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Economic and Technical

PREFEASIBILITY STUDY

for the

GRENADA AIRPORT

Prepared for

AGENCY FOR INTERNATIONAL DEVELOPMENT

United States International Development Cooperation Agency

Prepared by

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January 30, 1984

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January 30, 1984

Mr. Jay F. Morris
Deputy Administrator
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2201 "C" Street, N.W., Room 2249
Washington, D.C. 20523

SUBJECT: Contract No. OTR-1406-I-00-2253-00, Prefeasibility Study Point Salines Airport, Grenada

Dear Mr. Morris:

The following report has been prepared in response to the scope of work outlined in Work Order No. 2 of our Indefinite Quantity Contract, and discussions and meetings with you and other AID staff in Washington, Grenada and Barbados.

As you know, the field reconnaissance investigations analyses and report preparation were conducted under stringent time constraints. Therefore, we are most pleased to submit our report on schedule.

If we can be of any additional assistance, please advise.

Very truly yours,

WILBUR SMITH AND ASSOCIATES

Paul E. Conrad

Paul E. Conrad
Executive Vice President

SUMMARY –

CONCLUSIONS
AND
RECOMMENDATIONS

SUMMARY

CONCLUSIONS AND RECOMMENDATIONS

The following major conclusions and recommendations have been drawn from the detailed descriptions of the analyses and findings presented in the body of the following report.

S.1 POINT SALINES AIRPORT COMPLETION

The Point Salines Airport is necessary to provide safe and convenient access to Grenada. The existing Pearls Airport is operating under conditions that would not be acceptable to major international carriers, and improvement/expansion to overcome its present deficiencies would be difficult and costly (Section S-7).

On the other hand, the Point Salines Airport is ideally located to serve present and future centers of population and activity, especially tourists. Continuing growth in tourism is an essential factor in improving the economy of Grenada (see Chapters 2 and 3), and the Point Salines Airport is an essential factor in achieving this national objective.

A number of changes in the proposed development plan, and in existing construction, are proposed to improve the safety and efficiency of the proposed facility while minimizing completion costs. However, it should be noted that in general the Point Salines Airport was designed to comply with ICAO standards and recommended practices. While oversized in many respects for our projected air passenger and aircraft operations, overall it is an attractive and functional facility.

S.2 COMPLETION COSTS

The necessary investment to complete construction for projected needs, and to meet ICAO and international carrier recommended practices is about $24 million, in order to make operational a facility with total development costs in excess of $76 million. See Chapter 4, Section 4.9. Benefits to the Grenadian economy due to additional tourist air passengers generated by the Point Salines Airport (availability of jet/night operations) are substantial, with over $21 million in such annual expenditures expected by the year 2000. Analysis indicates that at a 12 percent discount rate and over a 30-year period, only 32 percent of the $50 a day expended by tourists would have to be allocated to the airport in order for benefits to equal completion costs. At 5 and 10 percent discount rates, the proportions would be 12 and 24 percent, respectively. See Chapter 6, Section 6.4.

Therefore, the expedited completion of the Point Salines Airport is strongly recommended.

S.3 IMPLEMENTATION SCHEDULE

Early completion of the Point Salines Airport is important to the economy of Grenada. Moreover, there is an intense interest on the part of all Grenadians in seeing that the airport is completed as soon as possible. It is a matter of national concern. Also, early transfer of LIAT operations to the Point Salines Airport will enhance air passenger and traffic safety.

October, 1984 is often referred to by Grenadian officials and private citizens as a most desirable, some state essential, date for completion of the Point Salines Airport. One reason is to take full advantage of the 1984-85 tourist season.

To expect full completion of the airport in an eight-month period is not realistic. Several major milestones must be met:

- o Financing must be finalized.
- o A project manager must be selected and contract executed.
- o The design-build contractor must be selected and a contract negotiated.
- o Equipment, materials and construction personnel must be mobilized.
- o In a closely integrated, coordinated and fast-tracked manner, the following must be completed:
  - runway paving
  - passenger terminal and several other ancillary buildings
  - aeronautical operational facilities and services (lighting, nav aids, etc.)

Expedited decision making will be required. While the time duration for the individual steps can be debated, it is obvious that there is no room for slippage.

S.4 POINT SALINES AIRPORT EARLY OPENING

While it is not realistic to assume that the Point Salines Airport, designed to meet recommended operational requirements, could be completed by October 1984, it is feasible to assume that by October 1984 the airport could be opened for day and night VFR operations for commercial and charter jet aircraft under safe conditions meeting all licensing and operational requirements. (The recommended design will provide for day and night operations under both visual meterological conditions and instrument - low visibility, low ceiling - conditions.) The

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recommended design also includes complete aeronautical information and meteorological services, and a modern terminal building, while the early opening would be dependent upon interim use of a temporary terminal.

A number of sequential, time critical steps are required of the Government of Grenada to make the early opening date. Time will be needed for locating donors, making arrangements with donors for the terms of the financing, the provision of letters of credit, etc. It would appear that the ownership of the airport property should be addressed; see Section 4.8. The hiring of a management firm to represent the Government of Grenada will require time for the selection, as well as for contract negotiations. There is an additional time requirement to settle the Plessey/Metex equipment damage situation so that equipment necessary to complete the airport is available when needed.

If the financing of the project for the completion of the airport can be finalized by March 15th and if contracts for construction management, design and construction can be negotiated by May 1st, then an opening date for limited operations of October 1984 appears within reach. The renegotiations of the Plessey and Metex contracts must be accomplished without unduly delaying the project, and it also is necessary that all lost or destroyed equipment, materials and supplies previously furnished by Plessey and Metex be replaced without adversely affecting the work schedule.

Although all contractual activity at the airport will be premised on the recommended design, the constructors will be required to give priority in construction scheduling to those items required to permit day and night VFR operations by October 1984. The major items that must be given priority are:

- o Completion of runway, taxiway, apron paving
- o Completion of Tower and Technical Block building
- o Installation of airfield lighting system
- o Installation of obstruction lights
- o Installation of air-ground-air communications systems
- o Establishment of a Crash, Fire, Rescue Facility
- o Establishment of a temporary structure for the purpose of processing enplaning and deplaning passengers

With the cooperation of the Director of Civil Aviation for the Windward and Leeward Islands, no delays are anticipated in the formalities required to designate and license Point Salines Airport for limited operations by October 1984. The LIAT operations at Pearls Airport could be moved to Point Salines and Pearls Airport closed.

S.5 EARLY OPENING IMPLEMENTATION COSTS

As indicated elsewhere in this report it is estimated that the cost of completing the airport, assuming "normal" construction sequencing, is about $23 million. If an early option, October 1984 limited operations opening, is selected the total cost of construction could be raised as much as $1 million to about $24 million. The increase in cost takes into account the construction of a temporary terminal building, the disruption of orderly scheduling created by priorities dictated by the early opening, and the added cost of construction of an open airport.

About $10 Million of the estimated $24 Million required will be expended during the May through October period in completing construction necessary for the early, limited operations opening.

S.6 GRENADA GOVERNMENT PLAN FOR LIAT OPERATIONS AT POINT SALINES AIRPORT

The Government of Grenada is currently considering a proposal for the immediate transfer of the LIAT day-only, VFR operation from Pearls to Point Salines Airport. Specific details of this proposal are not available. It is understood that a temporary air traffic control tower and temporary terminal building would be established. The tower would be equipped with portable VHF transceivers and ATC signalling equipment. As long as the operation is limited to day VFR and limited to LIAT, there is no major objection to the scheme. This proposal, if implemented, will increase the cost of an October 1984 opening, as discussed in the previcus section, and paving operations may have to be restricted to non-operational hours.

S.7 PEARLS AIRPORT CLOSING

Presently only daylight operations are possible at Pearls Airport, and under conditions that would not be acceptable to most carriers. The runway is not of adequate length for jet aircraft.

Pearls Airport cannot be economically modernized or improved to provide service and facilities required by jet air carrier aircraft for day, night, instrument runways. Terrain problems adversely affect the ability to design instrument approach and missed approach procedures. The required linkage between Pearls and the City of St. Georges, where international telecommunications circuits terminate, is difficult to establish, maintain and operate. The distance of Pearls Airport from the center of population and from the resort areas also makes Pearls an undesirable location.

To realize maximum economic benefits from opening of the Point Salines Airport and improve safety for all air passengers, the earliest possible transfer of present LIAT operations from Pearls Airport to Point Salines Airport is desirable. See Chapter 6.

The Grenadian Government is in the process of preparing and executing a plan to make this transfer by April or May of 1984.

As soon as Point Salines Airport is completed, Pearls Airport should be closed.

S.8 GRAY PLAN FOR EARLY POINT SALINES AIRPORT OPENING

A proposal has been made by Mr. Richard Gray, owner and operator of a Grenadian hotel, to open the Point Salines Airport this spring for day/night operations with a runway of 6,000 feet or less. A review of this proposal found it wanting. In order to open an airport to international air operations - charter, scheduled air carriers and general aviation - the facility should meet minimum standards. The high terrain east of the airport should be obstruction lit before opening the airport to night operations.

The assumption that the damaged or lost electronic equipment required for the early opening can be replaced with borrowed equipment does not seem realistic. There is great silence in the proposal as to how the Government of Grenada might proceed, after the early opening, with the completion of the project. The most optimistic, yet practical and economical, approach to "early opening" is to plan for an October 1984 limited-operation opening.

S.9 ECONOMIC IMPLICATIONS OF COMPLETING THE POINT SALINES AIRPORT

There are two principal industries in Grenada; tourism and agriculture. Tourism can be expanded faster than agriculture and can bring in significant foreign exchange. The airport is the key to the expansion of tourism, because it will ease the current access problem to the island.

Dependable electrical, water and phone service are prerequisites to a significant expansion of tourism on Grenada. In addition, the roads must be repaired. These improvements will be beneficial to other Grenadian economic activity, but tourism will benefit more than other industries.

Even if the Point Salines Airport were not completed, it is estimated that the number of tourists coming to Grenada by air will increase from some 30,000 in 1983 to 50,000 by the year 2000. However, with the Point Salines Airport operational and the infrastructure required to support tourism suitably upgraded, 100,000 tourists could be expected by 2000. Expenditures by the additional 50,000 would favorably impact the whole economy.

Surveys show that the typical air tourist spends 8.5 days in Grenada, and that he spends at least $50 a day while there. The 50,000 additional tourists expected annually by the year 2000 as a result of the new airport would, therefore, bring in over $21 million in additional expenditures, excluding the 10 percent service charge. The assumptions upon which the tourist forecasts were based include complementary improvement of the required supporting infrastructure (electricity, water, roads, telephones, etc.). However, this infrastructure supports other economic activities in the country, not just tourism. For this reason, the question as to how much of the airport benefits (the $50 a

day spent by tourists in-country) would have to allocated to the airport in order for benefits to equal completion costs, is of crucial importance.

It was determined that if only construction costs yet to be incurred are considered, only $16 a day (32 percent of the $50) would need to be allocated as airport generated benefits to make the project feasible, with a 12 percent discount rate. See Chapter 6, Section 6.4.

S.10 OTHER CONCLUSIONS AND RECOMMENDATIONS

In addition to the preceding items, the following major findings are noteworthy:

- The runway length of 9000 feet is not overdesigned; it is required to accommodate day/night/instrument operation for wide-bodied jets.
- The Terminal Building is overdesigned.
- Reductions in design in other areas of work on the airport can be accomplished without affecting airport operation.
- The Air Traffic Control, Aeronautical Information Services and Meteorology Provisions are satisfactory.
- The cost to finish Point Salines Airport to the recommended design is of the order of $19,700,000, excluding land costs and uninvoiced amounts in the Plessey contract estimated at $1,800,000 and $2,500,000, respectively.
- The Government of Grenada should let a contract to a firm with architect-engineer and construction management capabilities to be responsible for the completion of the Point Salines Airport.
- The existing contract with Plessey should be continued on a renegotiated basis considering work interruption and changes in scope.

