A certain facility can be designed for staged construction, or can be made flexible in some other way. This flexibility involves architectural, engineering, and administrative efforts--for example, the creation and judicious application of well-thought-out codes and ordinances. In some cases, these legal tools can supplement physical construction or rehabilitation effort--by eliminating congestion, pollution, and blight problems at the time when these problems are small or barely discernible. Very few cities can claim that they did not have ample warning and time to cope with the physical problems that plague them today.

A first principle in the physical planning of Cam Ranh City should be that none of the following are to be tolerated: random growth, urban sprawl, make-shift architecture, lack of open spaces, traffic strangulation, water pollution, air contamination, visual ugliness, health hazards, slums.

A final broad view concerns the attitude toward the development program, and specifically the physical and urban design planning. No urban design plans, in spite of all the work and care possible, can guarantee that future blight will be avoided. Yet without a well-conceived and well-considered urban design plan, the potentially magnificent City of Cam Ranh will have very little chance of succeeding.

Relation of Cam Rahn City to Development of the Region

The foregoing discussion has concentrated on the strategy of developing a major port, an industrial complex, and a well-designed modern city with essential amenities. As stressed earlier, the development of Cam Ranh City must be conceived in the framework of a regional development program. Consequently, the creation of a plan for the comprehensive development of the Cam Ranh Bay Region is an essential objective of the efforts of the suggested Cam Ranh Bay Development Authority. This will be the basis for the authority's action program. This program should be

consistent with the national development plan and efforts, of which it is necessarily a segment spelling out in more detail the development strategy and plans for a significant region of the country where the Government desires to make a special impact. After obtaining approval of the program, the Cam Ranh Bay Development Authority will have the task of mobilizing and guiding governmental and private resources plans and efforts toward the objective of implementing the program.

Interim Urban Development Approaches

Haphazard development of the Cam Ranh City community is presently occurring because a comprehensive physical land use plan is lacking. Simultaneously, the Government is maintaining a freeze in the sale of land until a suitable plan is completed and approved as the basis for long range development. Clearly, a well-conceived land use plan, agreed upon by everyone concerned, should be established as quickly as possible so that the land can be sold and the parties located in the right land use areas. A suitable land sales and land use policy is essential for attracting outside investment by entrepreneurs who will establish the services and industry required for Cam Ranh City to thrive. Such action would also serve to establish the Government's strong commitment to develop Cam Ranh City.

In view of the urgency of a general plan for the physical development of the City, it was being proposed in August of 1966 that a land use planning staff be assembled by the Cam Ranh Bay Committee and USAID/Saigon to prepare an interim land use plan, on the basis of which new in-movement of people into Cam Ranh City could be controlled by location. It was recognized that a long range General Land Use Plan and its several elements,* which would take longer to develop, would still have to be prepared. The architectural plan prepared by Architect Ngo Viet Thu, and an earlier city plan proposed by the French administration in the Tra Duc Valley west of Ba Ngoi would be available to the planning group.

The USAID financed project to provide low cost housing in Cam Ranh City was estimated to provide about 2,800 houses based on the investment of \$7,000,000, some of which would be required for the basic infrastructure, consisting primarily of streets, and water and sewage facilities. The Mayor of Cam Ranh City proposed that the houses be sold on the basis of a 10% down payment, the balance repayable in a 12-year period. The Mayor was of the opinion that 500 houses could be sold for cash without any down payment. The objective of the down payment, and sale of land in contrast to leasing, would be to obtain a cash turnover, which would then permit reinvestment in additional housing over time. The Mayor also proposed the sale of land for additional private housing and for a commercial area adjacent to the presently planned project. It was proposed that the construction of water and sewage facilities should provide

* For explanation of Total Development Plan elements, see Chapter VII and flow chart in Chapter VIII.

for approximately twice the demand originally planned for in the USAID project, in the expectation that more people are likely to move into the area, and this would require an expansion of the project. This latter proposal suggests the possibility of overcrowding and congestion--the very conditions that should be prevented in this prime location of the City.

The need for this AID financed housing project in Cam Rahn City is recognized, but great concern needs to be expressed about the proposed location, which is most likely to place the project too close to the area that may eventually be required for development of higher uses. The present site has obvious potential for becoming part of a major port oriented urban complex, complete with governmental and communication services, large scale commercial enterprises, business offices, etc. Also, as pointed out previously, this area will be one of the first views of the new City from the Grand Passé, as ships enter the Bay. Unfortunately a comprehensive land use plan based on sound analysis is not at hand, yet certain locational decisions are required to be made. A location for this housing project farther west of Ba Ngoi and south or southwest of the mountain Hon Rong is preferred at this stage of thinking. However, if there are strong views in Saigon in favor of the currently proposed location, then it is suggested that at least a phased construction program be considered that would allow for rectification of a possible long term mistake. It may be wise to build the southern portion of the housing project first, and if later found desirable, the rest of the project could be swung to the west (instead of north) along the Tra Duc Valley, if not totally relocating the unfinished portion.

Until recently, the population of Cam Rahn City was scattered in numerous hamlets, but there is an increasing tendency toward population concentration. The largest concentration is taking place in the town of Ba Ngoi, and another concentration is occurring along the road in the location of Thon Tra Long, in the northward curvature of the Bay to the west. There is thus in process of formation the nucleus of an urban complex of about 25,000 people in and around Ba Ngoi, within a total neighboring community of about 50,000 people. This urban concentration can be conceived as the nucleus of a future urban-industrial complex centered about a deep water international port.

Population concentrations such as these can occasion aggravated problems in health, safety, and welfare. One can readily imagine (especially where today, appropriate facilities are virtually nonexistent) periodic water shortages; sanitation deficiencies; garbage buildup; water pollution; disease and pestilence; loss of life and/or property from unusual storm water overflows; traffic congestion and strangulation from too many cars, trucks, bicycles, animals, and pedestrians on too few or inadequate roads, streets, bridges, and intersections.

Just as in the case of land use, the public facilities planning portion of the overall Comprehensive Development Plan is not at hand to prevent such consequences. Certain decisions and expenditures must be made

today. As noted elsewhere in this report, and beyond just going forward with long range comprehensive research and planning, early consideration should be given to:

- Additional water wells
- Portable or otherwise semipermanent power generators
- Installation of unitized or so-called "package" sanitary sewage treatment plants or minimal sewage collection lines and temporary aeration ponds
- Widening and cleaning of certain drainage courses of debris and vegetation; clearing of debris and obstructions to stream-flow at all bridges and culverts; installation of new culverts where roads or rail line are in danger of overtopping
- Establishment of medical aid stations, well-marked and at strategic locations, supplied with antibiotics and means for mass inoculation
- Provision for the removal of wet garbage by (1) municipal trucks charging or not charging pickup fees, or (2) a franchised and possibly subsidized private scavenger company. In any event, there should be certain prescribed disposal areas where a fill and cover operation can be carried out. One or two pieces of road grading or similar equipment would be necessary
- Provision for a maintenance crew with adequate trucks and hand equipment to make continuous checks on a periodic, yet scheduled, basis of all facilities, as well as to maintain all roads and streets in a safe and passable condition
- Expenditure of annual budget monies, as they become available, on public facility and utility items in need of repair or upgrading because of the current health, safety, and welfare needs of the city's occupants; and deferment of expenditures on major, more permanent works until such time as the Comprehensive Development Plan is well along
- Near term additions to the power supply at Cam Ranh Bay

The basis for the last-named action is as follows. The demand for electric power to serve a major industrial complex at Cam Ranh City could become significant; moreover, it would take considerable time to add large generating plants to meet these requirements. In considering important

near term projects,* attention should be given to the provision of major additions to the power supply at Cam Ranh Bay. A plan of action should be formulated for the early mobilization of men and equipment as soon as security and the general war effort allow, so that construction can commence of the proposed 230 KV transmission line from Da Nhim to Phan Rang and then north to Cam Ranh City. As many of the preliminary steps as practicable should be taken, such as site investigations, route surveys (if only by aerial photographic means), design plans and specifications, financing arrangements, land and right-of-way acquisition--all to be preparatory to actual construction. It may be more economic or more practical from a timing standpoint to install lesser voltage carriers on wood poles from Phan Rang to Cam Ranh City on an interim basis. Steel-lattice permanent towers and concomitant higher voltage could then be installed at a later time in accordance with the growth demands and staging recommendations elicited in Phase II comprehensive planning work.

In view of the arguments presented in Chapter V (the sections entitled "Comparative Position of the Port of Cam Ranh Bay" and "Considerations in Locating Deep Water Port Facilities in Central Vietnam") as well as the prospective installation of a temporary floating pier as mentioned in Chapter III, consideration should be given to establishing a firm policy position for the immediate commencement of the promotion of the port of Cam Ranh in lieu of expanding the port of Nha Trang. Reference is made to the DMJM report on the port of Nha Trang where it is stated:

"However, the 300 kilometers of rugged coast between latitude 11°30' and 14°00' (Nha Trang lies at 12°15') suggests consideration of possible better sites along the coast. . . ."
(p. 55)

"While the Port of Nha Trang is the specific subject of this study, it is clearly not the ideal site, as already indicated by review of its facilities and its problems. . . ."
(p. 57)

"During the monsoon season the northeast swells give trouble, so a breakwater is needed for an all year port. However, Nha Trang is one of the largest cities on the coast and already provides a labor supply and other facilities for the mutual support of a port." (p. 57)

* Additional power projects--such as the third phase of Da Nhim, Da Nhim Project No. 2, Upper Se San, Pleiku, or others--that could directly affect the power supply for Cam Ranh Bay are of special interest within the context of this report, but decisions in regard to these must be defined within a long term framework of countrywide master planning for electric power development.

Cam Ranh Bay could become as large as, if not larger than, Nha Trang; the labor force at Cam Ranh Bay is now developing at a relatively fast pace; however, the Bay area needs the backup facilities. The recommended research and planning program as outlined in Chapter VII addresses itself to this point of needed infrastructure in terms of "what" and "where." In the meantime, a policy statement in regard to the promotion of the port of Cam Ranh, as well as consideration of certain near term expenditures for making the port operational, could be a modest start toward the ultimate port development at Cam Ranh City.

As is the case with the installation of any new facilities at Cam Ranh City prior to the completion of the Development Plan, interim developments supporting dock/port activities should be viewed in terms of flexibility, mobility, and alternate use.

The following might be considered:

- Dredge (if required) and maintain 6-meter channel to pier side of new floating pier.
- In order to maintain safe two-way truck traffic, either (1) widen the causeway, or repair slipouts, or (2) abandon railroad tracks on the existing causeway from shore line to point of take-off of new pier construction. If the most expedient and economically practical way of acquiring this two-way truck traffic is to utilize the area presently occupied by trackage, it is suggested that a shallow earth road bed be placed over the rails, thus allowing for eventual re-establishment of the railroad spur or of its salvage at a later time in accordance with the recommendations or of its salvage at a later time in accordance with the recommendations of the Comprehensive Long Range Development Plan.
- Insofar as the military is not doing it, repair and widen the road, and where necessary, improve the road bed drainage conditions of Highway 1 between Ba Ngoi and Phan Rang and Nha Trang. Further, consideration might be given to some realignment of the Highway where curves are sharp and sight distance is poor. The emphasis here is to improve vehicular communication between dockside and cargo origins or destinations outside the City of Cam Ranh.
- It is understood that all lights on the navigational aids are extinguished; unless subject to military security, these should be activated.
- Minimum office space for the conduct of port business, record storage, custom functions, security guard, etc., should be provided. Also, employee facilities such as toilets and showers and space for foul weather protection for longshoremen should be considered. A new building is not necessarily recommended, but rather use of space in the Mayor's building complex south of the causeway; or

refurbishment of the "terminal" building on the causeway could be considered adequate on a temporary basis.

- Staff and equipment for maintenance and minor repair can be integrated with the maintenance operations as established for the City as a whole.
- As recommended by DMJM, one-half of a transit shed and certain asphaltic concrete pavement for outside storage and limited staging would no doubt be necessary. However, because of their more permanent nature, they should be kept to a minimum until the final location of the port complex is decided upon. In any event, the degree that Cam Ranh can successfully attract near term coaster traffic will dictate the near term demand for such items.
- Provide for pier side fire protection apparatus by hoses, light gasoline suction pumps, and chemical sprayers.
- If domestic water wells can be placed near the interim port area free from salt water intrusion, a water line should be provided for ships' supply, mechanical, washing, and fire protection purposes.
- Electric power might be provided at pierhead, subject to demand and competitive attractiveness of the berthing facility; however, for emergency and security reasons, night lighting should be considered at the earliest possible time.

Even though the foregoing represents minimal developments, the "over the pier" handling of such cargo as fertilizer, fish, lumber, charcoal, emergency civilian supplies, general civilian goods, equipment, rice, sugar, fruit, and other food stuffs should be possible in a relatively efficient and expeditious manner.

Until major berthing facilities, deep water channels, turning basins, dockside services, etc., are finally established at the port of Cam Ranh, there will be no major enhancement of Cam Ranh City's competitive position, compared with other posts along the coast. However, as indicated in Chapter V, the temporary pier and certain improvements similar to those suggested should provide a means of attracting coaster traffic and thus offer some test as to the commercial port traffic potential of Cam Ranh City.

VII STUDIES FOR THE COMPREHENSIVE REGIONAL DEVELOPMENT PLAN

Planning Sequence

The preparation of a comprehensive plan for the development of the Cam Ranh Bay area should be the outcome of a series of logically connected feasibility and planning studies designed to create a soundly based future action program. It will be the function of the Cam Ranh Bay Development Authority to structure the research and planning program so that a positive and comprehensive action program will result which this agency will then be in a position to promote.

The Comprehensive Regional Development Plan consists of:

1. A development plan for the hinterland region
2. A development plan for Cam Ranh City

One important objective of the hinterland region development plan is to promote economic activity in the area so it will support the creation of the proposed urban, industrial, and port complex at Cam Ranh City. The Comprehensive Urban Development Plan for Cam Ranh City will include the General Land Use Plan, which describes in specific terms the local land use by types of economic activity, plus a series of development plans for all the sectors of local urban development requiring both public and private investment. The emphasis is placed mainly on the preparation of the Comprehensive Urban Development Plan for Cam Ranh City.

The research and planning studies must be scheduled in a logical series so that the various elements resulting therefrom become integrated in the several components of the Comprehensive Regional Development Plan.

In general, the socioeconomic and data collection studies precede the engineering and physical planning studies, and all of them feed into the preparation of the Comprehensive Regional Development Plan, which becomes the ultimate action program.

The various steps in the process of creating a Development Plan, dating from the presentation of this Phase I report, including the time-phasing, are:

1. Preparatory Decisions
2. Immediate Actions
3. Basic Socioeconomic Studies
4. Intermediate Development Planning Studies
5. Final Preparation of Plan Components
6. Comprehensive Regional Development Plan

Sequence of Studies

The series of studies necessary to do the planning will be conducted as Steps 2, 3, 4, and 5. Step 1 provides the authority and funds for the studies to proceed; and it also provides for a Review Committee, to whom the separate studies will be submitted as they are completed. Step 6, and perhaps some of Step 5, will be a correlation and summarization stage firming up the various contributory segments of the development program. By the end of Step 5, all differences and conflicts will be resolved, and a unified perspective will be achieved. The final result of Step 6 will be a compilation of integrated and viable physical plans and recommendations for implementing all portions of the development program.

Immediate Actions

Immediate actions will consist of projects that can be initiated immediately, that will become the basis of future research and planning efforts, or that could lead immediately to action decisions. These projects would contribute directly to the development of economic activity, irrespective of whether a decision is made to invest a major block of resources to develop the Cam Ranh Bay area. The following projects are proposed for immediate action:

1. Hydrologic Data Program
2. Weather Data Program
3. Hydrographic Data Program
4. Preliminary Soils and Geological Surveys
5. Study of Steps to Resume Silica Sands Export
6. Local Procurement by Cam Ranh Bay Military Base

The level of effort proposed for items 5 and 6 is low because the work is intentionally limited to an initial feasibility inquiry, or because the urgency of the circumstances suggests early initiation of an inquiry, however limited it may be.

Four of the above project suggestions were submitted to USAID/Washington in July 1966--the data programs, items 1, 2, and 3, and the silica sands exports study, item 5.

Cam Ranh Bay Hydrologic Data Program

The development of streamflow data to correlate runoff from watersheds near Cam Ranh Bay with rainfall intensities and durations is a critical prerequisite to proper analysis of the water supply potentials during Phase II. Such data will also be vital to correlate stream stage with percolation rates and to relate the occurrence of precipitation of various intensities and durations to the long term record of daily total amounts. Further, this type of streamflow information is essential as it relates to the planning of downstream flood control and drainage facilities, channel sizing, and maintenance procedures.

A very significant advantage will accrue to the Phase II studies if these data gathering programs can be initiated immediately, so that data are available at the beginning of the Phase. This will also allow a longer period of record for use in the study and will greatly increase confidence in the data base.

Streamflow Data Collection. The recommended method for collection of the streamflow data will be to install water stage recorders on several streams in the lower canyon reaches, but above the alluviated areas. Additional recorders will be installed downstream on the same streams so that a reach of alluvial channel is included between. The relation between water stage and flow rate for each station will be established by a series of current meter measurements.

The following installations are recommended:

Suoi Tra Duc	2 to 3 sites
Suoi Hanh	3 to 4 sites
Song Can	1 site
Song Trau	2 sites

Precipitation Data Collection. A recording rain gauge should be installed at Ba Ngoi in order to get data on the rainfall intensity-duration-frequency. This recorder should be at the same site as the present rain gauge in order to apply these data to the long term record. This recorder should also be installed as soon as possible, and should be in operation during the streamflow observation program in any case.

Equipment Requirements. The rainfall equipment proposed requires only one recording gauge, to be installed at Ba Ngoi in addition to the existing standard rain gauge. Concurrent observations of these gauges will allow correlation of various intensities and durations with total daily amounts, and will provide the basis for statistical analysis of the 22 years of existing record.

The streamflow data program will require installation of eight to ten water stage recorders, and will require provision for making measurements at each of the sites.

Each recorder installation will require a stilling well and recorder shelter, with intake pipes so situated that the stream level will be reflected in the well. The installations must be accessible, and hence a walkway and platform above high water level will be required at most sites. Staff gauges will be needed at each station.

Measurements can be made from boats where velocities are moderate, but probably boats will not be usable at the upstream stations in the canyon mouths. At these stations, probably four permanent cable installations

will be required, capable of supporting a man and current-metering equipment above high water level, and equipped with cable cars for this purpose.

Two small boats, 12 to 14 feet in length, with outboard motors should be provided for measuring at the downstream sites during high flows. Special light cables and reels will be necessary for holding the boats during measurements. Other equipment will include three current meters, three sounding reels with cable for suspending current meters from boats or cables, and at least two sets of wading rods for use during low flows. Two vehicles for transportation of men and equipment are recommended.

Personnel Requirements. The proposed hydrologic data program should be an intensive, short term effort, designed to get a maximum of information as early as possible.

At least twelve men should be available during the construction period, and three men, trained to operate current meters and maintain recorders and stations, should be assigned to the program after construction is completed. Supervision during selection of the sites and construction should include a specialist with full understanding of the objectives of the program and with experience in the field. Many of the recommended stations will be temporary and improvisations can be accepted, but these should be made with the full knowledge of the effects on the results of the program. It is recommended that a consultant with a complete background in the theories of hydrology as well as experience with practical problems of construction, operation, and maintenance in the field be sent to Vietnam to initiate the program.

Security. The streamflow data program will require access into the lower canyons of the stream involved. Protection of the crews and of the equipment will be required, and therefore the first step of the program must be the military action to provide this security.

Administration. This program should be under the control and direction of the Public Works Ministry.

Cam Ranh City Weather Data Program

Although climatological data (some extending back to 1907) are available at Nha Trang--including wind, temperature, humidity, pressure, nebulosity, and storm readings--the potential future importance of Cam Ranh City as a major port suggests the early commencement of its own meteorologic station. The installation of the recording rainfall gauge and the addition of personnel discussed in the preceding Hydrologic Data Program suggests the concurrent expansion of the Ba Ngoi rainfall station.

Certain inferences and extrapolations might be made from the Nha Trang data; however, weather conditions depicting actual occurrence at and near Ba Ngoi would be far superior.

Devices. Local information on wind (force and direction) will be useful in locating (and ultimately designing) port facilities, small boat harbors, and heavy industrial plants where ship handling, off-wharf mooring, and industrial smoke, gases, and odors are considerations. Installation of wind recording instruments such as an Aerovane Wind Recorder or separate wind speed and wind direction indicators are recommended for the Ba Ngoi station. A second device might be installed near the bay front 12 to 15 kilometers north of Ba Ngoi, and this would be away from any influence of either the Tra Duc Valley or the mountainous areas immediately west of Ba Ngoi.

Of less importance at this time, however necessary from the long range viewpoint, would be measurements and observations of temperature, humidity, pressure, nebulosity, fog, sunshine, and storms. This body of data will be useful for many purposes, such as for: industry, shippers, tourism, recreationists, possible commercial aircraft; the setting of working hours; Chamber of Commerce promotions. The installation of weather instruments (preferably of the recording type) such as a maximum-minimum thermometer, psychrometer or hygrometer, barometer, and a solarimeter are recommended for the Ba Ngoi station.

Administration. This program should be under the direction and control of the Government of Vietnam Directorate of Meteorology who may already have much of the necessary instrumentation available.

Cam Ranh Bay Hydrographic Data Program

Much discussion has taken place and some advance planning has been done regarding use of the waters of Cam Ranh Bay for harbor purposes, underwater pipeline installation, off-wharf anchorage, channel dredging and maintenance, saltwater barriers, desalinization ponds, etc. Yet despite these efforts, very little seems to be known about tidal (or nontidal) current force and directions, or wave action, or possible pollution due to increased requirements for Bay front industrial and municipal facilities. Therefore, it is recommended that current and wave measurements at representative points and at periodic intervals commence immediately. These measurements should be conducted for a period of at least one year. The use of current meters or floats, dyes, and surveying instruments would be required. Even better would be oceanographic instrumentation with self-recording apparatus. This work should be under the direction and control of the Directorate of Navigation.

Preliminary Soils and Geological Surveys

Security problems at present preclude areawide geological explorations; however, certain local soils and geological surveys could very likely be conducted with only minimal security measures being taken. The purpose of these surveys are:

1. To determine the extent and characteristics of alluvial deposits.*
2. To determine the capability of the lowlands (onshore and offshore) along the southerly and southwesterly portion of the Bay for becoming the site of an industrial complex and supporting the buildings thereof. This part of the survey would include an indication of expected earth settlement that might occur under several possible development schemes.
3. To determine the feasibility of using interim or longer range sanitary sewage leaching fields and aeration ponds, including their effect on the pollution of underground water supplies.
4. To determine the likelihood that local barrow pits in the neighboring foothill areas can provide soil materials for construction purposes--i.e., asphalt aggregates, road base course, concrete aggregates, and other compositions.
5. To determine the fertility characteristics of the surface soils, particularly in potential agricultural areas.
6. To determine the degree of difficulty, locations, and costs of earthmoving applications for possible reclamation programs--for example, a south end industrial complex.
7. To determine the relatively exact location and depth of the coral underlying the southwesterly side of the Bay in particular, as well as to determine the ease (or difficulty) with which the coral can be penetrated by structural piles or caissons; the ease with which channels may be dredged; or the ease with which the coral may be removed for extractive industrial purposes.
8. To determine the nature, permeability, and depth below water of the soils in Area M (Upper Bay)--information that would be necessary as part of any salt extraction studies for this area.

To accomplish the above purposes, the surveys described below will be needed.

Test Holes in Alluvium. This type of survey will include holes to bedrock for determination of the total depths of the alluvium, the characteristics of the sediments, and the quality of the existing water. These test holes will be located to intercept the deeper sediments, except that two will be located within the depth range of the supplemental seismic work to aid in interpretation of the seismic readings. Also included will be shallower observation holes for defining the existing water table and for observing changes in water levels. Water levels will also be observed in any existing wells found in useful locations.

* Also in Reconnaissance Water Supply Study, Appendix E.

Two major alluvial areas having potential for large water supplies will be explored, and a limited effort will be included to explore the shallow coastal area for its use as a more immediate water source. These three area surveys will apply the following procedures:

1. Suoi Tra Duc and Suoi Hanh Valley--3 deep test holes, 2 intermediate-depth test holes, and 4 to 6 shallow observation holes are suggested.
2. Valley around Du Long--3 to 4 deep test holes, 2 intermediate-depth test holes, and 4 to 6 shallow observation holes are suggested.
3. Coastal shelf north of Ba Ngoi--about 6 holes to bedrock. All of the holes would be provided with casing and covers to keep them open for pumping tests, for observation of the effects of streamflow on the water tables, and for possible future development as wells.

Seismic and Resistivity Surveys. The seismic survey equipment involved could be the relatively simple and economical hammer seismograph, which will be used to supplement information from the test holes and define the edges of the useful alluvium. This equipment may also be used with a small explosive charge to increase the depth range.

The resistivity surveys, which are also relatively economical, will serve to further define the bedrock profiles, especially in the regions below the depth capacity of the seismic equipment, but not immediately adjacent to test holes. The resistivity readings become distorted in formations saturated with saline water, but these surveys may help to define the interfaces if salt water is encountered in parts of the deposits.

Alluvial deposits along the coastal shelf north of the Ba Ngoi will probably not be beyond the depth capabilities of either the seismic or the resistivity equipment. Surveys undertaken in this area may serve to define the erosional depressions in the bedrock surface and to provide a basis for selecting the most efficient sites for small wells that can meet immediate water needs in the area.

Pumping Tests. Carefully controlled pumping tests will be required to define the transmissibility and storage factors of the aquifers, especially in the Suoi Tra Duc-Suoi Hanh Valley and the Du Long area. These tests will require continuous pumping at a carefully controlled rate with frequent observations of the effects on the water levels at the pumped well and at other test holes. The duration of each test will be from two to five days, and careful records of water level changes versus time will be required.

Simple bailing tests will be made on test holes in the shallow alluvium north of Ba Ngoi, as these aquifers will not be extensive enough to justify the more extensive tests.

Test Holes Onshore and Offshore. This survey will be made onshore and offshore along the southerly and southwesterly portion of the Bay. A series of about six test holes should be drilled to bedrock in the onshore portion, and about six holes should be drilled in the offshore portion (from floating barge equipment) through at least the softer upper soils down to firm sands or clays. Sufficient undisturbed soil samples should be extracted from these borings, and subjected to laboratory tests, to determine the soil strengths necessary for support of structural foundations or pilings, and to estimate the magnitude of potential foundation costs. Compressibility tests should be run on samples to evaluate the earth settling that might occur from future reclamation and land-fill operations.

These borings will be correlated with the borings made by Nippon Koei Co., Ltd. and borings drilled for the military in the northerly portion of the Inner Bay.

Soil Permeability Tests. A sufficient number of undisturbed soil samples should be taken from all the land borings, and laboratory tests conducted, in order to determine the relative permeabilities of the various soils underlying Cam Ranh City. The results of these tests will be correlated with all available well logs as well as soil exploration borings that have been drilled in the past.

Soil Fertility Tests. Samples of the surface soil types in the upper valley areas and in all the flatter lands with potential for agricultural uses will be analyzed to determine their ability to support crops. The tests will be directed toward determining what nutrients may be lacking so that recommendations may be made concerning fertilizers and irrigation practices.

Hillside Examination and Exploration. In order to determine the applicability for possible hillside development of roads, underground utilities, housing, barrow pit excavations, raw material supply, etc., a ground reconnaissance will be made of the lower slopes within the Cam Ranh Bay area. The need for several possible shallow hand-dug test pits could be determined after this ground reconnaissance.

Coral Exploration--Soundings and Condition. In order to supplement prior investigations by Nippon Koei Co., Ltd. a series of probings will be made in the coral areas to determine their exact location, depth, and horizontal configuration. This will be done from the water surface by

boat, but underwater observations and explorations will be made as well. Areas where delineation of quality can clearly be determined will be defined and plotted together with extraction of certain coral samples for possible laboratory testing purposes. This type of survey will be generally confined to the southwesterly portion of the Bay where limited data are available about these corals.

Soil Surface Sampling--Upper Bay. By means of relatively simple sounding techniques such as fathometer, sparker, or boomer surveys, depths will be measured to the soil surface underlying the Upper Bay (Area M). Samples of these underlying soils will be extracted, and laboratory testing conducted in order to determine the nature and permeability of these surface soils as possible salt-bed bottoms.

Study of Steps to Resume Silica Sands Export*

Statement of the Problem. The major mineral resource at Cam Ranh Bay--silica sand--is reputed to have a reserve of 400 to 500 million tons. The export of this excellent natural resource, a highly pure silica oxide, was initiated in 1960 by a Japanese firm and continued into 1965. Export shipments built up very rapidly; at the peak in 1964, the annual volume had reached 235,000 tons, making the port of Cam Ranh Bay the third largest in Vietnam in terms of total tonnage, while exports of other commodities amounted to only about 5,000 tons per year.

Several reasons have been advanced for the cessation of exports in the summer of 1965, a major one being security from the Viet Cong. It appears, however, that the decision to cease exports was also influenced by economic reasons, including the rising cost of handling the sand at Cam Ranh Bay, and the competitive cost of acceptable silica sand deposits in Japan.

It could be decidedly advantageous to Vietnam to obtain a resumption of silica sand exports, inasmuch as they would contribute to earnings of foreign exchange, to the employment of local labor, and generally to the development of Cam Ranh Bay. It would be particularly desirable to get this commodity moving again into the export market in the coming months, at a time when employment in the Cam Ranh Bay area from military construction might be dropping into a declining phase.

Proposed Research. Accordingly, it is proposed that a modest study effort be conducted for the purpose of determining what steps might be taken by the Government of Vietnam to achieve a resumption of silica sand exports. With this objective, an industrial economist could be assigned

* This suggested study was one of three submitted to USAID/Washington on July 22, 1966.

the task of communicating with the original Japanese importer of silica sand to find out the true reasons why imports of silica sand were discontinued, and why the importer may have shifted to other sources of supply. Conceivably, security was not the main reason, and it may turn out that the decision was based largely on economic grounds. In any event, the problem of security might be solved in the coming months, in view of the large military forces now being deployed at Cam Ranh Bay, and the possibility that the nearby hinterland will be cleared of the Viet Cong as the overall military campaign progresses. If it should appear that the importer's decision was based entirely on economic grounds, the researcher would then need to investigate the pricing and the reserve supply position of other sources of silica sands competitive with the Cam Ranh Bay silica sand supply. This information would then enable him to arrive at a conclusion on how the silica sands at Cam Ranh Bay should be priced for potential importers to make this supply again competitive in the world market. Such information should be valuable to the Government of Vietnam in negotiating with potential foreign importers or domestic importers of the silica sand from Cam Ranh Bay, with the objective of getting this resource moving again into the export market.

Local Procurement by Cam Ranh Bay Military Base

One of the most effective ways of encouraging small and medium industry in an area is by means of a well-thought-out procurement program by an organization with a large demand for goods and services. The opportunity for this program should be explored at an early stage in the Cam Ranh Bay area to see whether the needs of the military base can to some degree be met locally. Laundry and other personal services immediately come to mind. The manufacturing of bread and other perishables may present other opportunities. Obviously, fruits and vegetables should be procured from nearby local sources. Such a program could have the effect of starting many local enterprises in the Cam Ranh Bay area and nearby communities.

A brief study is suggested of this possibility. This study would require discussion of procurement policy and flexibility available in decision-making with the logistics branch of the military. One of the obvious problems is the existing inflationary situation in Vietnam and the effect that a local procurement program would have on it. Consideration also needs to be given to the U.S. foreign exchange problem and the degree of latitude the military authorities have in undertaking a local procurement program instead of procurement from the United States.

Basic Socioeconomic Studies

The basic socioeconomic studies will consist of: studies of the economic framework including projections; demographic studies; studies of administration needs; and special feasibility studies.

Assumptions regarding the future of Cam Ranh City will emanate largely from the analysis of the economic framework, including economic projections, and the demographic studies suggested in this program. In addition, background studies on status and needs of local government (administration) will require attention at this stage. These studies are all essential for the subsequent work concerned with engineering, physical, and public administration planning.

An important outcome of these studies will be economic projections of population and economic growth. These will be used for evaluating the future economic prospects of Cam Ranh Bay, and for estimating the future land requirements for development purposes. In addition, the projections will be made for different sectors to permit their use in planning for the scale of the pier, housing, schools, traffic movement, and so on.

Alternative assumptions may be formulated as the basis for reconciling different viewpoints about the method of development; this multiple-choice approach may be a means of attaining the most acceptable development pattern for the area. The demographic analysis will become the basis for planning the requirements and standards for the construction of housing, water and sewage systems, schools, and other facilities and institutions needed.

Special feasibility studies of selected industrial and agricultural investment enterprises will be undertaken from this point in the research and planning program. Those enterprises which turn out to be feasible will be introduced into the economic model (described below) for determining the economic projections, in an iterative process.

Framework for Economic Growth and Development

Most of the development planning for Cam Ranh Bay will need to be based on a projection of the general socioeconomic framework for Vietnam within which Cam Ranh Bay will be developed. At this point, also the economic prospects for a major port and industrial complex at Cam Ranh Bay will be evaluated. Such a forecast will provide the necessary broad guide from which at least the general requirements for urban planning, infrastructure planning, water planning, etc., may be computed. This study needs to be undertaken at the earliest date so that the results will be available for use by the special feasibility studies described below.

Admittedly, it is difficult to say whether an economic framework is defined in terms of the sum of its components, or whether each component is defined in terms of a prior definition of the whole. Solutions to this sort of problem are clearly an iterative process.

It is proposed to create a model of the Vietnam economy comprising national aggregated variables plus a disaggregation of data on a sector and regional basis. Different assumptions about levels of population and economic activity when coupled with production in major sectors and proposed investments at Cam Ranh Bay should produce the estimates of potential impact of Cam Ranh Bay in terms of port activity, industrial growth,

commerce, and future population. If possible, the analysis will be a dynamic activity model for the overall projections, and a gravity model for traffic flow analysis, to test the future economic potential of Cam Ranh Bay.

Demographic Studies

Statement of the Problem. While some communities in the Cam Ranh Bay area have a long history, most of the present population is of recent origin, some seeking employment in construction of the military base, and some being refugees from the war zones. To plan for people who have recently become uprooted and seek established lives in a new community will require sensitive study. The needs of communities where they live will also need to be carefully explored. The social, economic, and political needs will need to be properly understood if the planning of physical facilities and of the amenities of the community is to be sound and effective.

Proposed Research. Much needs to be known about the size, composition, and structure of the population in the Cam Ranh Bay area, their living preferences, and their attitudes toward physical change and authority. The extraordinary needs of the low income groups in the area, particularly the refugee population, require extensive analysis in terms of their deprivations, family dislocations, and response toward public works and other physical improvements. Questions of health, nutrition, and family spending patterns can generate answers needed by urban planners in determining acceptable physical development standards and the future form of the City in terms of population concentration, residential density, circulation requirements, educational and employment aspirations, and community and cultural facilities.

The study should become the basis for an extensive statement on the goals and objectives of planning in Cam Ranh City. It should be prepared for review, discussion, and agreement by key representatives of governmental, private, and community groups. Agreement on these goals will enhance the possibility of a high degree of favorable response from the community toward future plans and proposals.

Studies of Public Administration Needs

Purpose. At present, Cam Ranh City is operating under a temporary administrative system in which decisions are made by the Mayor with the consent of the Commanding General Zone 2, and the Cam Ranh Bay Committee of the Government of Vietnam. Serious consideration and study will need to be made in order to determine the form of the permanent future government of the City, since local cooperation and even enthusiasm will be required to transform a regional and urban plan into a living reality. Consideration will need to be given to the form of government which might be appropriate for the administration of the new City, keeping in mind the constitution and traditions of Vietnam and the needs of the community at different stages of development.

Proposed Research. In seeking out a suitable form of permanent government for Cam Ranh City, the research will examine the community's cultural background and traditions, and will attempt to determine a form that will be both effective and supported by the community. For example, although the concept of a representative city council elected by the community is a ready possibility, this concept should be examined in terms of the local context, and should be initially considered as only one of several possible forms.

An important matter is the preparation of a framework of regulatory codes and ordinances that will eventually be required for the orderly administration of the community. These will include such matters as land use zoning, building codes, electrical codes, boiler codes, safety codes, traffic codes, licensing laws, mineral and property rights, and related matters.