- The existing contract with Metex should be continued on a renegotiated basis considering work interruptions.

- The LIAT proposal to provide ramp service equipment should be accepted. In this regard, the Government of Grenada should be receptive to proposals of this nature in other areas which will relieve them of maintenance and operation costs, such as completion and operation of the fuel farm.

- Complete runway surfacing and markings should be provided for the entire 9000 feet.

Other specific recommendations include:

- Acceptance of the 500-foot wide graded runway strip, an infringement of ICAO recommendations for an ILS runway, but adequate for the recommended non-precision instrument approach capability (Section 4.2.1).

- A survey, and an engineering/operational determination as to whether a displaced threshold is required, and if required the magnitude of the displacement on the east end of Runway 28 (Section 4.2.2).

- Reduce, rather than remove, the extent of penetration of the obstructions in the approach path to Runway 28 and light them, as presently proposed, with a resultant savings of about $500,000 in earthwork (Section 4.2.3).

- Defer grading of the 200 feet of overrun needed to meet overrun and safety area provisions until operations with A-300 or L-1011 type aircraft are scheduled, thereby deferring expenditures of about $275,000. This does not preclude occasional use by this type aircraft in the interim (Section 4.2.3).

- To provide an unobstructed view of the entire aircraft operational area of the airport and approaches from the west from the Control Tower, cut back the hill sides in two areas southwest of the Control Tower (Section 4.2.4).

- Do not reduce the original design for the protection of the south side of the runway at Hardy Bay without an engineering study of the effects of storm induced wave action (Section 4.2.5).

- Do not place high cost embankment protection at the west end of the runway. Replace lights on a stilt support system, if necessary, at the end of the Approach Light Lane in one area. Refill washouts, if and as they occur using tiff material. The cost of the embankment protection could run over $1 million (Section 4.2.6).

- Grass the shoulders of the runway and taxiways in lieu of paving. Paving is estimated to cost over $400,000 (Section 4.2.7).

- Grass the entire runway strip width of 500 feet (Section 4.2.8).

- Provide landscaping at the airport. Landscape at the Terminal Building area, as a minimum (Section 4.2.9).

- Realign security fencing at the east end of the runway to accommodate access road for Calliste fishermen to Bagadi Bay (Section 4.2.11).

- Defer sealing of joints in portland cement concrete apron and west end of runway pavement (Section 4.2.13).

- Reduce wearing course for the airport access road, internal road system and parking areas from 3 to 1 3/4 inches (Section 4.2.15).

- Provide an access road to Bagadi Bay for Calliste fishermen (Section 4.2.15).

- Modify the Terminal Building in the following manner (Section 4.3.1):

  - Do not finish the second floor, consisting of offices, restaurant, bar and kitchen areas.

  - Seal off the west bay of the building devoted to baggage claim and do not install one (of two) baggage conveyor.

  - Do not construct the three concession enclosures under the north gallery.

  - Omit the gallery on the south side of the building at the edge of the apron.

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- Do not install air conditioning equipment and ductwork for the office and restaurant/kitchen areas.

o Do not build the VIP building; provide VIP space in Terminal Building (Section 4.3.2).

o Use the small office building and residence/office building along the ridge above and overlooking the Terminal Building area to the northwest as airport management offices (Section 4.3.3).

o Complete the electric power system as originally designed (Section 4.4.1).

o Review location and planned size of the lagoon; about one-third of planned size should be sufficient initially; substitute membrane for proposed concrete lining.

o Defer provision of the VOR/DME until a site search is conducted using portable VOR equipment (Section 4.5.2).

o Eliminate provision of the VDF from the plan (Section 4.5.2).

o Eliminate provision of the ILS or MLS from the plan (Section 4.5.2).

o Add installation of an automatic ceilometer to the initially provided Meterological equipment (Section 4.5.4).

o Take immediate action to describe the services required from Grenada Telephone and from Cable and Wireless for AFTN and MET circuits and negotiate agreements with these companies (Section 4.5.4).

o Complete the Crash/Fire/Rescue/Cargo Building as originally designed. Delete the fire training tower (Section 4.6.1).

o Restore maintenance building area for airport maintemance purposes (Section 4.6.4).

o Install incinerator adjacent to the Maintenance area (Section 4.6.6).

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- Accept the proposal from LIAT to provide ramp service equipment (Section 4.7.3).

- Reduce planned size of fuel farm and arrange for operation by a private company as a concession (Section 4.7.4).

- Arrange for operation of the cargo function by non-government forces (Section 4.7.5).

- Arrange for operation of catering equipment for aircraft meal service to be a non-government function (Section 4.7.6).

- Commission a land-use study for the airport environs which gives consideration to airport needs, adjacent community requirements as well as tourist oriented development (Section 4.8).

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1. INTRODUCTION

CHAPTER 1
INTRODUCTION

The Grenadian Government considers the Point Salines Airport to be the keystone of the future economic development of the country. Because of its interest in seeing that the economic development of the country is placed on a firm footing, the Government of the United States through the Agency for International Development (USAID) authorized this prefeasibility study of the various aspects of completing the airport.

The purpose of the study is to examine those economic and technical factors present in Grenada which have a bearing on a decision to complete the Point Salines Airport. The study links the airport and its completion to the economic justification for its existence.

1.1 AUTHORIZATION AND SCOPE

USAID employed the firm of Wilbur Smith and Associates to make the required economic and technical prefeasibility study. The firm was charged with furnishing information on:

"1. Whether to complete the airport.

2. The standards to which construction should be specified.

3. The associated financial requirements to purchase any remaining fixtures.

4. Costs and training requirements for airport operations, and

5. An implementation schedule identifying any additional construction design, documents and/or bid tenders which may be required to re-mobilize the airport construction effort as a whole."

The scope of work also required "that the minimum airport standards will be based upon factors derived from utility to the economy (tourism, agriculture, manufacturing and normal commerce both present and projected, aircraft maintenance and fuel facilities) which might be derived from international flights scheduled for interconnection on the north/south international flights, intra-island flights, including air cargo and other charter or air cargo facilities".

1.2 METHODOLOGY

A team of specialists, including airport planning and design engineers, navigation aids specialists, an architect, a construction superintendent, an economist/financial analyst, geotechnic/pavement, and electrical engineers made on-site investigations of the existing situation in Grenada from December 18 to 23, 1983, and from January 2 to 16, 1984. Using information furnished by USAID, gathered from various sources in Grenada and resulting from direct observation together with experience in, knowledge of and research on comparable projects, this report was prepared.

Co-operation and assistance were freely offered and provided by many Grenadians, both in the Government of Grenada and private citizens, the USAID staff in the Caribbean, and representatives of the United States Army. Specific mention should be made of Mr. Ron Smith, the Project Manager of the airport for the Grenadian Ministry of Construction, Mr. Ted Morse of USAID and Major Ann Wright of the US Army; their assistance was invaluable in compiling needed information and insights under what can be described as difficult conditions.

1.3 ORDER OF PRESENTATION

This prefeasibility report consists of a summary, eight chapters, and two appendices.

The summary including major conclusions and recommendations, is followed by Chapter 1, Introduction, which summarizes the scope of work and methodology employed.

Chapter 2, Background, briefly touches on the setting, history, demographic, economic and existing condition of infrastructure of Grenada. Historic projections of air passengers, and the consultant's estimates of future non-tourist and tourist air passengers as well as air freight, mail and aircraft movements, for the years 1985, 1990, 1995 and year 2000 are detailed in Chapter 3, for alternative scenarios assuming continuing usage of Pearls Airport as well as completion of the new Point Salines Airport.

In Chapter 4, Airport Facilities, each of the major subsystems of the Point Salines Airport is addressed in detail with reference to what was originally planned, present state of completion, deficiencies and/or recommended changes, and cost. The major subsections are grouped for discussion purposes as follows:

- Site Development, including embankment, runway, taxiway, shoulders, apron, landscaping, drainage, fencing, access and circulation roads, parking, lighting and signage.

- Principal Buildings, including passenger terminal, VIP building and other miscellaneous buildings.

- Utility Systems, including power, water, sewage and telephone communications.

- Aeronautical Operations Facilities and Services, including airfield lighting, aeronautical information services, meteorology, navigational aids, control tower and technical block.

- Support Failities, including crash, fire, cargo mail, fuel farm, government hanger, maintenance, warehouse, refuse disposal, construction offices and camp area and facilities.

- Equipment and Furnishings, including (Plessey and Metex contracts) roads and grounds, emergency, ramp service, aircraft fueling, cargo handling, catering, building maintenance, communications repair, vehicle maintenance equipment, and furniture.

- Land Acquisition, including Bagadi Beach area access and need for a land use plan, and

- Cost of Development, including cost for the Cuban design, sunk costs, and costs to complete the project as now proposed.

In Chapter 5, four alternative organization and operation plans for reinstating construction at the Point Salines Airport in the most time and cost-effective manner are presented.

Chapter 6 contains a detailed economic evaluation of the feasibility of completing the new airport including operation costs and benefits with the Point Salines Airport in operation as compared to continued use of the existing Pearls facility.

Appendix A consists of 39 illustrations showing the status of completion as well as physical and architectural characteristics of the proposed Point Salines Airport.

Appendix B contains the computer printout tabulations supporting the economic feasibility computations in Chapter 6.

2. BACKGROUND

CHAPTER 2

BACKGROUND

This chapter includes a general overview of the nation of Grenada and touches on its historic development, demographic, and economic characteristics.

2.1 SETTING

Grenada, the southernmost of the West Indian Windward group, is an amoeba shaped island situated less than 100 miles north of Venezuela (Illustrations 1 and 2, and 100 miles from each of the neighboring islands of Trinidad, Barbados and St. Lucia, the closest large island being St. Vincent. The nation also includes the smaller dependent islands of Carriacou and Petit Martinique. About 133 square miles in area, the island is volcanic in origin, with many steep slopes. However, the tallest peak is only around 2,800 feet high. The soil is fertile and the mountains are covered with lush tropical growth. Grenada has one good harbor (at St. Georges, the capital) and it has many excellent beaches. It also has two airports; Pearls Airport near Grenville on the east coast and the new, unfinished Point Salines Airport, located south of St. Georges on the southwest corner of the island. The principal natural resources of the island are its climate with an average temperature year-round of 83 degrees Fahrenheit (28 degrees Celsius), its fertile soil and its industrious and friendly people.

2.2 HISTORY

Grenada was inhabited by fierce Carib Indians, when it was discovered by Christopher Columbus in 1498. However, the Indians eventually fell to the superior firepower of the Spanish, and the island changed hands several times during the succeeding centuries, notably between France and England. The principal product of the island during this period was sugar, produced on large estates.

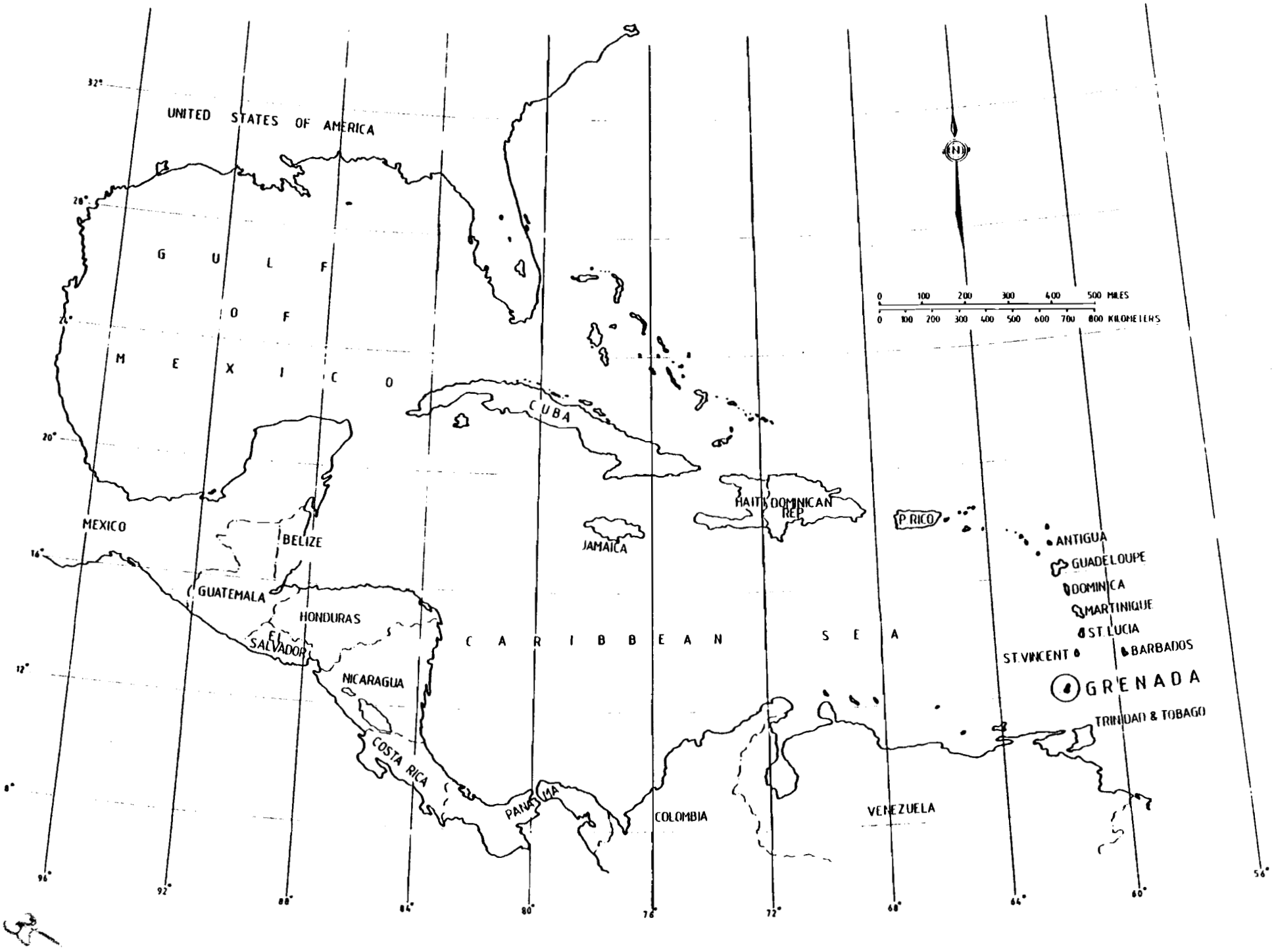

ILLUSTRATION 1 - GRENADA LOCATION MAP

ILLUSTRATION 2 - MAP OF GRENADA

BEST AVAILABLE COPY

Grenada was finally ceded to England in 1783, by the Treaty of Paris. In 1974, the nation became independent and opted for membership in the British Commonwealth of Nations.

2.3 POPULATION

The population of the island is around 110,000, with some 67 percent under the age of 25, and with a literacy rate of 85 percent. The population growth rate has been low in recent years (1.4 percent per year) due to a secular decline in the growth rate and heavy male migration. However, employment opportunities have not kept pace with increase in the work force, and unemployment is high. Although current data is lacking, it appears that over a third of the work force of around 38,000 is now under or unemployed.

2.4 INDUSTRY

The principal industries of the country are agriculture and tourism, followed by manufacture of clothing and miscellaneous products.

2.4.1 Agriculture

The principal industry of the country is agriculture, engaging about 30 percent of the labor force and producing a fifth of the Gross Domestic Product (GDP). Although a number of different crops are grown for the market, four products make up some 75 percent of farm sales: bananas, cocoa, nutmeg and mace. The remaining 25 percent is made up of sugarcane, timber, fruit and spice. Agricultural production could be increased significantly, since a large proportion of the arable land is presently not under cultivation. Land holdings are fragmented and the productivity of labor and land is low. Farms are very small, with most less than one acre in size.

Preliminary data indicate that 1982 domestic export of cocoa, bananas, nutmeg, mace and fresh fruits amounted to US $13.6 million, about 77 percent of total agricultural exports.

2.4.2 Tourism

After agriculture, tourism is the principal industry of the country. It employs some 6 percent of the labor force and provides around 10 percent of the GDP while generating about half of the nation's export earnings. Traditionally Grenada has not sought the mass tourist trade, catering instead to an upper middle to high class clientele, with accommodation in numerous small hotels. This is illustrated by Table 2.1, an inventory of Grenadian lodging facilities, updated to December 1983. Some 140 of the rooms shown for hotels are in the Grenada Beach Hotel, formerly the Holiday Inn. The kitchen area of this hotel was destroyed by a fire in 1981, and it was further damaged in the intervention. In spite of this, it currently operates as the only large hotel on the island. The number of stopover visitors (tourists) would probably have reached 30,000 in 1983 without the intervention. This would have been the first time since 1978 that this level had been achieved. Occupancy rates have been low, due in part to political climates which estranged North American visitors.

2.4.3 Clothing Manufacture

Preliminary data indicate that export of ready-to-wear clothing provided $2.4 million (13.7 percent) of domestic exports in 1982. As indicated later, production is centered in six small companies, the largest of which has 110 employees.

TABLE 2.1

GRENADA VISITOR ACCOMMODATIONS

TYPE OF ACCOMMODATION (1)	NUMBER OPERATING	NUMBER OF ROOMS	NUMBER OF BEDS
Hotels	18	415	830
Guest Houses	9	78	146
Apartments (2)	7	34	80
Cottages	9	79	166
Total	43	606	1,222

(1) Updated by R. Hopkin, Blue Horizon Hotel, Grenada, December 1983.

(2) Most under long-term lease to students.

2.5 INFRASTRUCTURE

The physical plant of the country has become rundown through past neglect, with consequent detrimental impact on development. The electrical generating system is overloaded, causing numerous outages. Partly as a result of difficulties with the electrical system, the water supply also suffers from outages. The telephone system, which was being upgraded with East German equipment, was damaged during the intervention, and phones are frequently out of order. Most roads are heavily potholed. Raw sewerage from a principal sewer at St. Georges is endangering beaches in the Grande Anse area, where tourist attractions are centered.

2.6 BALANCE OF PAYMENTS

In the last several years, Grenadian imports have heavily outweighed exports, with unfortunate results as far as the balance of payments is concerned. This is illustrated by Table 2.2 which shows an increasing imbalance between imports and exports from 1978 through 1982 for goods, services and private transfers, rising to US $35.7 million deficit in the latter year.

2.7 SUMMARY

Grenada is still relatively underdeveloped, but has a high potential for growth, particularly in its two main industries, agriculture and tourism. Other opportunities for development also exist, such as the readymade clothing industry. However, the physical plant of the country has deteriorated through past neglect and, until considerable upgrading is realized, development will be constrained. The situation is further complicated by deficit financing of previous governments.

TABLE 2.2

GRENADA - BALANCE OF PAYMENTS SUMMARY

ITEM (1)	1978	1979	1980	1981	1982 (2)
		(millions of US dollars)			
Exports, FOB	16.9	21.4	17.4	19.0	18.6
Imports, CIF	-36.7	-49.3	-57.5	-63.1	-71.3
Imports for government investment program	(- 1.0)	(- 5.6)	(- 9.3)	(-13.2)	(-15.8)
Travel (net)	10.4	12.0	13.3	10.0	9.7
Other services (net)	1.9	2.7	0.1	- 3.7	- 7.1
Private transfers (net)	7.0	8.0	13.4	14.6	14.4
Total Goods, Services and Private Transfers	- 0.5	- 5.2	-13.3	-23.2	-35.7

(1) Source: IMF memo, subject: Grenada - Recent Economic Developments.

August 11, 1983

(2) Preliminary Data p.27.

3. AIR TRAFFIC FORECASTS

CHAPTER 3
AIR TRAFFIC FORECASTS

This chapter includes forecasts for tourist and non-tourist air passengers into and out of Grenada, plus similar forecasts for air cargo and mail. These forecasts are made for the years 1985, 1990,1995 and 2000.

3.1 PAST FORECASTS

Past forecasts of Grenadian air traffic have generally been similar in at least one respect; they have been consistently high. For example, as shown by Table 3.1, forecasts made in 1969 and 1970 of Grenadian passengers originating, terminating and transiting in 1980 ranged from 258,200 to 603,500, while actual 1980 traffic later proved to be around 138,100. No doubt these forecasts were assumed as most reasonable when they were made. In retrospect, considering the state of the world at the time, they probably were. However, these particular forecasts were followed by the oil crunch, worldwide recession, and growing inflation, while aircraft have mushroomed in size.

3.2 FORECAST BY PASSENGER TYPE

For the purposes of this study, tourists are considered separately from other passengers of which most appear to be Grenadian residents. Tourists may be from within as well as outside of the Caribbean area. Over time, Grenadian air passengers have been divided about 50 - 50 between tourists and other passengers. When related to demographic and other developmental considerations, the tourist component is likely to be more easily influenced, or subject to change. Therefore, separate forecasts are desirable, and are developed and presented in this report. Alternatives in airport operations are also considered in the forecasts.

TABLE 3.1

HISTORIC AIR PASSENGER FORECASTS FOR GRENADA, 1985 - 2000

Year (1)	Interimco (1980)	Cuban (1974)	British (1969)	Montreal Engineering (1970)	AID Agency (1970)
		(000 Passengers)			
1980			603.5	494.0	258.2
1985	224.2			850.0	325.6
1990	334.4	603.5	900.0	1,224.0	410.6
1995	448.4				
2000	547.2	900.0 (2)			

(1) Source = Interimco International Inc., Ottawa, Canada, A Forecast of Air Traffic for Grenada, August 1980, p.9.

(2) May have envisaged visits to Grenada by East Bloc vacationers.

3.2.1 Forecast by Airport Used

Since the study considers the advisability of completing the Point Salines Airport, it is necessary to make a two-tier forecast. One is based on the assumption that the new airport is not completed and that Pearls Airport would continue in operation. The other assumes that Point Salines is completed, and that Pearls Airport is no longer operated, as an airport. The forecast only gives consideration to air passengers, with cruise ship and yacht visitors not considered.

Overall, it could be argued that it is the availability of the new airport which would be most important to air passengers (particularly tourists) since this would provide more direct service, eliminating most of the present overnighting in Barbados. On the other hand, the level of service resulting from the degree to which the landside facilities (terminal building, etc.) are completed may have a significant impact on patronage.

3.3 CASE 1 - POINT SALINES AIRPORT UNCOMPLETED

There would be some increase in both types of air passenger, i.e. tourists and other passengers, even if the airport were not completed, and no special tourist programs were initiated. As far as those passengers who are Grenadian residents are concerned, the natural increase and emigration should ensure a somewhat higher level of future passenger traffic. Some increases can also be expected in the number of tourists, since Grenadian tourist activity has been on a down trend since 1978, and a recovery seems to be in order. For example, based upon usage at the end of September 1983, it was estimated that (without the intervention) the 1983 total for tourists would have reached 30,000. This would have been the first time since 1975 that the number of tourists achieved this level.

3.3.1 Non-Tourist Passengers

A trend analysis was run separately on annual totals for "other" passengers enplaned and deplaned at Pearls Airport during the period 1973 through 1982, after deducting tourists. Totals for 1983 were not used because parts of the October data were missing. Forecasts were then made for 1985, 1990, 1995 and 2000. The correlation for these two trends was good, 0.92 and 0.89, respectively, for deplaning and enplaning air passengers. The results of this analysis are shown by Table 3.2. Based on the volume and timing of past traffic, deplaning non-tourist passengers should total 61,400 in the year 2000, compared to 62,700 enplaning passengers. These totals represent average annual growth ratios of about three (3) percent for both arriving and departing passengers, both calculated from a 1982 base.