An examination is necessary of the existing tax and revenue structure and the items of expenditures of the local government. Consideration must also be given to the future tax needs and the probable subjects of expenditures to be entrusted to the future city government.

Special Feasibility Studies

Nine studies are proposed to determine the feasibility of: (1) a fertilizer-chemical complex at Cam Ranh Bay; (2) production of caustic soda, chlorine, soda ash, and calcium carbide at Cam Ranh City; (3) salt evaporation ponds at Cam Ranh City and Phan Rang; (4) forest products industries at Cam Ranh City; (5) cement manufacture at Cam Ranh Bay; (6) industrial estates, candidate industries, and free trade zone; (7) fishing industry in Khanh Hoa and Ninh Thuan Provinces; (8) water utilization from the Da Nhim and Phan Rang projects; and (9) irrigation in the Suoi Tra Duc Valley.

Feasibility of a Fertilizer Complex at Cam Ranh Bay

A number of technical and economic questions must be answered before a chemical complex can be established at Cam Ranh Bay. A feasibility study should be able to find answers to most of the questions.

Statement of the Problem. The establishment of an oil refinery in Vietnam has been under consideration for a number of years, and certain efforts have been made toward realizing this objective. Thus, a joint government-industry consortium has been formed, technical and economic feasibility studies have been made, and land has been acquired in Nha Trang. At present, this venture remains in the planning stage, with a number of legal and economic questions unresolved. The recent emphasis on Cam Ranh Bay development has prompted a renewal of interest in locating

the refinery there, possibly under a different technoeconomic environment from that contemplated heretofore.

Concurrently, consideration has been given to the development of the An Hoa industrial complex in Quang Nam Province, about 500 kilometers to the north of Cam Ranh Bay. The central idea of this scheme is to utilize the low-grade anthracite coal at the Nong Son mine (100 kilometers inland from Danang) as a source of power and as a basic raw material for the production of ammonia/urea, ammonium sulfate, and calcium carbide. It is understood that French and German interests have shared equally in financing the \$27 million foreign exchange required for the necessary equipment, and that the bulk of the total required equipment is now in Vietnam (70% in Saigon, 30% in Danang).

The An Hoa venture is similar to the oil refinery in that it too remains in the planning stage today, essentially because the coal mine is surrounded by the Viet Cong.

Questions to be Investigated. The study proposed here would examine whether it would be wise to consider these two ventures together for a better utilization of Vietnam's limited resources. The first step in the study would be a preliminary inquiry into the questions or problems given below, and would be justified on the grounds that regardless of the forthcoming decisions about Cam Ranh development, answers to these questions will be useful immediately.

This research project is most urgent since it involves the need to make an early decision concerning the use of the equipment for the An Hoa-Nong Son project which remains unused while the coal mine is kept from operation by the Viet Cong. At the same time, technical questions (listed below) keep obtruding which throw some doubt on the project and suggest that it should be reconsidered before large resources are committed, perhaps unwisely.

1. This feasibility study should be undertaken with the attitude that the question of the most favorable location within the country is open; however, the number of choices regarding location will need to be explored, especially considering the possibility of establishing major facilities at Cam Ranh Bay. Since the proposed refinery could become a key installation upon which eventually a petro-chemical complex could be established, the possibility of locating it at Cam Ranh Bay will require special attention.
2. Special attention needs to be given to whether it will be more economical to produce the chemicals proposed--ammonia/urea, ammonium sulfate, calcium carbide, and possibly others--from the coal raw materials available at Nong Son or from raw materials obtained from the refinery. As there is little question today that technology favors petroleum-based raw materials over coal, possibly the best use of Nong Son coal would be as a power source.

3. Another question is whether the sulphur content of Nong Son coal is sufficient to produce the sulphuric acid and, if not, whether it would be economical to establish an ammonium sulphate plant based on imported sulphur. Perhaps non-sulfur-based fertilizer materials should be made in order to obviate the need for sulfur imports.
4. If the economic considerations favor establishing a chemical industry producing principally fertilizer or petro-chemical products from the refinery, then there is the question of what is the best utilization of the \$27 million of equipment already procured for the An Hoa-Nong Son project. It is probable that much of the equipment can be modified or otherwise employed to become the first increment in a petro-chemical complex located at Cam Ranh Bay.
5. Of basic importance to all of the foregoing is the extent of demand and type of product which the fertilizer industry would be called upon to supply. Determination of this information would be necessary in order to decide the location, type, and size of the petro-chemical plant justified.

Expected Results of Study. In summary, the essential approach in this study is first to derive some urgently needed information about each of these two ventures as they have been planned to date, and then to introduce some new planning horizons and submit them to factual test and inquiry. This approach should result in a much sounder basis for utilization of Vietnam's resources, and can have important effects at this time, when all of Vietnam's resources are being hard-pressed to meet the demands being made upon them.

Feasibility of Producing Salt, Caustic Soda, Chlorine, and Soda Ash

This project will examine the feasibility of establishing plants for the production of salt, caustic soda, chlorine (and/or hydrogen and hydrochloric acid), and soda ash at Cam Ranh City.

Industrial Potential. Approximately one-fourth of the world's output of salt is produced by evaporation, largely in solar salt evaporation ponds (see next section). Among many uses, salt constitutes the raw material for electrolytic production of chlorine and caustic soda. Salt is also the major ingredient for producing soda ash (1.7 tons of salt per ton of soda ash), which may be made also from caustic soda. Caustic soda has numerous uses, such as in the manufacture of paper, soap and detergents, and sodium silicate adhesive, and petroleum refining. About half the production of soda ash goes into the manufacture of glass (which also uses silica sand and limestone, obtainable from the Cam Ranh Bay area). Chlorine is used as a necessary input for many chemical processes in the synthetic chemical industry, including those used for producing polyvinyl

chloride, water purification compounds, bleaching agents, and many other chemicals. Hydrogen from the electrolysis could be used in production of oleomargarine from local vegetable oils.

All these industrial relationships are apparently so close that feasibility analyses regarding the commercial production of these four basic materials should proceed as a combined, or at least a closely coordinated, effort.

Proposed Research. The salt obtained by solar evaporation (see next section) could be used for the production of caustic soda, chlorine, and soda ash.

To see how reasonable it would be to consider production, the preliminary feasibility of such operations should be determined. Markets within South Vietnam, at the proposed petro-chemical complex, and in neighboring countries should be considered, and the justification for undertaking operation should be determined. Some of the market for these chemicals would probably depend upon establishment of local plants not now projected, and would necessitate looking into these end-product markets also. For example, the market for soda ash might be found in the manufacturing of local glass, based upon the silica sand deposits (see previous section on silica sand export study). Also in conjunction with soda ash, the economic feasibility of establishing a glass manufacturing plant at Cam Ranh City should be investigated. There may be opportunities for the feasible production of certain types of bottles and small sizes of sheet glass for the Vietnam economy.

The above studies represent a substantial addition to the petro-chemical complex (discussed previously) that might be established as an annex to the refinery or through a redirection of the An Hoa-Nong Son project. If the production of these materials should turn out to be feasible, such production would help in creating a substantial chemical complex at Cam Ranh Bay.

Feasibility of Solar Salt Evaporation Ponds

This project will study the feasibility of establishing solar salt evaporation ponds at Cam Ranh City and Phan Rang.

Statement of the Problem. The physical factors affecting the feasibility of salt production by solar evaporation are the amounts and times of excess evaporation over precipitation, and the feasibility of developing adequate ponds. Large, shallow ponds are required, which will provide optimum exposure to evaporation without excessive seepage loss, and which will allow proper circulation of the brines to control precipitation and provide for efficient recovery of the salable product.

The average annual precipitation at Nha Trang exceeds the average annual potential evaporation by over 25%, and average evaporation during

the maximum months is only about 50% greater than during the minimum months. These figures indicate that the Nha Trang climate would be very poor for solar evaporation, as an excess of evaporation over precipitation would occur only in a few months of the year and even then would probably not be large.

There are no evaporation records at Cam Ranh City as far as we know, but records at Phan Rang indicate 52 inches average annual potential evaporation, compared with 28 inches average annual rainfall. There is also a relatively long normal dry season at Phan Rang.

Records at Ba Ngoi, on Cam Ranh Bay, show an average of about 47 inches per year of rainfall, compared with 54 inches at Nha Trang and 28 inches at Phan Rang. It is probable that evaporation at Ba Ngoi compares more closely to Nha Trang than to Phan Rang, and hence there is probably very little excess of evaporation over rainfall on an annual basis. However, Ba Ngoi seems to have a more distinct dry season than Nha Trang, and therefore the excess in some months should be significantly greater.

As a preliminary evaluation, the climate at Nha Trang would appear to be unfavorable for solar evaporation. Ba Ngoi climate would probably be marginal, and Phan Rang would be favorable.

Proposed Research. The preliminary assessment above indicates that the prospects of establishing feasible solar salt evaporation ponds appear to be considerably greater at Dam Nai near Phan Rang than at the upper lagoon of Cam Ranh Bay. This tentative conclusion requires checking, primarily on the basis of the climatic conditions prevailing in each area. Since weather data are at present not available in sufficient detail or for sufficiently long periods of time at Cam Ranh Bay, further accumulation of data may be necessary. For this reason, it may be desirable at the initial stage to put the greater effort on the feasibility of establishing salt evaporation ponds at Dam Nai.

The details of topography and availability of impervious pond sites are not known at Cam Ranh City nor at Dam Nai. Much more needs to be known about the soil conditions, soil analysis, and the depth of the lagoons, as a prerequisite to the feasibility analyses.

Industrial Estates and Industrial Dispersal Policy

The feasibility of developing industrial estates, possibly separate estates for large and for small and medium scale industry, should be investigated for establishment at Cam Ranh Bay. In any case, the General Urban Land Use Plan should designate land for industrial estates so as to obtain an orderly location of manufacturing enterprises.

Determination of the size of the estates will depend partly on the results of the projections of economic growth for Cam Ranh City and partly on the results of a survey of industrial and commercial entities in Saigon-Cholon and other major cities. The survey will be able to determine the

number of entities that could be considered eventually interested in investment in industry at Cam Ranh Bay. This survey should be designed to provide indications of attitudes and other considerations concerning Cam Ranh Bay investment, thus providing some information needed for setting up a policy of industrial dispersal, with Cam Ranh Bay the object of this policy. This study should provide indications of the special incentives, services, and amenities that businessmen would desire as encouragement for establishing manufacturing and commercial facilities at Cam Ranh Bay. Associated with the study of the feasibility of establishing industrial estates in Cam Ranh City should be (1) study of candidate industries suitable for location there, and (2) the feasibility of establishing a duty-free port in Cam Ranh Bay. The study of candidate industries should examine the existing industrial structure and should project possible industrial enterprises linked to existing facilities in the form of inputs or possible end-products. While the emphasis in the first instance might be upon products consumed in Vietnam, attention should also be given to the possibility of expanding exports. The opportunities for importing raw materials for processing or manufacturing in Vietnam should also not be neglected. In this regard, the possibility of establishing a free trade zone should be explored, as discussed in Chapter VI. This will entail an examination of candidate industries that could be established on a competitive basis with export possibilities in view. Confirmation of the feasibility of establishing a free trade zone could be an important factor for developing a successful industrial complex, especially incorporating medium scale industrial enterprises.

Feasibility of Forest Products Industries at Cam Ranh City

Statement of the Problem. The recent report of the Dwyer Mission ("Recommendations for the Development of the Forest Resources of South Viet Nam," June 1966) dwells at some length on the potentialities of forest industries in Vietnam. Some highlights of this report follow:

1. Vietnam's forests cover 5.6 million hectares, approximately one-third of the land area of the country. Almost all of these timber stands are hardwood; less than 5% are 2-needle or 3-needle pine.
2. Available potential sources of timber are deemed sufficient to meet existing domestic demand for fuel wood, lumber, pulpwood, poles, and plywood.
3. The need for further development of timber resources had previously been recognized in Vietnam's 5-year Plan and the Day and Zimmerman report of 1958 (and now by the Dwyer Mission report).
4. The outlook for future demand, both domestic and foreign, for Vietnam's forest products is promising.

At present, Vietnam has only one pulp and paper mill (located at the Bien Hoa Industrial Park, 40 kilometers northeast of Saigon) and one newsprint plant (which uses bagasse). The Nippon Koei Planning Report recommended that a pulp and paper industry be started at Cam Ranh City, using timber from the Dalat area, 75 kilometers to the west.

Proposed Research. There appear to be prospects for establishing forest products manufacturing enterprises at Cam Ranh Bay. These could include sawmilling, plywood and veneer plants, and box manufacturing. If the waste and residue supply available from these operations is sufficiently large, a chip board or particle board plant could conceivably also become a candidate industry. Feasibility studies should explore foreign as well as domestic market outlets. Another key question is location at Cam Ranh Bay versus location in the forested area itself. Water transport from Cam Ranh Bay should introduce a favorable factor.

Feasibility of Cement Manufacture at Cam Ranh Bay

Statement of the Problem. At present, Vietnam has a cement grinding plant at Thu Duc (near Saigon) which uses cement clinker produced by a plant at Ha Tien (on the Gulf of Thailand at the Vietnam-Cambodia border). The clinker plant's annual capacity of 300,000 tons is presently being curtailed by Viet Cong operations. Even at full capacity, Vietnam's sole cement plant would not be capable of satisfying present domestic needs; the present substantial imports, now generated principally by military construction activity, will continue in the future as nonmilitary needs supplant military purposes.

The major requirements for cement production are limestone and large amounts of power. Cam Ranh Bay is located near three known supplies of limestone, including coral limestone reserves estimated at 3 to 6 million tons. It is estimated that 6 million tons of coral limestone are in the vicinity of Ba Ngoi at Cam Ranh Bay. There are also deposits of limestone at Hue. Limestone deposits may also exist elsewhere in suitable locations. Adequate power could be derived from the Da Nhim River hydroelectric project, approximately 30 kilometers west of Cam Ranh City.

Proposed Research. The proposed research will consist of four steps:

1. Determine the economic feasibility of utilizing the underwater coral limestone deposits at Cam Ranh Bay in a cement plant at that location. Would mining costs be excessive?
2. Determine the economic feasibility of utilizing limestone deposits from Hue or other sources in a cement plant at Cam Ranh Bay.
3. Determine whether the proposed plant should be another clinker plant whose output could be shipped to Thu Duc for grinding and blending, or whether the plant should be an integrated plant.
4. This study should approach the location problem broadly, and should compare the favorability of locating the plant at Cam Ranh Bay versus the economics of other more favorable locations from the viewpoint of raw material supply and prospective markets.

Analysis of the Fishing Industry in Khanh Hoa and Ninh Thuan Provinces

The fishing industry in Vietnam has recently undergone a substantial expansion. Consumption of fish rose 40% from 1961 to 1964; the fish catch grew from 200,000 to 312,000 metric tons from 1962 to 1964; and the number of employed fishermen rose from 200,000 to 220,000 between 1962 and 1964.

Statement of the Problem. While the outlook for the fishing industry is favorable for the nation as a whole, it is reported that this industry is in a depressed state in the two provinces adjoining Cam Ranh City: Khanh Hoa and Ninh Thuan. The fishing cooperatives need to be strengthened in providing credit and marketing facilities. In addition, the absence of marine engines in 80% of the fishing boats of these two provinces limits their fishing grounds to relatively shallow waters; motorizing these boats would permit access to deeper waters and perhaps would triple the annual catch.

Proposed Research. The proposed research will proceed in three steps:

1. Analyze the present role of the fishing industry in the economy of these two provinces.
2. Evaluate the benefits of equipping more fishing boats with motors, and the benefits of modernizing fishing practices and techniques. Compare the costs of these improvements with the benefits expected.
3. Assess the role which an expanded and strengthened fishing industry might serve in development of the Cam Ranh Bay region.

Other Possibilities Accruing from Research. Studies of the prospects for fish canning and processing should probably follow the availability of a greater supply of fish in both Nha Trang and Cam Ranh Bay. Fishmeal made from dead or waste fish could possibly be one of the earliest processing opportunities.

Screening Studies of Candidate Industries

In addition to feasibility studies of manufacturing enterprises based on regional resources, it is suggested that a major study be concerned with screening six to ten possible industries which represent important Vietnam needs, or which particularly present possible export opportunities, but which could be profitably located at Cam Ranh Bay. Among the candidate industries considered might be those that provide linkage opportunities to those suggested above for possible investment at Cam Ranh Bay. Those that indicate prospects of being successful enterprises could then be made available to private investors for consideration.

Restudy of Water Use--Da Nhim and Phan Rang Projects*

Statement of the Problem. There are a number of unanswered questions and certain problems associated with expanding the Phan Rang irrigation project and the possibility of importing water supplies to Cam Ranh City for the future development of the Cam Ranh Bay area. The original studies on which the Da Nhim power project and the Phan Rang irrigation project were based were undertaken independently, and apparently without considering the relationship between water for power and water for irrigation.

The Da Nhim power project diverts water supplies from the Da Nhim basin to the Phan Rang Valley, a type of venture which always raises some questions concerning the effect of such a diversion of water from the basin of origin. One question is whether the long term future water requirements of the basin of origin have been properly taken into account.

A second question also relates to the future. At present, the water supply available to the Phan Rang irrigation project is determined solely by the power load at which the turbines in the Da Nhim power plant are operating. For example, full scale operation of only one of the four turbines would permit only a quarter of the maximum water volume at capacity load of the Da Nhim plant to discharge through the penstocks and to become available to the Phan Rang irrigation project. This does not appear to be a problem at the moment, because Viet Cong interference restricts the plant operation to only a fraction of its power output capacity, and also because the Phan Rang irrigation project has not yet been carried to the point where it can utilize fully the water supplies available from the Da Nhim source. However, after the completion of the Phan Rang project, it will be necessary to obtain all the water that can be made available for extended periods of time during the growing season. Consequently, attention needs to be given to the possible construction of additional works so that water can be diverted to the Phan Rang irrigation project without being limited to the discharge flow through the Da Nhim penstocks for power production.