TABLE 3.2

GRENADA AIR PASSENGER FORECAST

CASE 1 - POINT SALINES AIRPORT UNCOMPLETED

Type Passengers (1)	000 Passengers			
	1985	1990	1995	2000
Non Tourist				
Deplane	39.5	46.8	54.1	61.4
Enplane	41.4	48.5	55.6	62.7
Intransit	18.6	22.0	25.4	28.9
Tourist				
Deplane	30.0	35.0	40.0	50.0
Enplane	30.0	35.0	40.0	50.0
Total	159.5	187.3	215.1	253.0

(1) Source: Wilbur Smith and Associates

A separate forecast was required for intransit passengers, i.e., people who transfer from one plane to another, without leaving the airport. The volume of such passengers is a function of those deplaning. For example, it was found that for the 5-year period ending in 1982, the number of intransit passengers approximated 47 percent of arriving (deplaning) passengers. This factor was used in developing estimates of intransit passengers through the year 2000, with 28,900 estimated for that year.

3.3.2 Tourist Passengers

Unlike the number of non-tourist air passengers, the volume of tourist passengers can be influenced dramatically by advertising and infrastructure development programs. The

assumptions behind each forecast must be clearly stated. As indicated earlier, the first assumption on this alternative was that the Point Salines Airport will not be completed, and that Pearls Airport would remain operational.

Basic Assumptions: This alternative assumes continuation of current Grenadian conditions, with limited or no improvement in the following areas:

- Electric generating capacity
- Water systems
- Roads
- Sewer systems
- Tourist accommodations
- Training of hotel personnel
- Implementation of a complete tourism development plan
- Tourist promotion
- Investment incentives

Forecast: While it is obvious from the above that Case 1 is intended as a worst case, a certain amount of increase in Grenadian tourist activity can still be expected. For example, it was earlier pointed out that a level of 30,000 tourists would probably have been reached in 1983, without the intervention. Table 3.2 estimates that the number of tourists will reach 50,000 annually by the year 2000. Based on the assumed 30,000 level for 1983, this represents an average increase of about three (3) percent per year.

It could be argued that even this modest increase is excessive. However, the level of this forecast is based on the following factors:

- Publicity: The U.S. intervention has provided Grenada with a windfall in worldwide publicity of a magnitude that could not be purchased. Once the negative aspects of this coverage have been overcome, and wide acceptance gained of the political stability of the island, Grenadian tourist activities should benefit accordingly.

- Electricity: Additional generating capacity has already been arranged. This should suffice for modest increases in tourist activity.

- Tourist Accomodations: Current occupancy rates are so low, (28.5 percent in 1982) that a significant number of additional tourists could be accommodated in present facilities.

- Large Hotel: It is an article of faith among tour operators that a country must have at least one large hotel, if tour activities are to be handled adequately. The Grenada Beach Hotel (formerly the Holiday Inn) currently has some 140 rooms operational out of 186, and could be fully operational as a first class hotel, with limited improvements to the kitchen area. This should fill the large hotel requirement.

In view of the above, the modest increase in tourist activities indicated by the forecast to a level of 50,000 tourists by the year 2000, is believed to be justified.

3.3.3 Overall Forecast - Case 1

The overall forecast for Case 1 (Point Salines Airport Uncompleted), as depicted by Table 3.2 estimates the following air passenger levels for the years indicated: 1985 - 159,500; 1990 - 187,300; 1995 - 215,100; and 2000 - 253,000. Based upon usage of 133,600 for 1982, the year 2000 total represents an average annual growth rate of 3.6 percent. The year 2000 forecast is less than twice the 1982 total. It should be attainable even if the Point Salines Airport were uncompleted and operations were confined to Pearls Airport.

3.4 CASE 2 - POINT SALINES AIRPORT COMPLETED

As with Case 1, the forecast for Case 2 was divided into two parts; non-tourist passengers and tourist passengers. While the forecast for the former is relatively straightforward, the latter forecast could be more controversial.

3.4.1 Non-Tourist Passengers

As indicated by Table 3.3, totals of 70,600 and 72,110, respectively, are forecast for the year 2000 for non-tourist deplaning and enplaning passengers. These estimates (plus those for 1985, 1990 and 1995) are based on similar data as Table 3.2, with a percentage added to reflect the increase in non-tourist passenger activity which would be generated by the new airport, due principally to large increases in the number of tourists. Examples of such activity include representatives of all of the enterprises which are necessary to support and entertain the tourists, plus those which provide and service the infrastructure which is required to support the facilities used by the tourists. This type of traffic will increase in proportion to the increase in tourist traffic. In addition, the completion of the airport should significantly

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improve air service to Grenada. As additional airlines become involved, increased competition should also be reflected in reduced air fares. This combination should increase the frequency of visits by Grenadians who live elsewhere but who still have families on the island.

In view of the above, the estimates for deplaning and enplaning tourists shown in Table 3.2 were increased for the forecast years, as follows: 1985 - 3 percent, 1990 - 5 percent, 1995 - 10 percent and 2000 - 15 percent. These increases appear modest, in view of the possibilities. The results are shown in Table 3.3.

TABLE 3.3
GRENADA AIR PASSENGER FORECAST
CASE 2 - POINT SALINES AIRPORT COMPLETED

Type Passengers	000 Passengers			
	1985	1990	1995	2000
Non-Tourist				
Deplane	40.7	49.1	59.5	70.6
Enplane	42.6	50.9	61.2	72.1
Intransit	19.1	23.1	27.9	32.3
Tourist				
Deplane	32.0	50.0	80.0	100.0
Enplane	32.0	50.0	80.0	100.0
Total	166.4	223.1	308.6	375.0

3.4.2 Intransit Passengers

As indicated earlier, these passengers are those who transfer from one plane to another, and their numbers are a function of the volume of deplaning passengers. As with Case 1, they were calculated as 47 percent of deplaning passenger totals for each year. As shown on Table 3.3 the number of intransit passengers is expected to reach 32,300 by the year 2000, compared to 19,100 in 1985.

3.4.3 Difficulties in Tourist Passenger Forecasting

As indicated earlier, forecasting of air passengers is difficult. This is particularly true when tourists are considered, because the number of variables which must be considered is so great. For example, the Program of Tourism Development of the Organization of American States (OAS) has prepared two tourism development plans for the government of Grenada in the last six years (1978 and 1983) and a third version is in preparation and due out in early 1984[1]. The 1978 report offered two projections for stayover visitors (as shown by Table 3.4), a low potential and a high potential forecast. The low potential forecast (37,300) turned out to be 140 percent of actual 1980 figures (26,700) while the high potential forecast (44,600) was 167 percent of the same figure. As a result, the forecasts in the OAS Attractions Development Plan for 1983 for 1985 and 1990 were considerably below those of the low potential forecast. Perhaps due to all this, the upcoming OAS Zone 1 Development Plan for Grenada avoids projections completely, citing the numerous uncertainties and risks which are involved[2].

(1) General Secretariat, Organization of American States, Grenada Tourism Development Plan - 1978; Grenada Tourism Attractions Development Plan, April 1983 and General Secretariat, Organization of American States, Grenada Tourism Plan, Zone 1 (unpublished - due out in early 1984).

(2) Grenada Tourism Plan, Zone 1, Ibid.

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TABLE 3.4

OAS PROJECTIONS OF STAYOVER VISITORS TO GRENADA

Projection Source/Item (1)	000 Visitors		
	1980	1985	1990
1978 Development Plan			
Low Potential	37.3	53.4	71.5
High Potential	44.6	70.3	99.2
1983 Attractions Development Plan (1)	--	40.7	74.8

3.4.4 Tourist Passenger Forecast Assumptions

Despite the difficulties outlined above, a tourist forecast is necessary in order to complete future air passenger estimates. However, particular care must be taken to ensure the conservative but yet sound nature of the result

In developing these forecasts, a review of stayover activity trends among competing Caribbean Islands was made, in order to develop a range of reasonable expectations. The results are shown by Table 3.5, which contrasts Grenadian activity with similar activity for nine other area nations for the period 1970 through 1982. Each of these nations was relatively undiscovered as a tourist destination in 1979, with the number of stopover visitors ranging from 15,000 to 50,000. Except for Haiti, each is also relatively small in both land area and population. During the period 1970 - 1980, the average growth in stopover arrivals in the area was 250 percent. Grenada was the only one of the ten which actually received less visitors in 1980 than in 1970. As indicated earlier, it was estimated that without the intervention, Grenadian tourist activity would have

(1) General Secretariat, Organization of American States, Grenada Tourism Development Plan - 1978; Grenada Tourism Attractions Development Plan, April 1983.

TABLE 3.5

LAND AREA, POPULATION AND STAYOVER VISITOR ARRIVALS
SELECTED CARIBBEAN ISLAND DESTINATIONS

Destination(1)	Area (sq.mi.)	Population (000)	Stayover Visitors 1970	1980	1982	Percent Growth 1970-80	1980-82
Haiti	10,714	5,104	33,691	137,992	139,000(2)	310	0.7
Cayman Islands	100	15 (2)	22,890	120,240	121,214	425	0.8
British Virgin Islands	59	NA	33,489	93,260	109,704	178	17.6
St. Kitts/Nevis/ Anguilla	138	49	13,472	32,751	34,538	143	5.4
Guadeloupe	687	330	47,225	156,457	152,375	231	(2.6)
Dominica	290	74	13,537	17,406	20,417	29	17.3
Martinique	425	325	33,415	158,462	176,237	374	11.2
St. Lucia	238	122	29,529	79,694	71,535	170	(10.2)
St. Vincent & Grenadines	150	110	16,352	50,351	37,456	108	(25.6)
GRENADA	133	112	30,436	29,418	23,270	(3.3)	(20.9)
Average, 10 islands	247	142(3)	27,404	96,260	97,279	251	1.1

(1) Destinations listed include all islands receiving 10,000 to 50,000 stopover visitors in 1970. Arrangement is geographic, from north to south.

(2) Estimate.

(3) Eight islands, excluding Haiti (which has an exceptionally high population) and the British Virgin Islands (for which population figures were not available).

Sources: 1983 World Book Atlas (population figures are for 1981); CTRC Statistical Report, 1983, Caribbean Tourism Research and Development Centre; and, Wilbur Smith and Associates, Inc.

approached 30,000 for 1983. However, this would still have been below the 1970 total of 30,400.

The reason for tourist growth (or relative lack of it) varied from nation to nation. For example, in Dominica, tourism made healthy strides through the middle 1970's, but in the latter half of the decade, a combination of political unrest and Hurricane David reduced growth significantly, with the result that growth for the decade was slightly under 30 percent.

Direct air service to major markets was also a powerful aid to tourist growth, as shown by the fact that the highest growth occurred at destinations which could be reached from the U.S. mainland or from Europe, without changing planes. Examples (with 1970 - 1980 percent increase in stopover arrivals) include Cayman Islands - 425 percent, Martinique - 374 percent, Haiti - 310 percent and Guadeloupe - 231 percent. St. Lucia also has the cited direct service, but growth has been hindered (especially since 1980) by political events and falling currency values in those European countries which comprise the prime sources of tourism for the country.

Other factors have also contributed to the tourist growth of those nations which have direct air access to major tourist markets. For example, since the Caymans are relatively close to the U.S. mainland, air fares are correspondingly less and travel time is shorter. The Islands also have a reputation of political stability, and offer the services of an offshore banking center. On the other hand the French roots of Martinique, Guadeloupe and Haiti provide an intriguing contrast to other area islands. These islands draw heavily upon the European tourist market, with numerous chartered aircraft involved.

Among those islands without direct access to major markets, 1970 - 1980 tourist growth has been especially impressive in the British Virgin Islands (178 percent) and St. Kitts/Nevis/ Anguilla (143 percent). Again these islands are near the U.S. mainland and enjoy a reputation for friendliness and political stability.

Tourism growth in St. Vincent and the Grenadines, which are geographically closest to Grenada and which are similar in resources, was less than average (108 percent) during the period. Amoung the reasons for this were distance to major markets and lack of direct air access.

The accelerated growth of tourism which was characteristic of the area in the 1970's has not been continued into the 1980's. However, it is pointed out that the large growth rates of the 1970's were calculated on relatively small bases, and that it is much more difficult to sustain such growth rates as the base becomes larger. Nevertheless, the British Virgin Islands registered a tourist growth rate of 17.6 percent for the period 1980 - 1982 and Martinique showed a 11.2 percent gain. Although Grenada showed a 20 percent loss for the period 1980 - 1982, indications are that the 1983 total would have reached 30,000, without the intervention. St. Vincent and Grenadines, and St. Lucia all realized 10 - 25 percent decreases in stayover visitors in 1982 compared to 1980. Other destinations held reasonably steady during the 1980 - 1982 period.

Market selection is another significant determinant of tourist volume. For example, a nation which opts to pursue the mass tourist market can be expected to have higher volumes of tourist activity than one which prefers the middle to upper class

market. However, the net income to the country might not be appreciably greater, because of the higher infrastructure requirements for mass tourist operations. In the past, Grenada has concentrated on the higher middle to upper class market.

The relative size of tourist accommodations is another factor which has a powerful effect on tourist travel. For example, larger hotels have the resources to advertise in market areas, and can accommodate group tours and charters. These advantages are not available to modest sized hotels. Accordingly, and as indicated earlier, it is a tourism rule of thumb that each destination should have at least one large hotel.

Past tourism performance in the area bears out the above observations. For example, in Guadeloupe and Martinique, where 1970 - 1980 rates of growth were high, from a third to a half of all rooms were in larger hotels of 100 rooms or more, as indicated by Table 3.6. This was also true of St. Lucia, where growth was moderate. In the high growth area of the Cayman and Haiti, there were one or two large hotels at each destination, although the majority of the rooms was in cottages and guest houses. As indicated earlier, to date, Grenada has not opted to pursue the mass tourist market, preferring instead the higher middle to upper class sector, and has relatively small facilities. The Grenada Beach Hotel is an exception to this last observation, but it still requires renovation of the kitchen before it could function adequately as a first class hotel.

Other area tourist destinations which have small facilities (under 100 rooms) include the British Virgin Islands (modest growth during the 1978 - 1979 period) and St. Kitts/ Nevis/Anguilla, Dominica and St. Vincent where growth was comparatively low.

TABLE 3.6

TOURIST ACCOMMODATIONS

SELECTED CARIBBEAN ISLAND DESTINATIONS

Destinations	TOURIST ACCOMMODATIONS (ROOMS)				
			Percent Growth	Hotels over 100 Rooms	
	1970	1979	1970-79	Hotels	Rooms
Haiti	NA	1,419	NA		215
Cayman Ialands	440	2,829	543	2	317
British Virgin Islands	302	656	117	-	-
St. Kitts/Nevis/Anguilla	350(1)	548	57	-	-
Guadeloupe	800(1)	3,063	283		1,208
Dominica	115	120(1)	4	-	-
Martinique	500(1)	2,285	357		1,148
St. Lucia	560	1,250(1)	123	4	725
St. Vincent & Grenadines	387	510	32	-	-
GRENADA	800	750(1)	(6)	1	142

(1) Estimate

Sources: OAS, Caribbean Tourism Research Center; Wilbur Smith and Associates, Inc.

3.4.5. Tourist Passenger Forecast

As indicated by Table 3.3 (See page 3-8) tourist air passenger levels for Case 2 were forecast as follows: 1985 - 32,000; 1990 - 50,000; 1995 - 80,000 and 2000 - 100,000. In contrast to Case 1, this forecast assumes that improvements will be made in the following areas:

- Electric Generating Capacity: increased sufficiently to carry the added load due to projected tourists, plus a safety factor to avoid power outages which have plagued the principal tourist area (Grande Anse) in the past.

- Water Supply: development sufficient to supply local needs plus tourism needs, avoiding past outages and water rationing.

- Roads: repair of roads sufficient to facilitate exploitation of tourist attractions, with emphasis on roads in the southwestern portion of the island.

- Sewer Systems: improvement at least sufficient to avoid polluting the Grande Anse beach area.

- Tourist Accommodation: return of the Grenada Beach to first class status, providing at least one large hotel to serve as a nucleus for tourist operations, plus completion of additional hotels as tourist numbers increase. For example, tentative proposals were received for the construction of two hotels (one with 150 to 200 rooms, and one with 100 rooms) during the visit of the White House Investment Mission to Grenada in January 1984.

- Telephone System: completion of system upgrading and assurance of dependable service.

- Training: training of hotel personnel to a level sufficient to ensure that first class service is offered in first class hotels.

- Tourism Plans: implementation of a comprehensive tourism plan which will ensure that a balanced tourism program is carried out, including a suitable promotion program.

- Tourist Promotion: initiation of a sufficiently funded tourist program which selects the proper markets for Grenada and concentrates on them. As larger hotels are developed, they could assist in this effort. Also, as business improves, the smaller hotels could become involved.

- Investment Incentives: the investment incentive program should be adjusted to ensure that hotel investment is encouraged without giving investors a free ride.

The improvements listed above are not just required for the tourist industry. They are also needed to support the activities of the other sectors, as well. However, their effects in the tourism industry would be especially beneficial.

The growth rates represented by the forecast tourist volumes are not excessive. For example, based upon air passenger tourist volumes of 21,700 for 1982, the last full year for which such data are available, the forecast of 100,000 air tourist

passengers by the year 2000 represents an average annual growth rate less than nine percent. This is a considerably lesser growth rate than that enjoyed by 8 of the 10 nations indicated during the period 1970 - 1980. (See Table 3.5).

3.4.6. Overall Forecast - Case 2

The tourist air passenger forecast is an increasingly significant overall forecast. As indicated by Table 3.3, the overall air passenger forecast for Case 2 (Airport Completed) is: 1985 - 166,400; 1990 - 223,100; 1995 - 308,600 and 2000 - 375,000. While the year 2000 forecast anticipates more than a 125 percent increase in total air passengers over 1985 it is 69 percent of a similar forecast (547,200) by Interimco in 1980 for the same year.(See Table 3.1). It is also 42 percent of the 1979 forecast made by the Cubans for the same year. Based on a 1982 level of 133,600 air passengers, the 375,000 total forecast for the year 2000 represents an average annual rate of growth of less than six percent per year. This rate of growth should be attainable, considering present developments and the aforementioned basic assumptions.

3.5 AIR FREIGHT

It is also necessary to forecast future levels of air freight and mail, since they form an integral part of the workload of an airfield. Data on these commodities are available only through 1980.

3.5.1 Growth rates

Trend lines were calculated for freight delivered and picked up, but the correlations were poor. Growth rates for Case 1 were, therefore, set as 1.5 percent per year for freight set down and 3.0 percent per year for that picked up. The latter higher rate was due to the opportunities already existing for the development of additional air freight, as will be described later.

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The results are shown by Table 3.7 which estimates air freight set down in the year 2000 (if the airport is left uncompleted) at 394,500 kg, compared to 89,900 kg of freight picked up. These totals were developed from a 1980 base.

As indicated in Table 3.7, air freight estimates for the year 2000 for Case 2 (airport completed) totalled 529,000 kg set down and 159,700 kg picked up. Growth rates used (with 1980 as a base) were 3 and 6 percent per year, respectively.

Although air freight picked up was less than 20 percent of freight set down in 1980 (49,800 kg to 292,920 kg) higher growth rates were assigned to the former because of possibilities for providing air freight to fill new capacity which will develop when the airport is completed and passenger flights increase to meet expected air passenger forecasts. Prospects are especially good in two areas; readymade clothing and agricultural products.

3.5.2 Readymade Clothing

Opportunities exist at present for a dramatic expansion of the production of readymade clothing in Grenada, due principally to five reasons. First, there is a small but active industry already in place which could serve as a nucleus for future development. This industry employs some 310 people, as follows:

Company	No. of Employees
Deco	110
Hadid	60
Liberty	60
Johnson	50
Ecstacy	20
Williams	10
Total	310

TABLE 3.7

FORECAST - AIR FREIGHT

CASE 1 - POINT SALINES AIRPORT UNCOMPLETED

Year	Air Freight	
	Set Down	Picked Up
	(000 kg)	
1985	315.5	57.7
1990	339.9	66.9
1995	366.2	77.6
2000	394.5	89.9

CASE 2 - POINT SALINES AIRPORT COMPLETED

Year	Air Freight	
	Set Down	Picked Up
	(000 kg)	
1985	339.6	66.6
1990	393.6	89.2
1995	456.3	119.4
2000	529.0	159.7

This small industry already contributes a significant portion of Grenada's exports, as well as providing clothing for domestic use. Discussions with trade and government people indicate that the entrepreneurs in this area are alert to investment opportunities, and are particularly interested in joint ventures involving U.S. firms.

Second, Grenadian tax laws permit duty free entrance of raw materials for processing. This allows goods to be cut elsewhere to pattern and forwarded to Grenada for final sewing.

Third, Grenadian workers are industrious and supervision requirements are not high, resulting in reduced overheads.

Fourth, American initiatives following the intervention have opened up opportunities for local industry to engage in joint business ventures, which were not previously available.

Fifth, readymade clothing is light in weight, and although bulky, can be compressed for shipment, and embodies styles which may have a time dimension, and would therefore be amenable to air shipment.

In sum, the industry offers a good potential for the development of outgoing air cargo.

3.5.3 Other Industrial Prospects

Possibilities exist in both the handicraft and handbag industries for development of air cargo. However, neither of these industries is presently as well established as the readymade clothing business.

3.5.4 Agriculture

In considering agriculture as a potential source of air cargo, cut flowers deserve special treatment. They are light in weight, have a high unit value, and are very perishable. All of these qualities make them prime air cargo potentials. However, they are also bulky and therefore are generally shipped with heavier cargo. Prospects for air cargo development, recommended by Agriculture Industry representatives (in order of priority) include:

Anthurrium lilies
Poinsettias
Evergreens
Orchids
Aeroids: such as cannas.

Certain food products currently raised on the island were suggested by Ministry representatives as possible candidates for air shipment. In order of priority, these are:

Mangoes
Eggplant
Avocado
Red tannia
Callaloo
West Indian cherry
Small yams
Sweet potatoes
Eddoe
Sorrel
Okra
Pumpkins.

Even a cursory examination of the above list will reveal products which are probably not of sufficient unit value to warrant air shipment, if shipped separately. However, if shipped along with higher priced goods, to use space which would otherwise be wasted, there still might be a possibility.

Certain of the above products are already being exported. For example, eggplant exports to Europe jumped from 15,000 lbs. in 1979-80 to 109,000 lbs. in 1981-82, while 410,700 lbs. of mangoes were also shipped to Europe in 1982. There is also a significant huckster trade of vegetables to Trinidad (nearly 400,000 lbs. in 1982).

The above concentrates on crops other than the traditional Grenadian big four, i.e., cocoa, bananas, nutmeg and mace, since transport channels are already well established for these crops. As far as incoming cargo is concerned, tonnage to support tourists will rise along with the number of tourists.