Further, the studies of the probable future cropping pattern and water use requirements of agriculture in the Phan Rang irrigation project are quite inadequate. An additional problem is that there are no calculations of the total annual water supply available from the Da Nhim power plant and from the Song Cai which flows through the Phan Rang Valley. The Nippon Koei estimate is that the total water supply is represented by a flow of about 25 cubic meters per second. After total water requirements are met in the Phan Rang irrigation project, it is estimated that approximately a million cubic meters annually may be available for export to Cam Ranh City. However, these flow data have been calculated on an instantaneous basis, and are not necessarily indicative of the supplies that would be available seasonally or on a year-round basis. In regard to total annual water requirements, it is certain that the diversion requirements in some seasons of the year will be less than maximum flow, so that a large potential supply may be available from the Da Nhim power project and Song Cai if regulating storage is provided. By taking

* This suggested study was one of three submitted to USAID/Washington on July 26, 1966.

this possibility into account, it is conceivable that perhaps even a larger supply of water might be available for diversion to Cam Ranh Bay than was estimated in the Nippon Koei study.

This study is urgently needed for the further effective development of agriculture in the Phan Rang Valley. It needs to be done irrespective of any commitment to develop Cam Ranh Bay.

Proposed Research. The foregoing unanswered questions, and certain unresolved problems have an important bearing on the effective development of the Phan Rang irrigation project and the availability of an economical imported supply of water at Cam Ranh City. Therefore, a study is proposed, to be concerned with the following questions:

1. On a long term basis, what volume of water supplies can safely be diverted by the Da Nhim project to the Phan Rang Valley and still meet the future requirements of the basin of origin?
2. What diversion or additional storage facilities would need to be built, and how much would they cost, in order to make additional water supplies available, on the basis of seasonal need, to the Phan Rang irrigation project, irrespective of the level of operation of the Da Nhim power plant?
3. What is the annual water requirement in the Phan Rang Valley, based on a projection of the probable future agricultural cropping pattern, assuming normal (as well as anticipated) relative crop prices, and future commercial and industrial utilization of water?
4. How much water would be available at any point in time on a year-round basis for exportation to Cam Ranh City for residential, commercial, industrial, and irrigation uses?
5. What additional flood control facilities are necessary, and how should they be located, to capture the runoff from the southern and western hills and to prevent flood damage from this source to the agriculture of the Phan Rang Valley?
6. What kind of extension program needs to be undertaken to educate cultivators in the Phan Rang Irrigation Project on how to conduct irrigation agriculture?

This project is estimated to require a team of two civil engineers and an agricultural economist.

Feasibility of Extending Irrigation in the Suoi Tra Duc Valley

In this valley, some irrigation is currently carried on, using small diversion dams on nearby rivers. When the studies are undertaken to determine the local supply of water available from stream flows and underground, the feasibility of extending irrigated agriculture in the Suoi

Tra Duc Valley should also be included. This means that the prospective agricultural demand for water based on suitable cropping patterns would need to be estimated. Presumably, the use of water for household and industrial consumption would have first priority. This poses the need for also relating to this study the possibility of importing water from the Phan Rang Valley in order to meet all water uses anticipated at Cam Ranh Bay.

Exploration of Resources in Western Highlands of Cam Ranh Bay Region

As indicated earlier, the development of the Cam Ranh Bay area is not dependent upon utilization of the resources that may exist in the Western Highlands, and therefore development need not be held up until the Viet Cong are cleared from this area. However, as soon as the area is open again, steps should be taken to study the potential of these resources. Aerial photographic and electromagnetic surveys should be undertaken for forestry and mineral explorations. Ground surveys would be essential later. The object should be to locate mineral deposits and to establish reserves. Timber supplies are known to be large and in sufficient supply to start certain enterprises, but timber stands by species need to be identified, and the volume of reserves determined.

Intermediate and Final Development Planning Studies

The General Land Use Plan needed for Cam Ranh City will be evolved from an understanding of the physical, social, economic, cultural, and political relationships now prevailing in the nation and the Bay area. This Plan represents a comprehensive statement on how people, land, money, community facilities, public utilities, policies, and administrative and incentive programs can be brought together into a meaningful force for viable urban living.

To determine the needs for land and the capacity of the area to absorb urban development to a given degree, many techniques and tools can be used, including: (1) analysis of all information pertaining to climate, hydrology, soil, hydrography, land use, traffic, etc.; (2) maps; (3) three dimensional work models; (4) aerial photographs; (5) demographic forecasts; and (6) economic forecasts. Alternative concepts for the future physical form of the City can then be developed and exposed to review and discussions by interested groups. The most desirable of these concepts, or the most workable features of any combination of them, can be combined into one or more preliminary General Land Use Plans for the area. Creation of alternative Preliminary Plans provides a basis for testing the goals and forecasts inherent in the studies--and for greatly extending the community's choice in a pattern delineating its future physical, social, cultural, and economic development. This is one way to bring meaning to the axiom "the greater the choice, the greater the civilization."

The General Land Use Plan will essentially be a refinement of the alternative Preliminary Plans, and will contain provisions for regional

factors, land uses, circulation facilities, community facilities, public utilities, population densities, and residential densities. Within the land use section will be provision for: residential, commercial, industrial, and agricultural lands; parks, recreation areas, and open spaces; generalized port and harbor designs; concentrations, clusters, or centers for cultural activities, governmental and administrative offices, medical-dental centers, and educational centers; aviation, seaport, and transportation terminals; and urban design features.

The General Land Use Plan will be implemented by a series of plan components--i.e., more precise plans and public facility systems plans for each major feature and element in the General Plan. These include the major public utilities, highways and roads, and maintenance and operations systems. The Plan will be further backed up by (1) recommendations on the codes and ordinances needed to carry out the provisions of the Plan, (2) a capital improvement and staged development program needed to finance all improvements, and (3) suggestions on keeping the Plan current and updated through the years. Community participation will be examined for its possible continuing value to the Plan. One of the most important elements bearing on the future form and quality of life in the City will be the Urban Design Plan. The creation of this feature might well be accomplished as a result of an international design competition to attract architects and builders throughout the world.

The Comprehensive Development Plan, which is the end result of the systematic approach presented herein, will not necessarily assure the creation of a great new city. However, existence of this program, once adopted as the official development policy of the Government of Vietnam, will be a major step forward in the attainment of this objective. In the absence of such a development program and policy, chaos is sure to result--in terms of human need, the quality of living, the use of resources, and the expenditure of public and private funds.

Outline for a Comprehensive Urban Development Plan

The following pages present an outline of the steps and procedures envisioned as an orderly movement from the first decisions to the finished Comprehensive Development Plan.

Statement of Development Policy

A Statement of Development Policy will be prepared as an interim guide for the program until the Comprehensive Development Plan is complete. Upon completion of the Plan, this Statement of Development Policy can be expanded and backed up by official actions bearing on financing, construction, and maintenance of all programs and improvement projects.

The Statement of Development Policy will be based largely on the assumptions for the future growth of the region, and the goals and objectives

for planning in the new City. The Statement will be used as a basis for review of every program and project being proposed for inclusion in the Plan, or being promoted independently of the Plan. Adherence to the Development Policy will assure the unity and integrity of the entire planning and development efforts.

Regional Considerations

The relationship of Cam Ranh Bay to the conurbation along Vietnam's southeasterly coast from Nha Trang to Phan Rang will be examined in terms of: shipping, rail, road, and air connections; physical contiguity; provision of governmental, cultural, and regional services; competitive position in world markets; and international interest in port facilities, raw material resources, and markets.

Official and Community Coordination

Within the comprehensive planning program, an ongoing methodology will be created for review and discussion of all features of the program by representatives of official national, regional, and local agencies; by international, local, and private financial and business interests; by technical participants; and by residents of the community. A forum will be provided for a continuing exchange of ideas and opinions on assumptions, goals, standards, concepts, plans, programs, and policies.

Social Science Studies

All social, cultural, and political data will be evaluated for impact upon physical planning studies and programs, in terms of population preferences for locational distribution, density, community and cultural facilities, public utilities, spending patterns, participation in the planning program, and participation in the life and government of the new City.

Economic and Population Forecasts, Standards, and Future Land Requirements

The population, economic, and related forecasts will be translated into land requirements:

1. Population Characteristic Forecasts

Number (high, medium, low range of forecasts)
Age group
Sex
Education
Income

2. Housing Requirements

Dwelling units by number and type
Densities
Costs

3. School Enrollment Forecasts

(From age group forecasts in item 1 above)

4. Commercial Land Requirements

(From forecasts of income and analysis of family and per capita spending patterns)

5. Industrial and Agricultural Land Requirements

(From forecasts of employment by major industry group)

6. Parks, Recreation Area, and Open Space Requirements

(Evolve from standards in relation to functional levels of recreation demanded by the population in every age group, passive and active, regional, municipal, and local)

7. Traffic Forecasts

(Evolve from expected modes of transportation, including bicycles, automobiles, and mass transit, to determine future rights of way for facilities)

8. Utility Requirements

(Evolve from standards of density and demand, to determine extent of land allocation requirements)

A Vietnam Standards Committee will be created, that will work in close conjunction with the research and planning team and representative community groups to create an acceptable level of standards for the new City.

Alternative Concepts for the Future Form and Character of the City

A series of concept studies indicating possible future forms for Cam Ranh City will be created in graphic and verbal terms. Some of these forms may be (1) linear (along the coastline predominately); (2) structured with a strong central core; (3) structured with a multi-center; (4) concentrated along major communication and transportation lines; (5) strongly oriented toward agriculture; (6) emphasized by hillside urban and flatland agricultural developments. Each concept will be related to ideas generated in the assumptions and goals.

Alternative Preliminary Plans

After review and discussion has been completed on the alternative concepts, a series of alternative Preliminary Plans will be created for Cam Ranh City, reflecting national (military) and regional considerations, and those concepts of form which best represent the assumptions, goals, and objectives of the development planning program.

The physical land configuration and its capacity to hold new population will be related to forecasts of land required for all needs. An alternative Preliminary Plan will be prepared for each estimated population range, showing a short range, a middle range, and a long range plan as the population builds up in the area.

Each Preliminary Plan alternative should indicate in generalized form the amount and distribution of land for all uses, the circulation and transportation system, the location of major open spaces, suggested density ranges and distribution patterns for residential areas, and major community facilities and public buildings.

General Land Use Plan

In conjunction with the Cam Ranh Bay Development Authority (or similar group, as suggested in Chapter VI) and other interested groups, one Preliminary Plan will be selected for modification, refinement, and improvement, and will become the Cam Ranh City General Land Use Plan. This Plan may be created from a combination of the best features in each of the alternative Preliminary Plans, and will contain the following elements:

A. Land Use

1. Agriculture
2. Residential, by density and location
3. Commercial, by function and service level
4. Industrial
5. Military
6. Offices (professional, mercantile, commercial)
7. Medical-dental
8. Educational
9. Religious
10. Cultural
11. Institutional, public buildings
12. Parks, recreation area, open spaces
13. Port and harbors
14. Water features
15. Interim and transitional use areas

B. Circulation and Transportation

1. Road
2. Rail
3. Water
4. Air

C. Densities

1. Residential
2. Commercial
3. Industrial
4. Population

D. Statements on Assumptions, Goals, Objectives, Forecasts, Standards

Implementation Features

Accompanying the General Land Use Plan will be the following implementation programs and plans needed to carry out the proposals of the Comprehensive Development Program for Cam Ranh City:

1. Codes and Ordinances

Codes and ordinances will be prepared in draft form for the regulation of land subdivision, zoning districts, physical development standards, and housing and building codes. These regulations will be subjected to Vietnam governmental analysis, review, and adaptation for legal adequacy and local use.

2. Public Works Systems Plans

The next section (Public Works Systems Plans) includes a description of each Public Works System which will be prepared as a further refinement of the General Land Use Plan.

3. Urban Design

The General Land Use Plan would be supported by urban design proposals for guidance in establishing the future form and urban character of Cam Ranh City. Some of these include:

- a. Architectural concepts; building types; vertical-horizontal building and open space relationships.
- b. Approaches to and exits from the City.
- c. Suggestions for the design, form, and spatial relationships of major locational and activity centers in the General Land Use Plan.

- d. "Townscape" concepts for urban character.
 - e. The "floorscape" (the texture and quality of horizontal surfaces--sidewalks, pedestrian pathways, bicycle routes, parking areas, roads).
 - f. "Land at the water's edge"--suggestions for treatment of port and harbor facilities, in terms of architecture, open space, public access to the water.
 - g. Color
 - h. Illumination
 - i. Sign control
 - j. Landscaping
 - k. Architectural design standards and architectural and site control review methods will be incorporated into the zoning ordinance.
4. Capital Improvement Program; Staged Development Provisions; Financial Programming

The General Land Use Plan and the Preliminary Public Works Plans will be evaluated in terms of cost and construction priorities. From these, a Capital Improvements list will be established. After review and discussion of this list, priorities will be selected, which in turn will be related to the capacity of the Government of Vietnam to pay for their development. A staged development program will be created to relate construction priorities to forecasts of revenues, expenditures, and financial programs needed to generate the necessary funds to build the various systems and improvements.

5. Zoning Districts

The General Land Use Plan will be supported by a zoning districts map which indicates the regulations and controls needed to officially and legally protect the integrity of the General Land Use Plan proposals. The zoning districts will indicate major land uses, densities, open space preservation, airport approaches, harbor areas, flood plain areas, etc.

6. Continuing Use and Updating of the Development Plan

The Development Plan will contain recommendations for its administration, and for its continuing use and updating through the years by official, technical, and advisory bodies.

7. Community Participation

The Development Plan will include recommendations on maintaining permanent community participation in the program.

Public Works Systems Plans

The following individual plans define each of the several major facilities and utilities that are implicit in the General Plan and are necessary for future developments at Cam Ranh City. Although each is self-contained, they would be carefully and deliberately coordinated with the overall matrix of comprehensive development planning, since they relate one to another, and their total relates to the General Land Use Plan.

Transport Systems Plan. This plan would encompass all modes of transportation of people and goods--i.e., roadways, railways, seaways, airways, and commercial pipelines.

Highways, major city roads, and primary through-streets would be shown in terms of location (or possible relocation), width, grade, and important intersection configurations. Special consideration would be given to pedestrian ways, bi-wheeled and tri-wheeled vehicles, trucks, buses, and any animal-drawn conveyances. Because Cam Ranh City has no experience records to draw upon, at least as far as making projections into the future are concerned, demands upon a future roadway system will be synthesized by traffic flow models (possibly an electronic computer program will be used for this purpose). Capacities, design standards, costs, and a time phasing schedule will be prepared.

Mainline railway, drill, spur, runaround, and team trackage would be indicated as to location and configuration. As with the roads and highway system, relocations that may prove to be necessary and that are economically justified will be shown. Also shown will be the necessary elevations of certain sections of the roadbed. Needed areas for passenger and freight stations, parking, transit freight storage, and equipment storage will be analyzed and located. Design standards, costs, and time phasing schedules will be prepared.

Concerning facilities at or near the proposed port, the prior planning by Daniel, Mann, Johnson, and Mendenhall will be incorporated insofar as it is applicable within the development planning context and can be economically justified. Such facilities will include: dredged channels; turning basins; anchorage areas; piers; off-wharf dolphins; staging areas; transit sheds; facilities for pilots, dockmaster, and weighmaster; facilities for customs, public health, and dock workers; and fire protection equipment. Costs and time staging schedules will be included.

As to an air transport system, a special feasibility study is recommended that will answer the questions, "Should the airport at Nha Trang

service Cam Ranh City or should the City develop its own facilities?" and "If Cam Ranh City is to develop in the dynamic manner that one might visualize, then at what point in time should an additional airport facility be constructed?" Pertinent also is the possibility of using one of the military constructed airfields. Such a study should consider air traffic potential, air traffic conflict, size and required services, economic and social impact, cost benefits, etc. The Transportation Consultants, Inc. report, which as of this time has not been published, may elicit thoughts about these questions; however, the report did not appear to consider Cam Ranh Bay in its fullest possible potential. Even though the need for such a facility is not one for the near future, longer range land planning must be considered.

Whereas transport of goods by commercial pipeline is a logical part of an overall transport plan, its intimacy with industrial development, yet to be determined, will preclude definitive pipeline studies at present.

Water Systems Plan. The water systems plan is composed of four elements: (1) domestic, (2) industrial, (3) irrigation, and (4) fire protection. These four classes of water usage will be analyzed and planned in regard to:

1. Source--underground and/or above-ground reservoirs; deep and/or shallow wells; transported water.
2. Transmission--pipeline; natural or constructed open channel; pumping versus gravity flow alternates.
3. Treatment--the need for and type of treatment; its location (whether at source or at distribution point); degree of treatment and other health aspects.
4. Distribution--pressure versus gravity system alternatives; short term storage; major trunks, loop and tie lines; laterals, hydrants, meters, and other appurtenances.

Consumer demands will be analyzed and projected commensurate with the forecasted growth rate of the City. Rate structures, costs and time staging schedules would be part of this plan.

Wherever the concept is applicable and feasible, possibilities of joint military-civilian use will be considered.

Sanitation Systems Plan. This element considers sanitary sewerage, garbage disposal, water pollution, and general health hazard. A quantitative analysis would be made to determine the magnitude of disposable matter commensurate with the growth pattern forecasted for the City. This plan in both map and written form will generally consist of the following:

1. Collection--methods (pipe, truck, etc.); locations and pick-up points; and major collector pipe sizes and locations.
2. Treatment--type and degree of treatment; location; and joint use possibilities (with the military).
3. Disposal--sludge; wet and dry garbage and refuse; ocean or bay outfall for effluent; aeration ponds; land spraying possibilities, septic tanks, and leaching fields; fill and cover methods; burning and enclosed incineration.
4. Health hazards--abatement (mosquitoes and rodents); and controls at and near port facilities.

Collection rates, costs, and time staging schedules will be included.

Flood Control Systems Plan. This plan would generally consider and delineate certain major channel and river improvements as well as new channel and stream diversion recommendations. An analysis will be made of "tidal blocks" concurrent with major storm runoffs in order to determine the need for collection basins, pumping stations, or upstream bridge improvements. Major culverts, open drainage, and piped systems would be shown, as well as cost and time staging schedules.

Recommended landfill or embankment heights as they relate to reclamation of tidal lands, roadbed construction, or protection to the low lying irrigable lands will be a part of this plan.