3.6 MAIL

As with other air cargo, separate projections were made by trend analysis for mail set down and picked up under Case 1 (airport uncompleted) and Case 2 (airport completed). As indicated by Table 3.8, it was estimated that 148,700 kg. of mail would be received in the year 2000 and 30,900 kg. would be shipped, under Case 1. Under Case 2, similar figures were 171,000 kg. and 35,500 kg. The basis for the Case 2 estimate was Case 1 totals plus percentage increases as follows: 1985 - 3 percent; 1990 - 5 percent; 1995 - 10 percent and 2000 - 15 percent. These increases are intended to reflect the increased requirements for supplying mail relative to the generally higher level of economic activity and number of tourists.

TABLE 3.8

FORECAST - MAIL

CASE 1 - POINT SALINES AIRPORT UNCOMPLETED

Year	Mail	
	Set Down	Picked Up
	(000 kg)	
1985	83.5	23.3
1990	105.2	25.8
1995	126.9	28.3
2000	148.7	30.9

CASE 2 - POINT SALINES AIRPORT COMPLETED

Year	Mail	
	Set Down	Picked Up
	(000 kg)	
1985	86.9	24.0
1990	110.5	27.1
1995	139.6	31.1
2000	171.0	35.5

3.7 CARGO/MAIL SPACE REQUIREMENTS

Preceding forecasts for air cargo and mail were included (along with passenger forecasts), in developing aircraft requirements, which are covered in the following sections of this report.

3.8 NUMBER OF AIRCRAFT OPERATIONS

A number of variables are involved in the estimation of future annual aircraft operations. Examples include the availability of aircraft, changes in the aircraft mix, seating capacity, aircraft configuration, number of passengers by type, quantities of cargo and mail, airport runway length and related airside and landside facilities, availability of navigation aids, load factors etc. These factors have been integrated into the forecast which is shown in Table 3.9. The aircraft characteristics which were used in developing the forecast are shown on Table 3.10. The forecast is conservative in that load factors of 75 - 80 percent were assumed for small planes, compared to 85 - 90 percent for large planes. Details on the methodology used are as outlined in the following discussion.

The aircraft operation forecast for Grenada was made by evaluating the type of aircraft which might operate on the island in order to determine the critical aircraft.

The peak months of December, January and February were assumed to comprise 50 percent of the annual aircraft activity. For purposes of estimating peak hour passenger flows, peak hours of busy months represent twice the activity of the off-season period. Similarly, a once daily flight during the peak months was assumed to occur only once every two days during the off-season.

Typical equipment operating in the Caribbean Islands was a key to defining the critical aircraft which would be used. Given the usual arrival times at most island destinations, the design aircraft generally operates once a day. The typical tourist was also defined as including representatives of moderate to upper income North Americans and West Europeans. For this traffic, the year 2000 design aircraft was identified as a Lockheed 1011. Initially, the estimated 1985 demand level indicates the need only for a commercial jet aircraft such as the Boeing 737 or Douglas DC-9.

The forecast of air carrier operations was based on allocations of passengers which were identified in the passenger forecast with the design aircraft. As stated earlier, assumptions of maximum payload for each aircraft were made. Remaining "re-assigned" passengers were then allocated to commuter airlines, based on aircraft such as the small to medium sized planes currently used by LIAT. A large commuter aircraft carrying 70 passengers or more was seen as a possibility for operation in Grenada. At this time, one existing aircraft which could fulfill this need is the Fokker 28.

A separate general aircraft operations forecast was made, using standard methods approved by the U.S. Federal Aviation Administration. The principal criterion for this forecast was typical aircraft operations in areas of low density, aircraft dependent, rural-oriented populations.

While regular, scheduled use of the Point Salines Airport by wide-bodied jets is not anticipated prior to 1990, the periodic use of the airport by larger charter jet aircraft shortly after opening is likely. Moreover, wide bodied jets presently are operated by major carriers to neighboring islands, making capability to accommodate these aircraft desirable. Due to the profile of the Point Salines Airport, and high ambient temperatures, even the 9000-foot runway will require load limitations for larger jets if long stage length flights are scheduled.

The aircraft operations for Pearls Airport assumed no operations by jets (737 class or larger) due to limitations imposed on such aircraft by the lack of sufficient runway length.

TABLE 3.9

FORECAST - ANNUAL AIRCRAFT OPERATIONS[1]

Type Aircraft	1985		1990		1995		2000	
	Case 1[2]	Case 2[3]	Case 1	Case 2	Case 1	Case 2	Case 1	Case 2
General Aviation	7,200	7,250	9,400	9,230	11,000	9,500	12,550	11,800
Embraer	1,340	1,210	1,600	1,340	1,800	2,000	2,200	2,250
AVRO 748	2,560	2,300						
Fokker 28			1,900	1,650	2,100	2,400	2,600	1,600
Boeing 767/737		336		336		672		672
Boeing 727/757				336		336		672
L1011								336
Total	11,100	11,096	12,900	12,892	14,900	14,908	17,350	17,330

(1) Prepared by Wilbur Smith and Associates. Each operation involves a landing or a takeoff.

(2) Case 1 is Pearls Airport operational, Point Salines uncompleted.

(3) Case 2 is Point Salines operational, Pearls closed.

TABLE 3.10
AIRCRAFT CHARACTERISTICS

Type Aircraft	Weight (1) (000 lbs)	Passenger Capacity (2)	Runway Length (3)
General Aviation	8.0	4 - 8	Less than 6,000 ft.
Embraer	12.5	14 - 18	
AVRO 748	44.5	40 - 52	
Fokker 28	62.5	60 - 98	
Boeing 767/737	115.5	70 - 120	6,000 ft.
Boeing 727/757	140.5	115 - 160	7,000 ft.
L1011	430.0	250 - 400	9,000 ft.

(1) Maximum takeoff weight.

(2) Capacity varies with configuration.

(3) Sea level, 0 gradient.

4. AIRPORT FACILITIES

CHAPTER 4

AIRPORT FACILITIES

In this chapter a brief reference to the studies and developments leading to the construction of the Point Salines Airport is followed by detailed discussions of -

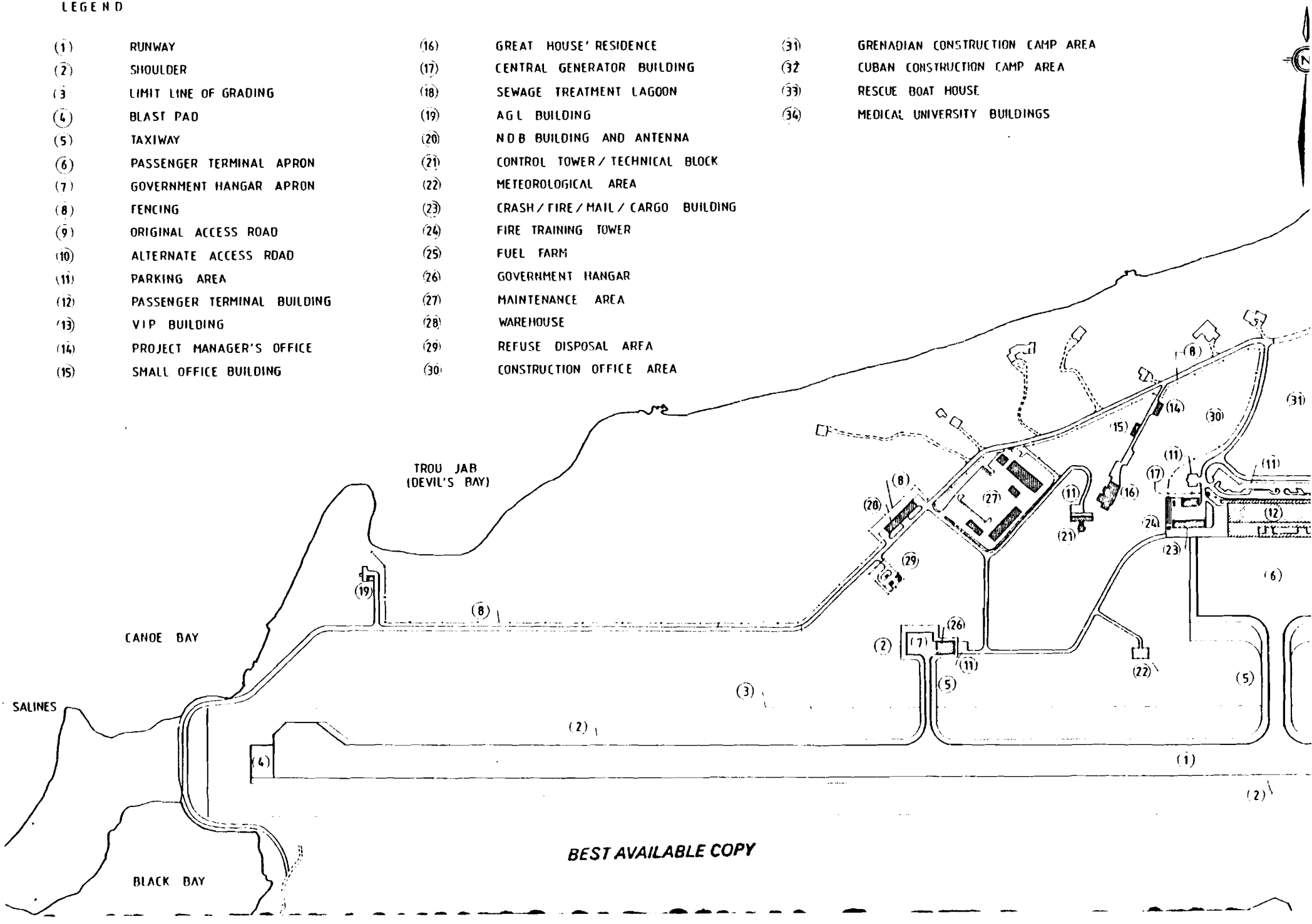
- Site Development
- Principal Buildings
- Utility Systems
- Aeronautical Operational Facilities and Services
- Support Facilities
- Equipment and Furnishings
- Land Acquisition
- Cost of Development

Under each major heading the design criteria and/or current status are reviewed, critiqued and recommendations made as to what changes and/or additional work are required.

Illustration 3, a plan drawing of the Cuban design for the airport, identifies the major facilities. Photographs, presented as Illustrations 5 through 43, contribute further insights and understanding as to the physical configurations and stations of the individual airport elements. For ready reference purposes, all of the photographs, Illustrations 5 through 43 are grouped together in Appendix A, following Chapter 6.