Electric Power Systems Plan. This plan will not be a nationwide power source study; it is assumed that at such time as security and the national policy and economy allow, construction of major high voltage power transmission lines will be provided to Cam Ranh City. This plan is rather one that analyzes power demands and locates power distribution lines and ancillary facilities in Cam Ranh City, within the context of the General Plan. Primary and secondary power systems will be delineated as well as required substations, switching points, and line transformer points.

Demands to meet the population forecasts will be estimated and costs and time staging schedules will be made. Other information incorporated will be recommendations on temporary thermal plants; and suggestions as to when these plants might be phased out of the system, or at least used for standby purposes only.

Communications Systems Plan. This plan will be more of a written "needs statement" than a physical plan. The demands to be placed upon a telecommunications and postal system by the growing City will be primarily a tool for the Post and Telephone Company in their planning of

short and long range communication extensions and facilities to this area. Such an analysis will be of considerable value in the current planning of the Northern Toll System.

Public Building Facilities Plan. As part of the General Land Use Plan program, the need for and location of public buildings will be analyzed and located. These will include administrative/government buildings, fire stations, police and public safety buildings, schools, corporation yards, transport terminal facilities, sewage treatment plants, water treatment plants, power substations, parks and recreation buildings, libraries, and other structures.

These buildings will not only be located but also be considered in terms of size, cost, personnel requirements, maintenance considerations, joint use by more than one agency, efficiency and intercommunications, multi-use of equipment, and specific points in time at which the various facilities should be constructed.

Public Works Operations Plan. This plan, in written form, will discuss primarily two functional procedures:

1. Administration. As an aid toward the efficient management of the new facilities as they are constructed and become part of the overall public works system, recommendations will be given concerning personnel qualifications, record keeping, permit procedures, code requirements, field measurements and data buildup, labor distribution practices, control and reporting, and personnel training.
2. Maintenance and operation. The need for sound maintenance and operation procedures will be discussed and outlined. Maintenance schedules and methods, instruction procedures, inspection methods, and equipment use and needs will be considered.

VIII DEVELOPMENT PLANNING PROGRAM SCHEDULE AND INTERIM ACTION PLAN

Summary View

The scope, objectives, and technical contents of the recommended research and planning effort for Phase II have been described in previous chapters. There now remains the task of providing a summary view of these studies, their mutual relationships, and a schedule for items of the work to be performed. This view is provided by Figure 9, showing both chronology and interdependence.

The flow of work is directed from left to right along the time scale as indicated. The time notation begins with the Basic Socioeconomic Studies. Times prior to this point are solely subject to GVN and USAID control. Thus, before the Socioeconomic Studies begin, several decisions will have to be made, as indicated in Chapter VI, regarding statement of policy, funding, and other matters furnishing the authorization for the research and planning effort to proceed.

Provision for Specific Review

Two specific periods of review have been provided for the Cam Ranh Bay group that would be responsible for the fulfillment of objectives. Time has not been indicated because of the unknown duration of review. These review periods represent times at which major decisions will be made toward advancing both development policy and physical form. General and more informal reviews are not shown; these would be made periodically throughout the program, for purposes of coordination, liaison, and assurance of overall program compliance with primary goals and objectives.

The first major review follows the work up to and including the "Alternative Concept Plans." At this point, the reviewers, after being given the pro's and con's of each concept, would choose from the possible alternative concepts. For example, in the work on urban design, reviewers would have to consider such typical questions as:

1. Should Cam Ranh City have a concentrated and highly centralized "core" activity unit, or should there be several activity centers extending linearly up and down the Bay front?
2. Should Cam Ranh City be considered as the nucleus of a vast industrial complex along the coastal areas of Central Vietnam, or should Cam Ranh City's orientation be toward a balanced community having several economic strengths?

The second major review period follows the "Alternate Preliminary Plans" phase and suggests such decisions as (1) Can the military peninsula be occupied in part for civilian use?; (2) Should a plan for concentrating refugees be accepted over one showing integration of refugees in many different areas of the City?; and so on. Reasons "for" and "against" would be given for all alternatives.

Time Phasing

The diagram suggests that any single indicated work item is subject to others, and that subsequent work cannot proceed until the prerequisite work item is completed. Within the context of overall flow process, however (not particularly indicated on the diagram), is the fact that in some cases, certain professionals will be in the field at times earlier than their indicated work items begin. These professionals will be in the field earlier, for data collection or on-site analyses before they begin their work item itself.

A breakdown of units of time less than one month is considered unrealistic for the following reasons: some items are prerequisites of others, and differ in their rate of accomplishment; various times required for interim decisions; and the inability at present to foresee feasibility or infeasibility of certain efforts. Thus the broader time segments shown will allow for some give-and-take in the scheduling, but still require that each major stage of the planning program should be completed before the next stage is begun, even though some overlapping of sub-items may occur.

Interim Action Program

The comprehensive nature of the program, as graphically shown and as discussed on several occasions elsewhere in this report, requires sufficient time and expenditure of energy to ensure meaningful results. Shortening of time, reduction in level or extent of effort, or segmentation of its integral parts can only decay the suggested program to the degree that its inherent comprehensiveness could be left open to question. Yet on the other hand, time, and possibly funding, are of the utmost concern, and some developmental decisions cannot wait for this desired degree of comprehensiveness.

An anomaly seems to present itself--the "ideal" approach of planning ahead in a prudent and logical manner suffers from the want of time, whereas the "let's begin something immediately" approach suffers under the very real possibility of irresponsible and ill-planned developmental decision-making.

It is suggested that the practical answer to how to proceed might lie in the following. If carefully conducted, the procedure can honor the problem of time and yet can maintain a goal of being as close to the "ideal" approach as feasible under the current conditions.

1. Immediately commence the formulation items shown on the left end of the flow chart to the left of time "zero."
2. Immediately thereafter, initiate the comprehensive research and planning program outlined to the right of time "zero," as shown on the flow chart. This is not only realistic but the only practical procedure to follow if Cam Ranh City is to truly play its envisioned role in the economy of Vietnam and IF immediately and concurrently, step 3 is initiated.
3. Begin the preparation of an Interim Cam Ranh City Land Use Plan, from which can stem (a) an interim program for the location of in-migrants, (b) an interim land sale policy, and (c) a modified (or at least carefully staged) community housing project. These items are indicated on the work flow diagram.
4. Initiate the features of the Interim Land Use Plan and its interim developmental policies, but maintain a posture of the greatest flexibility.
5. Initiate such physical improvements as required (a) to maximize Cam Ranh Bay's competitive position as the potentially largest, next to Danang, port facility in Central Vietnam,* and (b) to satisfy the immediate health, safety, and welfare environmental factors of Cam Ranh Bay's burgeoning population;† and yet minimize long term, unchangeable, or inflexible public investments.

Such a program of initial steps suggests on-going actions necessary to meet current demands. However, it should be fully realized that mistakes will no doubt be made and certain initial investments may be lost, at least until such time as the first outputs of the comprehensive research and planning program furnish information required for action decisions.

* See section in Chapter V on "Port Improvements Suggested."

† See section in Chapter VI on "Interim Urban Development Approaches."

Appendix A

GENERAL BIBLIOGRAPHY

Appendix A

GENERAL BIBLIOGRAPHY

ECONOMY OF VIETNAM & NATIONAL ECONOMIC STATISTICS

Studies in Vietnamese Economy, Vol. 1, A. A. Rozental, ed., Economic and Financial Planning Division, USOM, Vietnam, Saigon, 1964, 93 pp., English.

This is a collection of six papers with subject and author as follows: Central Government Finance 1961-1963, E. Heginbotham; Military Expenditures in Vietnam, Staff; Consolidated Balance Sheet of the Banking System of Vietnam, A. A. Rozental; The Money Supply in Vietnam, 1959-1963, E. L. Auchter; GVN Balance of Payments in 1962, H. Lubin; Status of Manufacturing in Vietnam, F. Ritchie.

Annual Statistical Bulletin, No. 8, August 1964 (data through 1964), Economic and Financial Planning Division, USOM Vietnam, 150 pp., English.

Statistical Yearbook of Vietnam, Vol. 10, (data through 1962), National Institute of Statistics, Vietnam, 1964, 481 pp., Vietnamese, French, and English.

Statistical Yearbook of Vietnam, Vol. 11 (data through 1963 and 1964), National Institute of Statistics, Vietnam, 1964, 425 pp., Vietnamese, French, and English.

These two volumes are the tenth and eleventh in a series. The chapter titles are: Climate, Population; Public Health; Education and Culture; Justice; Agriculture and Livestock; Forestry, Fishery and Land Reform; Industry; Transports and Communications; Money and Private Finance; Public Finance; Trade; Labour; Property and Income; and Consumption. The statistics presented cover figures for the total country, with a breakdown in a few chapters by province.

Economic Expansion of Viet-nam in 1964, Supplement to the Monthly Bulletin of Statistics, National Institute of Statistics (Ministry of Economy), Vietnam, 1965, 62 pp.

Enquete Demographique (Census of Population) a Saigon en 1962, National Institute of Statistics, Vietnam, 1963, 232 pp., French.

Annual Report, Fiscal 1964, Nation Bank of Vietnam, Saigon, June 1965, 119 pp., English.

Recensement Pilote de la Province de Phuoc-Tuy Effective le 6 Novembre 1959, National Institute of Statistics, Vietnam, 68 pp., French.

Monthly Bulletin of Statistics, National Institute of Statistics, Vietnam, Vol. 3, November 1965, Vols. 1, 2, and 4, January, February, April 1966.

Revenu National Du Viet-Nam 1960-1964, Comite Revenu National, Banque Nationale Du Viet-Nam, January 1966, 31 pp., mimeograph, French.

(Latest Statistics on the Vietnam Economy), National Bank of Vietnam, 1966, 30 pp., French and English.

All tables include statistics covering years 1962-1965, but many tables give economic indicators from 1955-1965.

Vietnam Population Census, 1964, National Institute of Statistics, 1965, 227 pp., Vietnamese, with English translations of tabular headings provided by Mr. Bang of Private Investment and Industry Division, USAID, Saigon.

This publication gives population by region, province, and village.

The U.S. Assistance Program for Vietnam, USOM Vietnam, January 1965, 20 pp., English.

Economic Bulletin, National Bank of Vietnam, Saigon, November-December 1961, 97 pp.; July-August 1965, 76 pp., Vietnamese and French.

Statistics cover national income for years 1960-1963.

Recensement Des Etablissements Au Viet-Nam 1960, National Institute of Statistics, Vietnam, Fascicule I, Methodologie-Recensement De Saigon, Aout 1962, 125 pp.; Fascicule II, Resultat D'Ensemble, Aout 1963, 290 pp., French.

Both sections contain manufacturing statistics based on a sample study. From the sample, 70 percent of the licensed establishments of the provinces in South Vietnam answered; 88 percent from the Central Lowlands; and 58 percent from the Central Highlands. The information is at the province level.

Etude Sur Les Conditions De Vie Et Les Besoins De La Population Du Viet-Nam, Decembre 1957 - Mars 1959, Mission "Economic Et Humanisme," National Bank of Vietnam, Saigon, Septembre 1959, 180 pp., French.

This publication contains statistical analyses of both the urban and rural population characteristics, 1956-1957.

"The Economic Battle in Vietnam," James Kolbe, in Western Political, Vol. 1, No. 1, Spring 1966, pp. 22-27.

Technical Assistance Programme: Toward the Economic Development of the Republic of Viet-Nam, FAO Report No. 539, United Nations, New York, 1959, English.

"Etude des Possibilities et des Conditions du Developement du Viet-Nam," Bulletin Economique, pp. 24-35, Vol. 3, 1965; pp. 22-40, Vol. 4, April 1965, National Bank of Vietnam, French.

Toward a Policy for Economic Growth in Vietnam, Frank C. Child, Michigan State University Vietnam Advisory Group (to Agency for International Development), 1962, 77 pp., English.

An authoritative source of material used by many organizations in their reports of Vietnam.

Promenades Dans Saigon, Hilda Arnold, S.I.L., Saigon, 1948, 117 pp., French.

L'Indochine Economique, Inspections Generales Des Mines Et De L'Industrie, 1931, 49 pp., French.

La Situation Financiere de l'Annam, Paris Librairie Coloniale & Orientaliste Larose, 1928, 222 pp., French.

L'Evolution Economique De L'Indochine Francaise, Centre D'Etudes De Politique Etrangere, Paul Hartmann, Ed., 1939, 392 pp., French.

Le Developement Economique De L'Indochine Francaise, Auguste Grandel, Ardin, Saigon, 1936, 234 pp., French.

L'Endettement Agraire En Cochinchine, Rapport D'Ensemble Au Gouverneur General De L'Indochine, 1933, 104 pp., French.

INDUSTRIAL DEVELOPMENT, VIETNAM

Industrial Development of Vietnam, Au Ngoc Ho, ed., Directorate of Mines, Industries, and Crafts, Ministry of National Economy, Saigon, October 1964, 105 pp., English.

"Business Boom in Saigon," by C. H. Barber, Far Eastern Economic Review, March 10, 1966, pp. 443-447, English.

Monthly Progress Report, Engineering & Construction, Public Works Division, USAID/Vietnam, March 1966, 100 pp., English.

Selected publications of the Industrial Development Center, Republic of Vietnam, Saigon.

1. Industrial Development Center, 7th Annual Report, 1964, 22 pp., English.

2. Organization and Functions of the Industrial Development Center, September 1965, 32 pp., English.
3. Official Documents on Investments in Viet-nam (2nd Ed.) June 1964, 35 pp., English.
4. Establishing an Industrial Undertaking in Viet-nam, July 1964, 41 pp., English.
5. Proceedings of the Seminar on the Question of Stocks, January 1965, 50 pp., French.
6. Establishing a Corporation in Viet-nam, April 1964, 50 pp., French.
7. Financing Enterprises, June 1964, 76 pp., French.
8. Fiscal Environment for Investments in Viet-nam, July 1964, 34 pp., French.
9. Studies by the Department of Productivity, February 1964, 33 pp., French.
10. Plan for Establishing an Enterprise, November 1964, 50 pp., French.
11. Some Industrial Statistics Useful for Market Studies in Vietnam, 1964, 30 pp., Vietnamese and English.

Industrial Development in Asia and the Far East, Industrial Development News, No. 1, Regional Industries Promotion and Planning Centre, ECAFE, United Nations, New York, 1965, 97 pp., English.

The Role and Application of Electric Power in the Industrialization of Asia and the Far East, (Report of a Working Group), Economic Commission for Asia and the Far East, and Bureau of Technical Assistance Operations, United Nations, New York, 1965, 98 pp., English.

Studies in Economics of Industry (Cement and Nitrogenous Fertilizers Based on Natural Gas), United Nations, New York, 1963, English.

Energy Resources and Their Utilization in Viet-Nam, Electricity of Viet Nam, September 1965, 42 pp., English.

General Industrial Survey of 17 Industries for Vietnam, Technical Aids Branch, (contract studies by Day and Zimmerman for Office of Industrial Resources), I.C.A., January 1959, 235 pp., English.

Small Industry Bulletin for Asia and the Far East, No. 3., Economic Commission for Asia and the Far East, United Nations, New York, 1964, 143 pp., English.

Economic Feasibility of a Chemical Industry in South Vietnam, Prepared by Hibben Ziesing, Princeton, New Jersey, submitted to AID, Washington, D.C., January 1962.

The Feasibility of Establishing a New Lumber Mill at Dalat, South Vietnam, prepared for the Dwyer Mission by Stanford Research Institute, Menlo Park, Calif., June 1966, 25 pp., English.

Les Bois et les Principaux Sous-Produits Forestiers de l'Indochine, Exposition Coloniale Int.. 1931, 63 pp., French.

AID publications.

1. Aids to Business (Overseas Investment), AID Bulletin, September 1965, 63 pp.
2. Report of Participation, AID, Dept. of Commerce and U.S. Businessmen meeting with representatives of Vietnam Industries.
3. INDEX - CATALOG OF INVESTMENT INFORMATION AND OPPORTUNITIES, AID, Office of Development Finance and Private Enterprise, January 1966.
4. "Hands of Viet-nam Need Technical Guidance," International Commerce, U.S. Dept. of Commerce, March 7, 1966, investment mission report, pp. 2-17.

Industrial Development in The Republic of Vietnam, N. M. Uquaili, November 1962, 51 pp., English.

Industrial Development-Progress Report #20 (June 1963) EBASCO Services Inc., 12 pp., English.

Report on Fertilizer for Viet-nam, Day & Zimmerman, Inc., Advisors, Industrial Development Center, Republic of Viet-Nam, 31 pp., English.

Motorization of Fishing Junks in Vietnam, Division of Agriculture, USOM, 1960, 30 pp., English.

CAM RANH BAY DEVELOPMENT--TRANSPORT

Viet Nam Transportation Study, June 1966, Transportation Consultants, Inc., Washington, D.C., 358 pp., English.

Development of Harbor Facilities: Basic Information, Conditions and Criteria. Basic volume of DMJM 17 report set, Daniel, Mann, Johnson & Mendenhall. February 1966.

1. Development of Harbor Facilities at Cam Ranh Bay
2. _____ Hue

3. _____ Da Nang
4. _____ Quang Ngai
5. _____ Qui Nhon
6. _____ Nha Trang
7. _____ Phan Thiet
8. _____ Vung Tau
9. _____ Saigon
10. _____ Can Tho
11. _____ Rach Gia
12. _____ Ha Tien
13. _____ Cargo Handling Equipment and Cargo Handling Operations
14. _____ Warehouse Construction Program
15. _____ Tugs and Barges
16. _____ Dredging

The first 12 reports listed above deal with the feasibility of improving the designated port sites. The studies cover historical background, area description, resources available, present and future traffic of the various ports, and economic justification of the future development of the port.

Preliminary Report - Water Investigation and Study - Cam Ranh Peninsula, by Pope, Evans, and Robbins International, Ltd., for U.S. Navy Dept., OiCC, Vietnam, January 1966, 30 pp., English.

Climatological Information for Meteorological Stations of the Republic of Vietnam (data from Vietnam Directorate of Meteorology), USOM Vietnam, March 1964, 35 pp., English.

This report contains data on temperature and average rainfall by various meteorological stations throughout Vietnam; reported stations closest to Cam Ranh Bay are Nha Trang, Dalat and Phan Thiet.

Preliminary Feasibility Study of Electric Power 1967-1975 for Republic of Vietnam, P. G. Whitmore, Public Works Division, USAID, Vietnam, April 1966, 11 pp., English.