LEGEND

(1)	RUNWAY	(16)	GREAT HOUSE' RESIDENCE	(31)	GRENADIAN CONSTRUCTION CAMP AREA
(2)	SHOULDER	(17)	CENTRAL GENERATOR BUILDING	(32)	CUBAN CONSTRUCTION CAMP AREA
(3)	LIMIT LINE OF GRADING	(18)	SEWAGE TREATMENT LAGOON	(33)	RESCUE BOAT HOUSE
(4)	BLAST PAD	(19)	AGL BUILDING	(34)	MEDICAL UNIVERSITY BUILDINGS
(5)	TAXIWAY	(20)	NDB BUILDING AND ANTENNA		
(6)	PASSENGER TERMINAL APRON	(21)	CONTROL TOWER / TECHNICAL BLOCK		
(7)	GOVERNMENT HANGAR APRON	(22)	METEOROLOGICAL AREA		
(8)	FENCING	(23)	CRASH / FIRE / MAIL / CARGO BUILDING		
(9)	ORIGINAL ACCESS ROAD	(24)	FIRE TRAINING TOWER		
(10)	ALTERNATE ACCESS ROAD	(25)	FUEL FARM		
(11)	PARKING AREA	(26)	GOVERNMENT HANGAR		
(12)	PASSENGER TERMINAL BUILDING	(27)	MAINTENANCE AREA		
(13)	VIP BUILDING	(28)	WAREHOUSE		
(14)	PROJECT MANAGER'S OFFICE	(29)	REFUSE DISPOSAL AREA		
(15)	SMALL OFFICE BUILDING	(30)	CONSTRUCTION OFFICE AREA		



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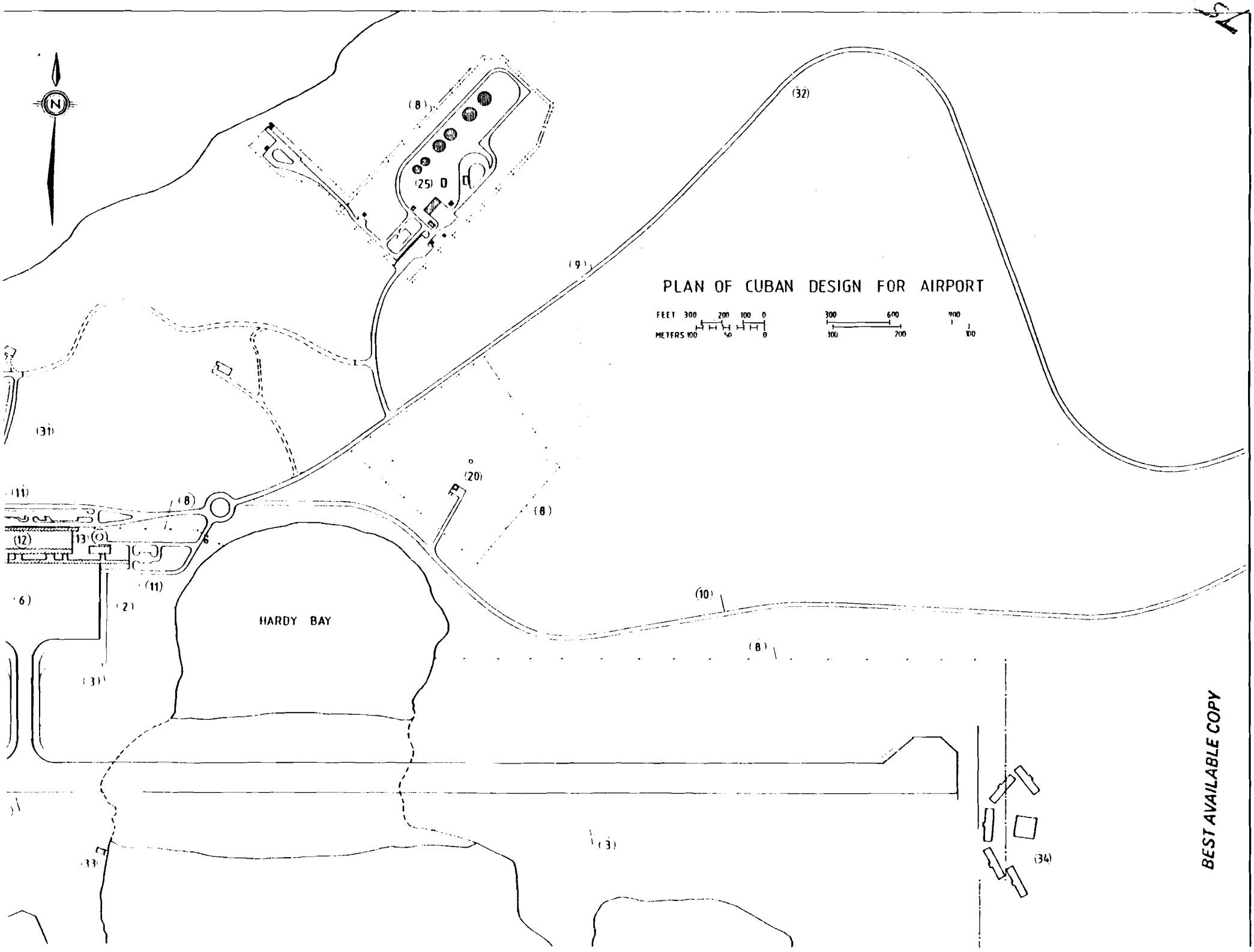

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4.1 HISTORIC PERSPECTIVE

There has been and is high local interest in improving the level of airport facilities on the Island. The location of and desire for these improvements at Point Salines go back in time many years. A study entitled "Grenada" by the London Board of Trade, dated 1968, includes consideration of an 8000 foot runway at Point Salines. Another study, entitled "Grenada Airport Development, Economic and Technical Feasibility Study" commissioned by the U.K. Ministry of Overseas Development at the request of the Government of Grenada, was carried out in 1969 and included consideration of a 7800 foot runway at Point Salines.

Construction of the airport at Point Salines was begun in late 1979 by the Cubans. The Cuban effort was being carried out by two entities. The Master Plan design, overall direction and policy determination for the airport development were under the control of the Cuban Ministry of Transport (MITRANS) and the construction was being performed by a Cuban construction organization identified as UNECA.

A contract was let by the Government of Grenada to Plessey Airports Ltd., a British firm, in May 1982 for furnishing and installing electrical and electronic equipment and miscellaneous additional equipment. Another contract was let, also in May 1982, with a Finnish firm, Metex, covering airport lighting and fire fighting equipment. The Plessey and Metex contracts are still valid and only the activities for which MITRANS and UNECA were responsible must be reactivated to complete the airport.

The on-site condition of drawings and specifications covering all aspects of the work in progress was found to be in complete chaos. The availability of drawings and specifications ran from zero to partial in all areas. As a result, much of the

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information obtained during the course of the work was from individuals who were familiar with the installation in varying degrees.

Much of the Plessey and Metex furnished equipment was stored in a building known as the "Plessey Warehouse". This equipment has been vandalized and an inventory of the equipment is currently underway. The results of this inventory will not be available prior to the completion of this report. Since these contracts call for payment upon delivery and include materials and installation, no additional costs for Plessey or Metex furnished items are included in our estimates of completion cost. It is assumed that any items found to be damaged or missing would be subject to claims procedures.

UNECA furnished heavy earthwork equipment as well as a rock crushing plant, an asphalt mixing plant and an asphalt paving machine. There has been some damage to the earthwork equipment, however the rock crushing plant, asphalt mixing plant and asphalt paving machine appear to be undamaged. The general opinion of knowledgeable construction personnel on our Team is that the Cuban furnished equipment is operable. There was no attempt made to start up individual pieces nor was there detailed examination.

It is our understanding that the Cubans have requested the Government of Grenada to return the equipment and at this time the request is being considered.

The cost estimates contained in this Report are based upon both cases, one, with the Cuban equipment available for use and the other assumming necessary replacement equipment will be mobilized.

During the course of the data gathering phase, the Team became aware of two Grenadian generated proposals for early opening of the Point Salines Airport. One of these proposals was developed by the Government of Grenada and the other by a local business interest.

In this regard, the following was attributed to the Chamber of Commerce of Grenada in a December 5, 1983 document entitled "A Report by the Interagency Team on Commercial and Private Sector Initiatives", ".... it is imperative that this airport be made operational by 1st October, 1984".

4.2 SITE DEVELOPMENT

Under this heading Earthwork, Paving, Storm Drainage, Grassing and Landscaping, Fencing, Off-airfield Lighting and Signage are discussed. The work accomplished to date and actions required to meet the year 2000 requirements in these areas also are described. Illustrations 5, 6 and 7 demonstrate current construction status.

The airport is designed as a one runway field without a parallel taxiway. Generally oriented east-west, the runway bearings are 10/28. It is 9000 feet long and 150 feet wide. Elevation at the center is 23 feet above sea level.

A section of runway about 1500 feet in length has been built across Hardy Bay on a 500 foot wide fill. This is located about 3000 feet from the east end of the runway.

The Terminal Building area is located on the north side of the runway at midpoint and a 600 foot long taxiway leads to the center of the aircraft parking apron. A small aircraft hangar with associated apron and taxiway is located about 3100 feet east of the west end of the runway, and 500 feet north of the runway centerline.

A fuel farm is located in the northeast section of the airport property (Illustration 29).

A non-directional beacon (NDB) is located on the airport 1500 feet north of the runway centerline about 2400 feet west of the east end of the runway.

Principal building areas aside from the Terminal Building (see Illustrations 10 through 15) are the Control Tower and Technical Block (see Illustrations 26 and 27) and the airport maintenance area (Illustrations 31 and 32).

4.2.1 Instrument Runway

ICAO recommends that an instrument runway should have a strip extending 500 feet on each side of the centerline of the runway with the graded area extending 250 feet on each side of the runway centerline. ICAO defines a "runway strip" as "a defined area" including the runway intended:

a) to reduce risk of damage to aircraft running off a runway, and

b) to protect aircraft flying over it during take-off or landing operations.

At Point Salines, the strip width, as constructed, was reduced from the original design (which met this recommendation), to provide a strip 250 feet wide on either side of the runway centerline instead of 500 feet. This is the most significant infringement on ICAO recommendations at the airport.

In section 4.5 of this chapter, it is recommended that an Instrument Landing System not be planned for Point Salines Airport. If this recommendation is adopted, the instrumentation to be provided will result in a non-precision approach capability. It is an accepted practice that when operations are limited to non-precision approaches, a strip 500 feet wide is acceptable.

The reduction in strip width from 1000 feet to 500 feet with the full 500 feet graded, is therefore, considered acceptable and no increase in this width is recommended.

The runway strip length recommended by ICAO for this category airport extends 200 feet beyond the runway ends. ICAO also recommends a minimum runway end safety area of 300 feet beyond the runway end.

4.2.2. Displaced Threshold Runway 28

All instrument approaches to Point Salines International Airport and most of the approaches under Visual Flight Rules (VFR) will be from the west on Runway 10. The terrain to the east of the airport would rule out low visibility and low ceiling approaches from that direction. The Airport Master Plan, without explanation, indicates that the threshold on the east end of Runway 28 be displaced to the west by approximately 330 feet. During the limited time available for this feasibility study no supporting documentation for this displacement has been uncovered, no one found who has knowledge concerning the reasons for the displacement, nor has it been possible to develop a defensible rationale for the specific displacement called for in the Master Plan. It is recommended that as a matter of priority, a survey be conducted and an engineering/operational determination made (in accordance with the procedures set forth in Section 10.2 of Attachment B of Annex 14 to the Convention on International Civil Aviation) as to whether a displaced threshold is required and if required the magnitude of the displacement.

4.2.3. Obstruction Removal, Approach Path Runway 28

The Master Plan calls for the removal of numerous obstructions in the approach path to Runway 28 (approach from the east). Some of the more serious obstructions have been removed during the earlier stages of construction. In the past few months, conversations between Mr. John Velox, Director of Civil Aviation, Windward and Leeward Islands and Mr. Ron Smith, Project Manager, PSIA, Ministry of Construction, Grenada, have led to the conclusions that in lieu of removing the obstructions, the extent of penetration of the obstructions could be reduced and then the obstructions lighted. These arguments have been reviewed and conclusions drawn that safety would not be compromised nor would operations suffer if the remaining obstructions were not totally removed but reduced and adequately lighted. This alternative action will result in a reduction in earthwork of 160,000 cubic yards at a saving of some $500,000.

At the west end of the runway there is a 1000 foot graded area provided for the Simple Approach Light lane. Thus, the overrun and safety area requirements are met at the west end.

At the east end of the runway, however, there is only approximately 100 feet of overrun beyond the runway end. It is recommended that the additional 200 feet which would meet the overrun and safety area provisions be provided. This added fill and associated building removal is estimated to cost approximately $275,000.

The additional earthwork to provide the overrun and safety area can be deferred if funding at this time so dictates, until operations with A-300 or L-1011 type equipment are regularly scheduled at Point Salines Airport. Until then the existing 100 foot overrun is considered acceptable and will not affect licensing of the airport.

4.2.4. Control Tower Line of Sight

In order to provide an unobstructed view of the entire aircraft operational area of the airport as well as a clear view of the approaches from the west from the Control Tower it will be necessary to cut back the hill sides in two areas southwest of the Control Tower.