Water Supply, papers by W. C. Rasmussen, USAID, May 1965, July 1965, and November 1965, English.

Newsletter of the Directorate of Water Supply and RUWSTAF (Vietnam Delta area), January 1966, 22 pp., English and Vietnamese.

Progress Report - Ammunition Pier, Cam Ranh Bay by Dames and Moore, Soils Consultants for R. M. Parsons Co., May 1966, 12 pp.

This report contains soil boring logs from borings drilled in Cam Ranh Bay in 1966, offshore of the northerly portion of the Peninsula; includes recommended dredging procedures.

Index to Hydrological Surveys 1955-1964, Public Works Ministry, Republic of Vietnam, 1965, 20 pp. (maps).

Tide Tables 1966, Director of Ports, Republic of Vietnam, 1966, 20 pp. (tables), French and Vietnamese.

Includes daily tide information for year 1966 at Qui Nhon, with conversion factors for determining tide at Cam Ranh Bay.

Hydrology Data, 1964, Irrigation and Rural Affairs Directorate of Vietnam, Saigon, 1965, 152 pp., English and Vietnamese.

Contains data for the year 1964 on stream flows of major rivers in Vietnam, as well as daily and hourly precipitation at some rainfall stations; Cam Ranh Bay rivers not reported.

CAM RANH BAY DEVELOPMENT--INDUSTRIAL DEVELOPMENT

Planning Report on Cam Ranh Industrial Center and Harbor, Nippon Koei Co., Ltd., Tokyo, November 1964, 107 pp., English.

"Cam Ranh Industrialization Project," by Tranh Ngoc Danh, ESSO magazine, Vol. II, No. 3, 1965, Esso Standard Eastern, Inc., Saigon, 5 pp., English.

Status Report, Vietnam Refinery Project (Draft), F. W. Penn, General Manager, Viet-nam Refinery Project to Minister of National Economy, May 14, 1966.

Vietnam Refinery Project (Engineering Survey), Esso Corp., Vietnam, July 14, 1962, 100 pp., English.

VIET NAM--PHYSICAL FEATURES AND NATURAL RESOURCES

Archives Geologiques Du Viet-nam, No. 8, 1966, Geologic Service, Direction des Mines, Ministry of Economy, Saigon, 250 pp., Vietnamese and French.

Fisheries Statistics Yearbook 1963, Dept. (Ministry) of Agriculture, Directorate of Fisheries, 44 pp., Vietnamese and English.

All aspects of the fishing industry are included with much data given for individual provinces.

Vietnam Agriculture--Background Information Prepared for Visit of Hon. O. L. Freeman, February 1966, USAID/Agriculture, 71 pp.

A very thorough and up to date study of Viet Nam agriculture.

CAM RANH BAY DEVELOPMENT--GENERAL

Suu-Tam Va Nghien-Cuu, 2nd report by the GUN Cam Ranh Development Study Committee for the six months ending February 1966. Includes architects' preliminary land use plan for Cam Ranh Bay area, and an annex (in English) prepared by USAID, 81 pp., Vietnamese. (Our copy of this report attaches a summary translation by Mr. Bang, USAID/PRIID staff.)

File on Cam Ranh Bay, Mr. Bang, USAID/PRIID staff, submitted to SRI team May 7, 1966.

First Report by GUN, Cam Ranh Development Committee, August 1965, 11 pp., English.

Cam Ranh City Development, Keith Emrich/USAID, 3 pp.

Map - The Refugee Problem, South Vietnam.

Preliminary Study on the Electrification of the Nha Trang-Cam Ranh-Phan Rang-Dalat Area, Electricity of Viet Nam Planning Department, 104 pp.

Includes information on the feasibility of industrialization in the Cam Ranh Bay area.

SAIGON

Publications of Saigon Metropolitan Region, Doxiaois Associates, Athens, for the Ministry of Public Works, Vietnam, French.

1. Vol. 1 Urban Development Program and Plan, January 1965, 300 pp.
2. Vol. 2 Administration, Types of Structures, Construction Materials, Human Resources, January 1965, 150 pp.
3. Vol. 3 Pilot Project, January 1965, 52 pp.
4. Vol. 4 Summary of Reports, February 1965, 52 pp.

The objective of this project was to work out long range planning program for development of the Saigon area. Many of the statistics apply to the total economy of Vietnam.

Saigon Metropolitan Water Project, Monthly Report of Progress No. 23, Hydrotechnic Corp., Inc., for Ministry of Public Works and Communications, Vietnam, and USAID/Vietnam; March 1966, 100 pp., English.

Municipal Water Supply Project, Monthly Report of Progress No. 6, Ralph M. Parsons Company for Ministry of Public Works and Communications, Vietnam, and USAID/Vietnam.

Thu-Duc Thermal Power Plant and Transmission System Project, Monthly Report of Progress, Gibbs and Hill, Inc., for USAID/Public Works Division, March 1966, 50 pp., English.

VIETNAM--GENERAL

Country Assistance Program FY1967 Vietnam, Part II, USAID/U.S. Dept. of State, December 1965, 553 pp., English.

Posts and Telecommunications Project, Final Report, March 1, 1966, General Telephone and Electronics International (GT & EI) for Ministry of Public Works GVN and USAID, 151 pp., English.

Proposed Scope of Work, Operations and Maintenance Contract, General Telephone and Electronics International for GVN and USAID/Vietnam, 17 pp.

Study of Land Transportation in Vietnam, by Transportation Consultants, Inc., to be completed August 1966. (It will contain a chapter on the economy of Vietnam.)

Rehabilitation of Hospitals, Republic of Vietnam, Monthly Report of Progress, No. 12, Pacific Architects and Engineers, Inc. for Ministry of Health, Vietnam, and USAID/Vietnam, March 1966, 50 pp., English.

Various publications by the Director-General of Plan, Republic of Vietnam, Saigon.

1. Second Five-Year Plan, 1962-1966, 272 pp., French.

2. Notes and Etudes.

No. 1 Agriculture, Livestock, Forests, Fisheries
Jan. 1965, 93 pp., French.

No. 3 Industrialization in Vietnam
May 1965, 107 pp., French.

No. 4 Planning for Needy Children & Youths, 37 pp., French.

No. 5 Development of the Economy and Human Resources of Vietnam
35 pp., French.

Annual Report, 1965, Committee for the Coordination of Investigation of the Lower Mekong Basin, ECAFE, United Nations, (E/CN, 11/WRD/MKG/L 159), 1966, 200 pp., English and French.

Vietnam - Post Review - 1965, USAID, 65 pp., English.

Land Reform in the Republic of Vietnam, USAID/Agriculture, Prepared for (USO) Mission Council meeting March 7, 1966, 50 pp.

File-Pocket of Misc. Publications, selected and obtained from Mr. Clary, Public Administration Division, USAID, May 7, 1966.

Most of this material deals with government and public administration affairs in Vietnam.

Part 1: Some Fundamental Concepts on National Transportation Policy, Highway Dept., Ministry of Public Works and Communications, 1964, 14 pp., English.

Part 2: Thinking on Transportation Policy, 1964, 9 pp., English.

Introduction to Vietnam, prepared for Congressional and Business Survey Group, No. 1965, by Industrial Development Division, USAID/Vietnam, 30 pp., English.

Ten-Year Plan of Highway Improvement 1965-1975, Dept. of Highways, Ministry of Public Works and Communications, Republic of Vietnam, 1965, 28 pp., English.

Les Stations Climatiques en Indochine, Exposition Coloniale Int., Paris, 1931, 49 pp., French.

L'Eau Potable En Indochine, Exposition Coloniale Int., Paris, 1931, 26 pp., French.

Le Probleme Humain de L'Indochine, Libraire Delagrave, Francisque Vial, 237 pp., French.

Histoire Populaire des Colonies Francaises, Editions Du Velin D'or, Robert Barroux, Archiviste-Paleographe, 400 pp., French.

Second Fertilizer Plant, CEB-P-57-287a, U.S. Department of Commerce, (U.S. Operations Mission Republic of Korea), English.

Final Report, Engineering & Construction Contract Urea Fertilizer Plant at Chung-Ju, Korea, McGraw-Hydrocarbon, January 24, 1961, English.

Appendix B

CARTOGRAPHY BIBLIOGRAPHY

Appendix C

LIST OF INTERVIEWS

Appendix C

LIST OF INTERVIEWS

Interviews - Cam Ranh Bay: Officials, Government of Vietnam

Au Ngoc Ho
Assistant Secretary of State for Mines, Industries, and Crafts
Government of Vietnam

Au Trong Thanh
Minister of Economy and Finance
Government of Vietnam

Bui Quang Minh, Director
National Institute of Statistics
Saigon

Bui Thuc Qui Nhon
Director, Research and Economics, National Bank of Vietnam
Saigon

Colonel Bang
Mayor, Cam Ranh City
Vietnam

Khuong Hau Dieu
Assistant for Commerce to the Minister of Economy
Government of Vietnam

Le Van Canh
Representative of Realty Record Directorate
Government of Vietnam

Ngo Ba Thanh
Director, Fisheries Directorate
Government of Vietnam

Ngo Khac Thieu
Director of Budget and Foreign Aid
Government of Vietnam

Ngo Viet Thu
Architect
104 Nguyen Du
Saigon

Nguyen Van Chieu
Manager, Cam Ranh Bay Project, and formerly
Director General of Ports
Government of Vietnam

Nguyen Anh Tuan
Director General of Planning, Government of Vietnam
Chairman, Cam Ranh Bay Committee

Nguyen Van Hiep
Chef du Service National de la Conservation de la Nature
Government of Vietnam

Nguyen Van Tan
Director of Forest Affairs
Government of Vietnam

Phan Van Co
Representative of Directorate General of Ports
Government of Vietnam

Lt. Col. Thien
Mayor, Cam Ranh City

Ton That Ngo
Director, Irrigation Department
Government of Vietnam

Tran Van Tri
Chief, Marine Fisheries Division
Government of Vietnam

Truong Thai Ton
Special Assistant for Finance and Economy
to Prime Minister Nguyen Cao Ky
and Secretary of State
Government of Vietnam

Interviews - Cam Ranh Bay: U.S. Agency for International Development

Ahlgren, Gilbert H.
USAID, Agricultural Division
Saigon

Alinski, John A., Jr.
Assistant Director, AID
USAID, Saigon

Ballanfonte, Errol T.
USAID, Office of Refugee Coordination, Regions I and II
Saigon

Breakefield, General D. E.
Assistant Director, Logistics Division
USAID, Saigon

Brown, Owen K.
USAID, Agricultural Division
Saigon

Chalfant, James G.
USAID/PRIID
Saigon

Chamberlain, Lloyd A.
Urban Planner, Programs Division
USAID, Saigon

Clary, Robert B.
USAID, Deputy Chief, Public Administration Division, Region II
Vietnam

Cremer, A. C.
Chief, Reconstruction and Urban Planning Branch
USAID, Saigon

Culbertson, Robert C.
Associate Director of Programs
USAID, Saigon

Fannin, Casey C.
Deputy Director, Region II
USAID, Saigon

Fraleigh, Albert S.
USAID, Field Operations
Saigon

Ford, John
USAID, Operations, Region II
Saigon

Hallinan, Timothy
USAID, Economic Section
Saigon

Haworth, Howard
USAID, Public Works Division
Saigon

Herter, Charles J.
USAID, Provincial Operations
Saigon

Klein, Robert M.
USAID, Program Director
Saigon

Mann, Charles A.
Director, USAID
Vietnam

Marinelli, Lawrence A.
Evaluations Section, ADPE
USAID, Saigon

Marks, Edward
USAID, Refugee Coordinator
Saigon

Mott, Robert
USAID, Region II, Hq., Nha Trang
Advisor to Mayor of Cam Ranh City

Naughten, Thomas E.
Associate Director, Field Operations
USAID/Saigon
Formerly, USAID Director, Region II
Nha Trang

Nguyen Phi Bang
USAID/PRIID
Saigon

Niese, William, Jr.
USAID, Public Works Division
Saigon

Norton, Royall E.
USAID, Public Works Division
Saigon

Parish, John
USAID, Public Works Division
Saigon

Riley, Richard
USAID, Region II, Public Administration Adviser
Saigon

Ritchie, Frederick
USAID/PRIID
Saigon

Salter, MacDonald
Chief, Public Administration Division
USAID, Saigon

Schoof, James E.
USAID, Irrigation Adviser
Saigon

Sharpe, Willard
USAID, Chief, Joint Economics Division
Saigon

Sherper, Keith
USAID, Agricultural Division
Saigon

Tolman, Miss Elizabeth
USAID, Economics Division
Saigon

Townsend, L. R.
Economics Section, ADPE
USAID, Saigon

Wehrle, LeRoy
Associate Director for Program and Economic Planning
USAID, Saigon

Werther, Francis R.
Chief, Private Investment and Industry Division
USAID, Saigon

Whitmore, Paul
Public Works Division
USAID, Saigon

Wilson, David
Deputy Chief, Public Works Division
USAID, Saigon

Wirtz, Anthony H.
Region II, Operations and Plans Officer
USAID, Saigon

Interviews - Cam Ranh Bay: Private Firms

Auckenthaler, Francis
Vietnam Refining Company
Saigon

Cole, John D.
Manager, Daniel, Mann, Johnson, & Mendenhall (DMJM)
40 Hong Thap Tu
Saigon

Coyne, Barney J.
Manager, Processing and Supply
RMK-BRJ Corporation
Saigon

Do Vyen
Economist, Esso Standard Eastern, Inc.
Saigon

Doyle, James
Representative, Daniel, Mann, Johnson, & Mendenhall (DMJM)
40 Hong Thap Tu
Saigon

Fell, William K.
Esso Standard Eastern, Inc.
Refining Coordination
15 West 51 Street
New York, New York 10019

Gross, B. K.
Chief Engineer, Associated American Engineers, Inc.
Overseas, Inc.
Vietnam

Hoar, William H.
Transportation Consultants, Inc.
Washington, D.C.

Jessup, Alpheus W.
Esso Standard Eastern, Inc.
15 West 51 Street
New York, New York 10019

Klemmer, Harvey I.
Transportation Consultants, Inc.
Washington, D.C.

Kubota, Yutaka
President, Nippon Koei Company
Tokyo, Japan

Layne, Charles E.
Ralph W. Parsons Co.
117 Trinh Minh
Saigon

Orr, Earl
Economist, Transportation Consultants, Inc.
Washington, D.C.

Paulson, Oscar
Assistant Chief Engineer, RMK Corporation
Saigon

Richardson, W. Bryan
Meraging Director
Chartered Bank
3-5 Vo Di Nguy
Saigon

Sanders, Luther A.
Local Manager, Associated American Engineers
Saigon

Schubert, John E.
World Wide Consultants, Inc.
35 Han Thuyon
Saigon

Sigua, Dr. Richard
Rosa and Sigua Trading and Associates
Saigon

Interviews - Cam Ranh Bay: Others

Eiffler, General Charles W.
Commanding General, Logistics
United States Army

Mallet, Jean-Marie
Attache Commercial pres le Consulat General de France at Saigon
26 Gia Long
Saigon

Captain Seuffer
Office in Charge of Construction, MACV
United States Navy
176 Hai Ba Trung
Saigon

Appendix D

DETAILED STATISTICAL DATA

Table D-1
 POPULATION OF VIETNAM BY PROVINCE AND REGION
 1964
 (Thousands)

	<u>Population</u>		<u>Population</u>
Total Vietnam: 14,316			
<u>South Vietnam</u>	9,367	<u>Central Lowlands</u>	4,314
Saigon City	1,333	Binh Dinh	804
Vung Tau City	38	Quang Ngai	618
Chau Doc	420	Quang Nam	569
An Giang	430	Thua Thien	462
Gia Dinh	778	Quang Tin	340
Dinh Tuong	530	Phu Yen	328
Ba Xuyen	362	Khanh Hoa	291
Vinh Long	549	Quang Tri	273
Kien Hoa	569	Binh Thuan	241
Vinh Binh	528	Ninh Thuan	140
Phong Dinh	404	Danang City	144
Long An	391	Cam Ranh City	(30)
Kien Giang	362	Hue City	104
Kien Phong	274		
Bien Hoa	283	<u>Central Highlands</u>	635
Chuong Thien	247	Darlac	155
Binh Duong	248	Pleiku	153
Hau Nghia	228	Kontum	83
Tay Ninh	230	Tuyen Duc	56
An Xuyen	224	Lam Dong	64
Go Cong	171	Phu Bon	43
Phuoc Tuy	100	Quang Duc	25
Long Khanh	113	DaLat City	57
Binh Long	83		
Binh Tuy	54		
Phuoc Long	61		
Kien Tuong	51		
Phuoc Thanh	48		
Con Son	1		
Bac Lieu	257		

Recapitulation

46 Provinces
 241 Districts
 6 Autonomous Cities
 2,547 Villages
 10,000 Hamlets

Source: National Statistical Institute, Saigon.

Table D-2

POPULATION OF VIETNAM BY PROVINCE AND ZONE
1964
(Thousands)

	<u>Population</u>		<u>Population</u>
<u>First Zone</u>	2,510	<u>Third Zone</u> (cont.)	3,988
Quang Tri	273	Binh Duong	248
Thua Thien	462	Long Khanh	113
Quang Nam	569	Hau Nghia	228
Quang Tin	340	Gia Dinh	778
Quang Ngai	618	Bien Hoa	283
Danang City	144	Phuoc Tuy	100
Hue City	104	Long An	391
<u>Second Zone</u>	2,440	Binh Tuy	54
Kontiem	83	Vung Tau	38
Pleiku	153	Saigon	1,333
Binh Dinh	804	<u>Fourth Zone</u>	5,379
Phu Bon	43	Kien Tuong	51
Phu Yen	328	Kien Phong	274
Darlac	155	Dinh Tuong	530
Khanh Hoa	291	Kien Hoa	569
Quang Duc	25	Vinh Long	549
Tuyen Duc	56	Vinh Binh	528
Ninh Thuan	140	Phong Dinh	404
Binh Thuan	241	Chau Doc	420
Lam Dong	64	An Giang	430
Dalat	57	Ba Xuyen	362
Cam Ranh City	(30)	Bac Lieu	257
<u>Third Zone</u>	3,988	Chuong Thien	247
Phuoc Long	61	An Xuyen	224
Binh Long	83	Kien Giang	362
Phuoc Thanh	48	Con Son	1
Tay Ninh	230	Go Cong	171

Source: National Statistical Institute, Saigon.

Table D-3

AREA AND POPULATION CHARACTERISTICS OF
THE NHA TRANG-CAM RANH-PHAN RANG-DALAT AREA
1963

Provinces and Districts	Surface Area (sq. km.)	Population	Density (persons/ sq. km.)	No. of Houses	Main Professions
Khanh Hoa	5,609	290,000	52	49,406	
Nha Trang		58,000			
Vinh Xuong	284	55,000	195	8,925	Farming, handicraft
Dien Khanh	1,381	47,000	34	7,805	Farming
Ninh Hoa	1,010	73,000	73	13,883	Farming, salt producing
Van Ninh	284	29,000	102	5,826	Farming, fishing
Khanh Duong	1,384	1,000	3	621	Farming
Cam Lam	1,266	23,229	18	5,109	Fishing
Ninh Thuan	2,768	139,000	50	30,571	
Phan Rang		22,000			
Buu Son	1,365	34,000	25	6,462	Farming, handicraft
Thanh Hai	599	83,000	139	20,136	Fishing, farming, handicraft
An Phuoc	83	13,000	158	2,480	Farming, handicraft
Du Long	721	9,000	12	1,500	Farming
Binh Thuan	4,277	243,000	57	42,347	
Phan Thiet		57,517			
Ham Thuan	698	84,000	121	14,909	Farming
Thien Giao	655	41,000	63	7,348	Farming
Hai Ninh	48	12,000	241	2,487	Farming
Hai Long	261	27,000	105	5,211	Fishing
Phan Ly Cham	1,634	12,000	7	1,953	Farming, handicraft
Hoa Da	517	42,000	82	7,059	Fishing, farming
Tuy Phong	641	24,000	52	3,380	Farming
Tuyen Duc	5,070	127,000	25		
Dalat	69	59,000	855		Farming
Lac Duong	1,711	14,000	8		Farming
Don Duong	1,419	27,000	19		Farming
Duc Trong	1,871	27,000	14		Farming
Total	17,724	799,000	45		

Note: Blank spaces indicate no data available.

Source: Preliminary Study on The Electrification of the Nha Trang-Cam Ranh-Phan Rang-Dalat area, Published by Electricity of Vietnam Planning Department, July 1965.

Table D-4

TOTAL TRAFFIC THROUGH VIETNAM PORTS
1954-1964
(Thousand Metric Tons)

Ports	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
Hue					2.5	3.5	1.7	0.8	2.7	1.9	2.3
Cua Tu Hien					0.9	2.6		0.5			
Danang	218.1	234.4	191.0	195.8	230.1	231.4	253.7	148.8	268.7	317.0	301.6
Hoi An		0.5	1.1		2.6	4.5	2.7	1.9	2.4	3.0	3.0
Tam Ky						1.0	1.0	1.0	0.5	1.0	1.4
Quang Ngai		2.3	1.2		2.0	2.1	3.2	2.2	3.0	2.8	3.9
Tam Quan					2.0	1.3		1.1	0.8	1.0	1.3
De Gi					6.1	8.2	4.9	4.1	5.1	2.8	5.4
Qui Nhon		12.3	21.6	23.0	29.6	33.0	28.0	34.6	37.8	85.5	77.3
Song Can					2.4	2.0	1.4	1.2	3.0	4.2	1.0
Tuy Hoa					0.8	0.5	1.0	1.2	0.6	1.4	0.4
Hon Khoi	24.4	4.3	4.0	42.2	5.1	19.1	55.1	0.7	1.9	0.4	
Nha Trang					9.9	9.2	20.5	32.5	54.8	109.9	85.9
Cam Ranh (Ba Ngoi)	14.9	13.9	6.6	6.8	0.1	0.1	44.8	80.0	100.0	147.6	232.0
Ninh Chu		1.6	2.6	2.3	1.9	1.5	2.6	2.3	10.4	42.8	29.5
Ca Na	54.3	54.3	32.6	33.0	25.0	43.4	44.2	20.7			
Phan Thiet	0.4	9.7	12.3	20.0	28.9	21.1	14.5	10.4	8.3	6.3	5.0
Saigon	2,215.3	2,093.7	1,687.2	2,025.6	2,059.2	2,403.8	2,590.5	2,452.9	2,474.3	3,160.4	2,750.5
Song Ong Doc				0.2	0.4	0.8	42.0		0.2	0.4	0.7
Hach Gio	5.2	4.6	8.7	10.1	7.1	5.7	4.8	4.8	5.7	6.4	7.4
Duong Dong					5.6	8.7	10.3	2.9	5.1	7.9	8.8
Ha Tien						3.2	1.9	0.1	11.0	19.3	2.1
Tan Chau				41.1	4.2	2.6	150.6	252.6	97.9	220.5	60.7
Ding Tuong	3.8	6.2	1.2	2.0	4.6	5.2	5.7	4.5	4.8	2.6	2.3

Note: Blank spaces indicate no data available.

Source: Port Studies by Daniel, Mann, Johnson, and Mendenhall.

Table D-5

VIETNAM GENERAL CARGO PROJECTIONS
1966-1985
(Thousand Metric Tons)

Ports	1964 Adjusted	1966	1967	1968	1969	1970	1975	1980	1985
Total general cargo	3,300	3,900	4,340	4,775	5,215	5,655	7,700	9,700	11,700
Hue	3	4	4	5	5	6	11	16	21
Da Nang	350	450	560	670	780	900	1,300	1,700	2,100
Quang Ngai	6	7	7	8	8	9	11	13	15
Qui Nhon	80	80	85	90	95	100	125	150	175
Nha Trang	85	86	88	90	92	95	110	125	140
Cam Ranh	240	500	450	510	580	610	1,000	1,300	1,600
Phan Thiet	8	20	23	26	29	32	42	52	62
Saigon									
Vung Tau	2,153	2,480	2,680	2,880	3,080	3,280	4,400	5,500	6,600
Can Tho	30	32	34	36	38	40	50	60	70
Rach Gia	11	12	13	13	14	14	16	18	20
Ha Tien	3	4	4	5	5	5	8	9	11
Other ports	215	319	381	427	469	494	575	681	787

Source: Development of Harbor Facilities, 17 Volume Report by Daniel, Mann, Johnson, & Mendenhall, February 1966.

Table D-6

DETAILS ON ADJUSTED FIGURES OF CARGO PROJECTIONS
(Thousand Metric Tons)

	<u>1959</u>	<u>1964*</u> (Adjusted)	<u>1970</u>	<u>1975</u>	<u>1980</u>	<u>1985</u>
Hue†	3.5	3.0	6.0	11.0	16.0	21.0
Danang‡	231.4	350.0§	900.0	1,300.0	1,700.0	2,100.0
Quang Ngai†	2.1	6.0	9.0	11.0	13.0	15.0
Qui Nhon†	33.0	80.0	100.0	125.0	150.0	175.0
Nha Trang**	9.2	85.0	86.0	110.0	125.0	140.0
Car. Ranh‡	0.1	240.0	610.0	1,000.0	1,300.0	1,600.0
Phan Thiet**	21.1	8.0	32.0	42.0	52.0	62.0
Saigon and Vung Tau‡	2,403.8	2,153.0	3,280.0	4,400.0	5,500.0	6,600.0

* Based on data obtained from the Directorate-General of Customs, with adjustments to exclude bulk petroleum and to include certain tonnage not reflected in Customs figures.

† Projections exclude bulk petroleum.

‡ Projections exclude bulk liquid cargo.

§ 1965 adjusted figure.

** Projections exclude bulk petroleum oil lubricants.

Source: Development of Harbor Facilities, set of 17 reports, Daniel, Mann, Johnson, and Mendenhall, February 1966.

Appendix E

RECONNAISSANCE WATER SUPPLY STUDY--CAM RANH CITY

by

Robert L. Nevin
Consulting Civil Engineer

Appendix E

RECONNAISSANCE WATER SUPPLY STUDY--CAM RANH CITY

by

Robert L. Nevin
Consulting Civil Engineer

Scope

The reconnaissance study of water supply for Cam Ranh City included a brief review of limited material available in California, followed by a trip to Vietnam, where existing reports were reviewed, and discussions were held with key personnel who might be able to contribute knowledge to the water supply study. Field trips were made in the Cam Ranh-Phan Rang area inspecting the terrain by helicopter and automobile.

Topographic maps at a scale of 1:50,000, with 20-meter contours, were available from the U.S. Army Map Service.

Objectives

The primary objective of the reconnaissance study was to make a preliminary evaluation of potential water sources, on the basis of existing data, knowledge of the area available in existing reports and from individuals, and the judgment of the consultants. This reconnaissance was intended to answer the following questions:

1. Are there sources, either local or within economical transmission distance, that could be adequate for the ultimate needs of a commercial-industrial city at Cam Ranh Bay? It was assumed that a local source, if available, might be useful for interim needs even though it might be inadequate for the ultimate supply. Military needs, especially on the mainland side of Cam Ranh Bay, were also to be included in the overall requirements.
2. What additional data collection, testing, and studies will be necessary for (a) accurately assessing the quantity and quality of water from the potential sources, (b) developing preliminary plans for the facilities required to exploit these sources, and (c) defining the methods of operation that will assure a continuing, dependable supply?

The study has served to eliminate some areas from further consideration, as well as to pinpoint certain areas with significant possibilities.

A secondary objective was to make preliminary estimates of probable per capita requirements in order to establish a reasonable range of total water requirements for the proposed city. Eventual water requirements, the initial requirements, and the rate of increase cannot be appraised accurately until the industrial-commercial potential has been evaluated, the social-political-economic factors have been assessed, and the needs for nearby military bases and possible agricultural expansion have been determined. It was necessary to make some preliminary assumptions of water needs to determine the minimum magnitude of potential supply that merits further consideration.

Magnitude of Water Requirements

The possible water requirements were estimated on a preliminary basis only in order to establish within reasonable limits a range of total supply that may be necessary. It was neither feasible nor advisable to attempt careful and more definitive estimates of water requirements; such estimates must await completion of pertinent industrial, agricultural, and demographic studies during Phase II of the overall Cam Ranh development study.

An estimated 30,000 persons are living within Cam Ranh City at present, and the rate of increase is already rather high because of the influx of workers for the large military construction projects, augmented by the relocation of refugees from the combat areas in Vietnam.

To establish an order of magnitude for an initial requirement, a population of 40,000 was assumed, with an average consumption of 100 liters per capita per day, or about 26 gallons per capita per day (GPCD). This figure would include normal commercial and municipal use, but no agricultural use, and would provide only for nominal industrial use. If unusually high water-use industries or large agricultural uses were to be included, their requirements would have to be considered separately and added to the average GPCD. These assumptions indicate a possible initial requirement of 1.46 million cubic meters (1,150 acre-feet) per year, or a little over one million gallons per day.

If the fullest development of Cam Ranh City proves to be feasible, we can logically assume that the population could increase to 160,000 within a reasonable planning period, and that the per capita use might increase to 200 liters per day. This would include domestic, commercial, and municipal uses and would allow for substantially greater industrial use, but again, especially high-use industries and agriculture would have to be considered separately. On this basis, the requirement may increase to 11.7 million cubic meters (about 9,500 acre-feet) per year within a few years, or nearly 8.5 million gallons per day.

The economic, social, and political analyses of the Comprehensive Development Plan study will probably modify these estimates, and the possibility of special industries or the need for additional agricultural supplies in the area will certainly increase requirements, but the above range is adequate for the purpose of planning the Phase I water supply investigations.

To summarize the water requirements, any source that can yield a dependable normal supply in excess of 1.5 million cubic meters, or 1,200 acre-feet per year, is worth further investigation for interim supplies, and a source or sources that can yield 12 million cubic meters, or about 10,000 acre-feet per year, may be adequate for a long time in the future.

There will also be water supply requirements for military installations in the Cam Ranh Bay area, and these requirements, particularly on the mainland side of the bay, should be considered in the Phase II studies.

Local Water Supply Conditions

A local water source will probably be more economical than imported supplies, especially if large storage reservoirs are not required. An interim local supply, even though inadequate for ultimate needs, can be advantageous because it may require a minimal immediate investment and can defer the time when extensive transmission works must be designed and constructed.

The availability of local water sources at Cam Ranh City depends first on precipitation and runoff, but since the local streams have very little flow during the dry season, the dependability of the supplies depends on storage, either in surface reservoirs or in permeable underground formations.

Precipitation

Records taken at Ba Ngoi on Cam Ranh Bay during the periods 1927-44 and 1960-65 show an average precipitation of 1,140 millimeters (45 inches) per year. However, precipitation in the minimum year was only 288 millimeters (about 11 inches), and the average for the lowest three-year period, 1961 through 1963, was only 470 millimeters (about 18.5 inches). The minimum two consecutive years averaged only 415 millimeters (16.4 inches) per year.

The records at Ba Ngoi reflect conditions at sea level, and the mean precipitation over any of the nearby watersheds will be somewhat higher because of the difference in elevations. It is certainly reasonable to assume an average annual rainfall of 1,200 millimeters (47.5 inches).

Evaporation

There are no evaporation records available for Ba Ngoi, but 30 years of record at Nha Trang show 1,100 millimeters (43 inches) average potential evaporation per year and 1,375 millimeters (54 inches) average annual rainfall. An analysis of 15 years of records by months shows a low average of 72 millimeters potential evaporation in November and highs of 105 millimeters per month in July and August.

Since the rainfall is probably slightly less at Ba Ngoi than at Nha Trang, the average relative humidity of the air is probably somewhat lower at Ba Ngoi as there are probably more days of sunshine per year at Ba Ngoi. These observations indicate that the average potential evaporation per year is probably higher at Ba Ngoi than at Nha Trang, and probably is greater than the average annual rainfall. However, this difference will not be large enough to make evaporation losses from surface storage a major problem if favorable reservoir sites can be found.

Runoff

Studies of the Da Nhim river basin above Dran by Nippon Koei Co., Ltd. indicate that the mean precipitation over the watershed in an average year is about 1,680 millimeters (66 inches), and that the average annual runoff is equivalent to about 710 millimeters (28 inches). Thus, the Da Nhim watershed apparently retains on the average about 970 millimeters (38 inches) of the rainfall per year. This is the water used by vegetation and lost in evaporation and transpiration, and hence does not contribute to runoff.

The apparent retention in the maximum and minimum years analyzed by Nippon Koei did not differ greatly from the average, but the records were short and did not include the driest years as recorded at Ba Ngoi.

Total use and losses in the Da Nhim basin are less than the probable potential evaporation. This is due to the rainfall intensity during storms and exceeds the ability of the watershed to retain the water on the surface and within the plant root zone. This water either runs off directly as streamflow, or percolates to groundwater which may appear later as streamflow. The amount of actual evaporation is always less than the total potential evaporation except on free water surfaces, because the water is not available at all times to satisfy the potential. The use of water by plant transpiration can never exceed the potential evaporation, and is actually limited to the water available in the root zone. It is also regulated by the density and type of vegetation.

The difference between potential evaporation and actual evaporation/transpiration losses within a watershed tends to become greater as the climate becomes more arid. The vegetation becomes less dense and the capacity of the watershed to retain rainfall decreases. The moisture to satisfy potential evaporation is actually available a smaller percentage of the time.

The watersheds near Cam Ranh Bay undoubtedly get somewhat less rainfall than the Da Nhim basin, and observation discloses that their vegetation is less dense and the average slopes are steeper. The retention of rainfall on these would probably be less than in the Da Nhim basin, and it certainly would not be greater.

For the purpose of preliminary calculations, it was assumed that the average retention on the watersheds above Cam Ranh Bay would be about 950 millimeters (37.5 inches) per year, out of the average annual rainfall of 1,200 millimeters. Thus, for the purpose of preliminary calculations, the average annual runoff from watersheds in the Cam Ranh Bay area can be conservatively assumed as 250 millimeters, or about 10 inches. This means that the average annual runoff will be 0.25 million cubic meters per year per square kilometer of drainage area, or 525 acre-feet per year per square mile.

The rate of runoff will vary from flood flows during major storms to nearly zero during dry seasons, and the total annual runoff during extremely dry years may be negligible. Dependable year-round supplies will not be available from the watersheds near Cam Ranh City without some form of storage or retention for seasonal regulation and carryover to dry years. Storage capacity for more than a full year's supply may be required.

Groundwater Storage

Storage in permeable underground formations, or aquifers, is often the best means of regulating nonuniform streamflows and meeting variable supply requirements. However, the suitability of this method depends on (a) achieving adequate percolation rates into the aquifers during the times that streamflows are occurring, and (b) economically recovering the water from the aquifers at the times and rates required, without undue loss or depreciation of water quality. The operable storage capacity in the aquifer must be adequate to meet the water supply requirements plus losses during periods of deficit in the recharge rate.

Groundwater storage possibilities near the mainland side of Cam Ranh Bay are limited to alluvial deposits along the edge of the bay and in the lower valleys of streams entering the bay. Alluvium on the shelf bordering the bay will be generally shallow, with limited capacity, but some of the stream valleys contain extensive alluvial deposits that have surface elevations ten meters or more above sea level, and that have depths indicated to be considerable. These deposits are all adjacent to salt water, however, and care will be required in well design and operation to avoid contamination by salt water.

Surface Storage

The mountains adjacent to Cam Ranh City are steep and the canyons generally narrow. The possibilities for extensive surface storage do not

appear good, but small reservoirs to retard runoff and allow more efficient percolation to groundwater may be possible. The 20-meter contour intervals on the available topographic maps are not adequate for an accurate determination of this potential, and this evaluation must await inspection at the sites during Phase II.

It has been suggested that the upper portion (Area M) of Cam Ranh Bay be divided off by a barrier across the narrows and made into a fresh water lake, to be utilized for water supply. The total watershed area draining into this portion of the bay is quite large, and it is obvious that a few feet of depth over this area of the bay would represent a large volume of storage.

This alternative is questionable, for the following reasons. Examination of the watershed reveals that the only stream originating in the higher mountain area is the Suoi Truong. This is undoubtedly the best runoff-producing stream in the watershed, but it flows through seven or eight kilometers of swampy terrain before reaching the bay. The long swampy reach would reduce the amount of water entering the bay and would tend to degrade the quality of the water.

A large area southeast of Suoi Truong is relatively flat, with little evidence of stream channels, and probably produces very little runoff. Other contributing streams are relatively short, with little or no drainage from the higher elevations, and also discharge into swampy terrain before reaching the bay. A careful analysis would probably show that the average annual runoff available for a fresh water storage project in north Cam Ranh Bay is not large.

If the fresh water pond behind the barrier was filled to a level above sea level, necessary in order to allow for depletion periods, water would certainly percolate into the sands and would spread over portions of the swampy land to the northeast of the bay. Much of the seepage to the sands and water flooding over the lowlands could be lost, and that which did return to the reservoir would certainly be badly degraded in quality through leaching of accumulated salts in the sands and marshes. Lowering of the pond below sea level would probably cause inflow of salt water from the sands, again badly degrading the quality of the fresh water. Thus, this alternative does not appear to have merit, and no detailed study is suggested.

Favorable Local Sources

The groundwater potential along the bayside shelf is quite limited, and would be adequate only for single family wells, or at the most, for several families per well. This source may have some immediate value for refugees now moving into the area, but will not be significant in planning for a municipal system.

On the other hand, some of the stream valleys near Cam Ranh City are worthy of consideration: Suoi Tra Duc and Suoi Hanh, Song Can, and Song Trau.

Suoi Tra Duc and Suoi Hanh

The valley of Suoi Tra Duc and Suoi Hanh, opening to Cam Ranh Bay near Ba Ngoi, has many favorable indications for a groundwater supply potential. The drainage area above the railroad to the west of Ba Ngoi totals about 170 square kilometers (66 square miles), of which about 14 square kilometers (5-1/2 square miles) is in the alluviated valley portion. If an average annual runoff of 250 millimeters is assumed (see previous section on Runoff), this watershed produces over 40 million cubic meters (35,000 acre-feet) per year on the average. Thus, it is obvious that development of an adequate local source depends on the capacity to store adequate supplies for the dry periods rather than on the average runoff.

Groundwater Storage in Suoi Tra Duc Valley. There are geologic indications that the sea level at Cam Ranh Bay has been about 100 meters lower than at present, and that the rising sea level has caused alluvial deposits in the canyon mouths. These indications suggest that the alluvium may have considerable depth well up into the valley.

Two test holes described in the Nippon Koei report on Cam Ranh Bay industrial development show good indications of permeable material. These holes were drilled near the edge of the valley and encountered bedrock at 10 to 13 meters, but the sediments will probably be much deeper in the valley center.

Surface elevations run from near sea level at the mouth of the valley to about 20 meters at the upper edge of the alluvium. Thus, there may be a considerable depth of permeable material from which water can be pumped and which will be recharged from streamflows. An average effective porosity of 25 percent (one-fourth liter of free water per liter of alluvium) is not unusual in alluvium, so that each meter of depth of permeable material may contain the equivalent of one-fourth meter in depth of recoverable water.

If the extent of operable aquifer in Tra Duc Valley is 10 square kilometers, this will represent a storage capacity of 2.5 million cubic meters for each meter of operable depth, or would require almost five meters of operable depth to store an estimated annual requirement of 12 million cubic meters for a population of 160,000 (see previous section on Magnitude of Water Requirements). It is quite possible that the average operable depth in this aquifer will be in excess of five meters, and that more than a year's supply of water can be stored and recovered in the Tra Duc Valley without lowering the water table to a level at which salt water intrusion can occur. In this regard, further studies are recommended in Phase II.

Surface Storage in Suoi Tra Duc and Suoi Hanh Canyons. The topography in the Suoi Tra Duc and Suoi Hanh canyons does not appear to be favorable for large surface reservoirs, but possibly smaller retention reservoirs could be developed to retard the runoff and allow more efficient percolation into the valley alluvium. The feasibility of such reservoirs and the need for retention of the runoff cannot be evaluated without more detailed studies. Such studies will be included in Phase II.

Surface storage on these streams could also help to reduce floods which have caused loss of life and property damage in the past.

Other Local Sources

Several other streams at the south end of Cam Ranh Bay have significant possibilities for water production. Song Can, immediately south of the Suoi Hanh watershed, has a drainage area of about 53 square kilometers above the mouth of the canyon, indicating a possible average annual runoff of over 13 million cubic meters. There does not appear to be much possibility for groundwater storage in this stream because there is little indication of alluvium except very close to tidewater. However, the canyon may be suitable for a surface reservoir.

Song Trau, which empties into the valley around Du Long, has a drainage area of nearly 70 square kilometers above the mouth of the canyon, and other watersheds draining to this same valley total about 65 square kilometers. The total average annual runoff from these watersheds may be over 30 million cubic meters.

The valley area around Du Long may contain substantial deposits of permeable alluviums, and a retention reservoir in the Song Trau canyon appears to be a good possibility, if needed to augment the groundwater recharge.

Sources for Imported Water Supplies

There is a strong possibility that adequate water supplies for the proposed Cam Ranh City can be developed from local sources, and imported supplies should not be considered unless further studies prove this assumption to be wrong, or unless high costs for developing these sources indicate that imported water will be more economical.

An imported water supply would be required under the following conditions:

1. Large industrial or agricultural water requirements exceed the local supplies.
2. The available local supplies are much less than preliminary calculations indicate.

3. Costs for imported supplies are less than would be expected, because simultaneous developments to expand the Phan Rang Irrigation Project or to meet military needs reduce the costs allocable to the Cam Ranh City development.
4. Development and operation costs for local supplies are much higher than can be predicted without the more detailed studies of Phase II.

If an imported supply is eventually required, it may be desirable to develop the local supplies first. Deferment of construction costs for transmission works for a period of years could well represent a large overall saving due to the time-value of money. Also, delaying the final design of the importation facilities for a period of years will make possible much better predictions of the capacity requirements. The total savings due to deferment of a major construction project might be more than the development costs for local supplies.

If an imported water supply is required, the water may be available either from the Da Nhim project or from the Song Cai, which flows out through the Phan Rang Irrigation Project and is the source of a portion of the Project water supply. The transmission distance from these sources to the Cam Ranh City boundary is in the order of 30 kilometers, but this distance might be reduced, if expansion of the Phan Rang Irrigation Project toward Cam Ranh Bay is found to be feasible.

Water From the Da Nhim Project

The firm sustained discharge rate that will be available from the Da Nhim storage project after all of the planned works are completed has been calculated to be in excess of the diversion rate required from this source for the Phan Rang Irrigation Project after full development. This excess has been suggested by Nippon Koei and others as a source of water supply for Cam Ranh City. These calculations of excess water from the Da Nhim project are based on the assumption of a continuous and constant rate of diversion, 365 days per year.

No calculations have been made of the total annual water requirements for the irrigation project, but it is certain that the diversion requirements at some seasons of the year will be less than the maximum, and that on an annual basis, a significant total volume of excess water must be available. Utilization of this source would entail provision of storage to receive the water during seasons of minimum requirements in the Phan Rang Project and retain it for withdrawal to meet Cam Ranh City needs.

Water From Song Cai

Plans for the Phan Rang Irrigation Project assume a minimum diversion of four cubic meters per second from the Song Cai, and the maximum

capacity of the diversion works is six cubic meters per second. There is no storage in connection with this Song Cai diversion, and therefore the figure of four meters per second represents a safe estimate of the firm minimum flow of the stream during the driest seasons.

A stream which has a minimum flow of four meters per second may be expected to have an average annual flow of several times this rate, and the excess annual water supply above the Phan Rang Project diversion will be many times Cam Ranh City's indicated requirements. Storage would be required to utilize this supply, but there appear to be possibilities for such storage within the river system.

No report has been found concerning a reservoir study on the Song Cai system, but it has been stated that such a study had been made by personnel of the Irrigation Division, Government of Vietnam, and that the costs were too high to be justified for irrigation use in the Phan Rang area. However, much higher unit costs of water can be tolerated for municipal-industrial use than for agriculture, and hence this source may merit reexamination.

Recommendations

It is recommended that the potential local water supply sources be evaluated thoroughly in the second phase of the study, with a less detailed study of the sources for imported supplies, for the purpose of economic comparisons.

The study of local sources should include (1) collection of flow data and continuous rainfall records to refine the estimates of runoff, (2) evaluation of groundwater storage, streamflow percolation, and well production in the valleys west of Ba Ngoi and around Du Long, and (3) examination of possible retention reservoir sites to retard runoff and augment groundwater recharge. Some exploration of the alluvial depths and well possibilities along the coastal shelf north of Ba Ngoi should be included, as these may be a source of immediate supplies needed to provide for refugees now moving into the Cam Ranh Bay area.

Collection of streamflow and rainfall intensity-duration data should be commenced as soon as possible.

A modest study of the water supply potential and the costs for storage, diversion, and transmission facilities from the Da Nhim project and from Song Cai should be included, in case local supplies do not prove to be adequate, and as a check to determine the most economical alternative. These costs will also serve to calculate the savings due to deferring construction of importation facilities if local supplies prove to be inadequate for ultimate needs. These savings may justify development of local water sources for an interim period.

The possibility of a barrier to form a fresh water lake in the north end of Cam Ranh Bay does not appear to merit detailed study.

Phase II studies should investigate carefully the possible benefits of joint planning, construction, and operations to supply water for nearby military installations as well as for Cam Ranh City.

Proposed Phase II Program

The data collection, exploration, testing, and analyses of Phase II will be designed to select a specific source or sources of water supply for Cam Ranh City; to provide reliable estimates of the dependable yield; and to develop a Master Water Systems Plan, including cost estimates and a time staging schedule for the necessary facilities. Progress on other aspects of the Cam Ranh City study will provide a better basis for estimates of the initial and ultimate water requirements and the rate of growth than could be made during Phase I.

Evaluation of Local Water Sources

The detailed evaluation of local water sources will not be particularly concerned with the total supply which is available in an average year, as the average annual runoff in the area is undoubtedly far in excess of the probable requirements. The critical problems will be to determine: the volumes of water that can be retained on the surface and percolated into groundwater storage; the feasibility of storing sufficient quantities to meet requirements during deficit periods; and the methods of operation necessary to recover this water without excessive losses and without causing salt water intrusion into the aquifers.

Groundwater storage is expected to be the most significant factor, but surface storage possibilities will be examined, both as to potential for direct water supply and as to the usefulness in augmenting groundwater recharge.

Streamflow Studies. There will be no time for the accumulation of long streamflow records, but an understanding of the relation between rainfall intensity and runoff is critically needed, as are evaluations of the relations between streamflow and percolation to groundwater in several alluviated areas.

The recommended method for collection of the streamflow data will be to install water stage recorders on several streams in the lower canyon reaches, but above the alluviated areas. Additional recorders will be installed downstream on the same streams so that a reach of alluvial channel is included between measuring points. The relation between water stage and flow rate for each station will be established by a series of current meter measurements.

The upstream station records will be compared on a storm-by-storm basis with precipitation records to establish rainfall-runoff relationships, and these relationships will be used to develop probable magnitudes and frequencies of runoff during the full period for which precipitation records are available.

Comparisons of flows at upstream and downstream stations on each stream will be used to estimate percolation rates and groundwater recharge potentials in the alluvium.

The following recorder installations are suggested tentatively:

Suoi Tra Duc	- 2 to 3 sites
Suoi Hanh	- 3 to 4 sites
Song Can	- 1 site
Song Trau	- 2 sites

The recorders should be installed as soon as possible, and the program of observations and measurements should be intense, so as to gather as much storm-by-storm information as possible during the short time available. Specific selection of the proper measurement sites must be made in the field.

Precipitation Data. A recording rain gauge should be installed at Ba Ngoi to get data on the rainfall intensity-duration-frequency. This recorder should be at the same site as the present rain gauge in order to apply these data to the long-term record now existing. This recorder should also be installed as soon as possible, and should be in operation during the intensive streamflow observation program in any case.

Test Holes in Alluvium. Phase II must include a drilling program aimed at determining the extent, storage capacities, and transmissibilities of alluvial deposits. The existing water qualities in these formations and the probabilities of salt water intrusion must also be determined.

This program will include holes to bedrock for determination of the total depths of the alluvium, the characteristics of the sediments, and the quality of the existing water. These test holes will be located to intercept the deeper sediments, except that two will be located within the depth range of the supplemental seismic work to aid in interpretation of the seismic readings. The program will also include shallower observation holes for defining the existing water table and observing changes in water levels. Water levels will also be observed in any existing wells found in useful locations.

Extreme care will be required in obtaining water samples during the drilling so that, if changes in water quality occur, the level of these changes can be accurately determined.

Data obtained on the alluvial formations by the drilling program will be supplemented with seismic and resistivity surveys. This combination of data sources will provide the basis for more complete analyses of the formations, while minimizing the overall costs of the program.

The recommended program includes exploration of two major alluvial areas with potential for major water supplies, and also includes a modest program in the shallow coastal area which may be useful for immediate needs.

The following minimum effort is suggested:

Suoi Tra Duc - Suoi Hanh Valley

- 3 deep test holes
- 2 intermediate-depth test holes
- 4 to 6 shallow observation holes

Valley around Du Long

- 3 to 4 deep test holes
- 2 intermediate-depth test holes
- 4 to 6 shallow observation holes

Coastal shelf north of Ba Ngoi

- Up to 6 holes to bedrock (these will not be very deep)

All of the holes will be provided with casing and covers to keep them open for pumping tests, for observation of the effects of streamflow on the water tables, and for possible future development as wells.

Seismic and Resistivity Surveys. The seismic survey equipment used will be the relatively simple and economical hammer seismograph, which will be used to supplement information from the test holes and define the edges of the useful alluvium. This equipment may also be used with a small explosive charge to increase the depth range.

The resistivity surveys, which are also relatively economical, will further define the bedrock profiles, especially in the regions below the depth capacity of the seismic equipment, but not immediately adjacent to test holes. The resistivity readings become distorted in formations saturated with saline water, but these surveys may help to define the interfaces if salt water is encountered in parts of the deposits.

Alluvial deposits along the coastal shelf north of the Ba Ngoi will probably not be beyond the depth capabilities of either the seismic or the resistivity equipment. Surveys undertaken in this area will define the erosional depressions in the bedrock surface, and will provide data for selecting the most efficient sites for small wells to meet immediate needs in the area.

Pumping Tests. Carefully controlled pumping tests will be required to define the transmissibility and storage factors of the aquifers, especially in the Suoi Tra Duc-Suoi Hanh valley and the Du Long area. These tests will require continuous pumping at a carefully controlled rate with frequent observations of the effects on the water levels at the pumped well and at other test holes. The duration of each test will be from two to five days, and careful records of water level changes versus time will be required.

These tests are essential (1) to determine the groundwater storage that can be safely used, (2) to calculate proper well spacing, and (3) to define safe pumping rates for the various well sites that can be maintained without causing salt water intrusion and ruining the aquifers. These calculations, together with the streamflow calculations and percolation rate estimates, will determine the dependable, continuous yield of each aquifer studied.

Simple bailing tests will be made on test holes in the shallow alluvium north of Ba Ngoi, as these aquifers will not be large enough to justify the more extensive tests.

Sources of Imported Water

The reconnaissance of Phase I has indicated that imported water supplies to the Cam Ranh area will probably not be needed initially, and may not be needed at all. Yet this is only a preliminary conclusion, and more details are needed. In addition, the requirements for additional irrigated agriculture in the Cam Ranh area, if justified, will probably exceed the local supplies.

The recommended Phase II study of imported water supplies will be a limited study of the availability and cost of water, from the Da Nhim hydroelectric project and the Song Cai, which is in excess of the requirements for the Phan Rang Irrigation Project. The total supply available from these sources, although probably quite large, is not known at this time and must be calculated during Phase II.

Irrigation Project Requirements. The total annual water requirement and the probable seasonal pattern of use in the Phan Rang Project have apparently never been computed. These factors must be understood in order

to determine the excess average annual supplies and to determine the storage requirements necessary for their use at Cam Ranh.

These calculations will be made on a preliminary basis during Phase II.

Da Nhim and Song Cai Hydrology. The total water supply from the Da Nhim project will be reviewed from existing reports, and the flows in the Song Cai will be estimated from available rainfall data and watershed area. These data will be compared to the Phan Rang Project requirements to determine the annual excesses and the seasonal patterns of occurrence.

Storage Requirements. Map studies of possible storage sites in the Song Cai system will be used to develop a preliminary cost estimate of a regulating and storage reservoir. If a previous study of storage on Song Cai by the Vietnam Irrigation Division can be found, the work may be adequate for Phase II purposes, except for the updating of construction costs.

Transmission Works. Preliminary cost estimates for transmission works to Cam Ranh will be developed. These data will be useful as a check against the estimated costs for development of local sources, and together with storage costs, will be the basis for reevaluation of the feasibility of a water supply to Cam Ranh, in case local sources prove to be inadequate.

Agriculture at Cam Ranh. Any increase above the present area of irrigated agriculture near Cam Ranh will probably depend on imported water. The preliminary cost estimates for water from Da Nhim and Song Cai will provide the basis of an appraisal of the economic feasibility of increased irrigation.

Expansion of the Study. If the importation of water supplies to Cam Ranh turns out to be necessary because of inadequate local supplies, or justified because of agricultural demand or high industrial use, the study of the Da Nhim-Song Cai area should be broadened. However, it is quite likely that even though imported water will be ultimately needed, local supplies will be able to serve for an interim period, and the design and construction of importation works can be deferred until the development rate and ultimate requirements are better understood.

STANFORD
RESEARCH
INSTITUTE

Menlo Park
California

Regional Offices and Laboratories

Southern California Laboratories
820 Mission Street
South Pasadena, California 91031

Washington Office
1000 Connecticut Avenue, N.W.
Washington, D.C. 20036

New York Office
270 Park Avenue
New York, New York 10017

Detroit Office
1025 East Maple Road
Birmingham, Michigan 48011

Chicago Office
103 S. Stone Avenue
La Grange, Illinois 60525

Huntsville, Alabama
4810 Bradford Drive, N.W.
Huntsville, Alabama 35805

European Office
Pelikanstrasse 37
Zurich 1, Switzerland

Japan Office
Nomura Securities Building
1-1 Nihonbashi-cho, Chuo-ku
Tokyo, Japan

Retained Representatives

Toronto, Ontario, Canada
Cyril A. Ing
67 Yonge Street, Room 710
Toronto 1, Ontario, Canada

Milan, Italy
Lorenzo Franceschini
Via Macedonio Melloni, 49
Milan, Italy