These line-of-site requirements are specified by ICAO and should be met.

4.2.5 Armor Protection, Southside Runway at Hardy Bay

The construction of the runway across Hardy Bay required a mammoth earthmoving operation. The southern section of this runway embankment is exposed to the sea and possible damage by wave action.

The original Cuban design for the embankment area consisted of an extensive stone protective barrier. Local officials have expressed the view that the protective measures as originally designed may be excessive.

The barrier is approximately 60 per cent constructed and it is recommended that the originally designed barrier be completed. This involves placement of additional facing material consisting of large 1 to 2 ton boulders taken from the quarry, and minor shaping. It would be unwise to suggest any reduction in the original design without an engineering study of the effects of storm induced wave action.

4.2.6 Embankment Protection, West End Runway

The overrun area and approach lighting installation area off the west end of the runway was created by cutting the high ground toward the tip of Point Salines, filling a short distance into the sea and filling the low lying land back toward the end of the runway. While the runway itself is constructed on original ground, some approach lights have been installed in the embankment fill.

Two areas for potential problems exist. One is washing out of the embankment fill, currently in progress, at the end of the approach lights, where about one half of one line of lights is in the fill (see Illustration 33). This sea erosion will be arrested when the original tiff face is reached. Thus, a limited amount of material and loss of only part of the end line of lights would occur. While the risk of this happening is reasonably high, the consequences are not great enough to justify the high cost of providing protection. Minimal protection might involve armor rock facing for at least 200 feet, at a cost in the order of $280,000. Replacement of the few lights involved on a stilt support system, should this be necessary, could be done at a small fraction of this cost.

The second potential problem is cutting back of the fill embankment due to wave action between the original ground section to the west and the end area of the runway. This would be due to high seas from the northwest, probably associated with a hurricane, which is said to be rare in this area of the Caribbean. Loss of this embankment section would take out the majority of the approach lights and the overrun area but would not destroy any of the runway. The risk of such washout to affect the approach lights is relatively low and the cost of armor stone protection along the north side of this embankment would be of the order of $800,000.

It is not recommended that high cost protection be placed, but rather that this situation be observed over time and be treated as a maintenance project, using tiff materials to refill washouts as they occur.

4.2.7 Runway/Taxiway Shoulders

ICAO recommends for runways of basic lengths over 7000 feet that 25 foot wide shoulders should be provided on each side. The Cuban design proposed paving 20 foot shoulders. This paving is estimated to cost over $400,000.

Considering the levels and types of activity forecast for Point Salines Airport it is recommended that the runway and taxiway shoulders be grassed in lieu of paved.

4.2.8 Runway Strip

The entire runway strip width of 500 feet should be grassed in order to control erosion. As the runway embankment has been in place for some length of time, approximately 10 per cent of the grassing of this area has been completed. The remainder of the areas not already in grass should be fine graded to provide proper slopes, top soil placed and then seeded.

4.2.9 Landscaping

A plant nursery was started at the airport to provide plants and trees for landscaping the site. Although landscaping can be considered a luxury, the image of the airport in the Grenadian scene is such that it requires a completed and finished appearance for which at least limited landscaping is necessary. Therefore, it is recommended that the nursery be rehabilitated and that plant material from both the nursery and commercial resources be used to landscape the Terminal Building area, at a minimum.

4.2.10 Storm Drainage

The Cuban design provided for area storm drainage throughout the entire airport site. Essentially, all slope grading, cutting of ditches, and installation of pipe and culverts have been completed. This work is estimated to be over 95 percent complete. The remaining minor work consists of cleaning ditches, fine grading in some areas, installation of grates, backfilling of manholes, etc.

No changes are recommended in this area.

4.2.11 Fencing

Security fencing is required throughout the airport area and the Cuban design provided for this. Some minor readjustments in the level of security being planned in some areas are recommended as well as certain realignments to accommodate some off-airport activities.

The Cuban design provided for on-site casting of concrete fence posts to support the chain link fabric. Very few of these have been cast and no permanent fencing had been installed on the airport. The chain link fabric and gates have been purchased and were found to be on the dock in the port of St. Georges. Barbed

wire was to be installed on top of the chain link fence and this proposal should be carried out, although none of the barbed wire was found at the port or at the site.

The perimeter fence will require a change in location at the True Blue Medical building area to take into account the proposed, staged timing of building removal. A similar realignment will be required so that the road to provide access for fishermen from the village of Calliste to Bagadi Bay will be outside airport operational areas.

The determination as to whether or not to substitute steel posts for concrete cast-on-site posts can be made at a later date based upon relative cost to the project.

4.2.12 Light House

A light house beacon existed on the west end of the airport peninsula but it was displaced by new grading at that end of the runway. According to the Project Manager, a new beacon was installed nearby and is now functioning. This is, of course, an integral part of the airport development.

4.2.13 Apron and Runway Pavement

The apron in front of the Terminal Building is non-reinforced portland cement concrete cast in 13 x 20 foot blocks. The Project Manager has advised that all joints are doweled.

Test pits were opened at the apron edge and also at the similarly constructed portland cement concrete area at the west end of the runway. This confirmed that the thickness is in the 15" to 15½" design range. The Project Manager reported that concrete strength in cylinder tests were typically very good and there is no visual evidence to suggest any deficiencies in concrete strength. Workmanship and quality in connection with this concrete work is considered acceptable.

The material below the concrete rigid pavement is compacted tiff, a volcanic ash. This material is made up of essentially sand and silt sizes and is non-plastic. California Bearing Ratio (CBR) values for a minimum of 12 inches below the pavement level exceed 24, according to the Project Manager, which provides an excellent subgrade for either rigid or flexible pavement.

The structural capability of these rigid pavements is high and considering the forecast low volume of traffic, could support loads up to and including wide-bodied commercial aircraft now in use (B-747). None of the joints in the rigid pavements have been sealed, although the original Cuban design did call for joint sealing. The joints have been formed by casting individual blocks and not in the normal way where strips are cast and transverse joints sawn. The method used minimizes the opening of the joint due to concrete shrinkage. Further, the temperature changes in Grenada are small so that large movement due to thermal expansion and contraction does not take place. Nevertheless, there are some very narrow cracks at the joints which may extend fully through the slabs and can allow water to seep through to the subgrade. This could cause some subgrade loss of support and eventually some joint deterioration.

It is recommended that no joint sealing be done at this time. Monitoring of the situation should be part of the normal maintenance program and the sawing and sealing of the joints be done at some future time if it appears to be required.

4.2.14 Runway/Taxiway Wearing Surface

The runway and primary connecting taxiway to the parking apron were designed and constructed as flexible pavements. Final Cuban design apparently consisted of 10.5 inches of coarse graded

plant mix asphaltic concrete laid in four lifts with a 1.75 inch fine graded plant mix asphaltic concrete wearing surface.

Several actual thickness measurements were made. Base coarse thickness was found to be about 11 inches. Thus, the final pavement thickness, with wearing surface, would be in the 12.5 to 13 inch range. The underlying soil is compacted tiff, as is the case with the rigid pavement areas.

The structural capability of this flexible pavement completed to its full depth is high and again, considering the forecast low traffic volume, could support loads up to and including wide-bodied commercial aircraft now in use (B-747).

Approximately 25 per cent of the wearing surface for the runway is now in place at the west end and all of the asphaltic concrete base is laid. (See Illustration 33).

The airport paving has undergone considerable use over the last several months by military aircraft (C-130, C-141). Close inspection revealed no damage to the existing base or surfacing due to this activity. The only runway damage which was observed is very minor gouging at several locations where tracked vehicles were on the pavement. This is not considered serious and can easily be repaired.

Some areas of the existing wearing surface show evidence of aggregate dislodgement. This is not a serious problem; if it continues to occur, a seal coat can be applied sometime in the future.

Generally, the workmanship in the paving is acceptable. Some of the base course mix lacks fines but this is not a serious deficiency and will not adversely affect the pavement's structural

performance. Fines for the mix must be manufactured from the quarry rock and this has always been a problem due to the hardness of the volcanic rock. The crushing plant production of fines in production of aggregates has been generally insufficient for needs, particularly for the finer surfacing mix. It is suggested that if the amount of fines being produced using the existing crusher becomes a problem, rental of a hammer mill may be necessary.

4.2.15 Airport Access and Circulation Roads

This section addresses the provision of the airport access road, interior service roads and associated parking areas. The Cuban design specified a 3 inch wearing course for these areas. Parking was provided at the Terminal Building, Control Tower and Technical Block, the Airport Ground Lighting (AGL) Building, the Non-directional Radio Beacon (NDB) Building, the Fuel Farm, the VIP Building and the Government Hangar.

All of these are in various stages of construction, from 0 to 50 percent complete. Provision must be made for satisfying the vehicular needs of the facilities making up the airport. It is recommended that this be done, generally at a lesser design level than apparently was the Cuban intent.

Airport Access Road - The airport access road is defined as beginning at the Sugar Mill, extending to the True Blue Roundabout, and thence to the Airport Terminal Building. (See Figure 4).

The section of roadway from the Sugar Mill area to the True Blue Roundabout has been completed up through, and including, the compacted subgrade. This section consists of a dual two-lane roadway separated by a 3 foot wide curbed median. Each lane is approximately 18 feet in width. Culverts have been installed under the southern roadway at a minimum cover depth. It is

recommended that the southern section be scarified, sufficient material be added to provide adequate cover over the culverts as presently installed, and after proper compaction of the material that this roadway be surfaced with a 1 3/4 inch bituminous surface course. The culverts already in place should be extended across the northern section of roadway. Minor ditching and grading would complete this section to an acceptable standard.

From the True Blue Roundabout to the Terminal Building extensive grading and drainage have been performed. Major culverts have been installed in all but one location. No curbing has been constructed. Installation of the one missing major culvert and earthwork to provide cover over all culverts is required. Shaping and compaction of the roadway section and ditching are all that is required to prepare this roadway section for its 1 3/4 inch bituminous surface course.

An alternate alignment for the access road from the True Blue Roundabout to the Terminal Building had been partially developed. Grading and drainage work have been done. It is estimated that costs for completing either alignment will be of the same general magnitude. It is recommended that the final selection of the alignment be made based upon the decision of the Grenadian Government considering utilization of existing buildings along the alternate routes, among other factors.

Internal Airport Roads - The only road surface which should be constructed to conform to the Cuban designed 3 inch wearing course is the roadway used by aircraft refueling vehicles.

Roadways leading to the AGL building and the NDB site should receive a double surface treatment, consisting of prime coats and rolled crushed stone, since their utilization will be low.

All other access and interior service roads should consist of compacted tiff subgrade with a 1.75 inch asphaltic concrete wearing course.

For estimating purposes roads were considered to be 18 feet wide with 5 foot grassed shoulders on each side, and all drainage provided by open ditches. No curbing should be provided except in the immediate vicinity of the Airport Terminal Building.

Bagadi Bay Access - The Team was made aware of the requirement to maintain access to Bagadi Bay for the fishermen of the village of Calliste. The Project Manager indicated that in discussions with the residents of Calliste, the Grenadian Government has agreed to construct a minimal standard access road to Bagadi Bay. The road will be outside the confines of secured airport property.

Parking Areas - The Cuban design called for a 3 inch wearing course in all parking areas being provided. We recommend that this be reduced to 1 3/4 inches.

All facilities which are manned or require maintenance will require an area for vehicular parking and will be provided.

Grading for the auto parking at the Terminal Building is virtually complete, although some fine grading work will be required.

4.2.16 Road and Parking Area Lighting

The Metex contract included supplying and installing lighting for the parking areas and along the roads. Layout plans for the system could not be located, but it is assumed that the roads to be lighted are the access complete road system and the road to the fuel farm. It also is assumed that the quantity of lights called for is sufficient to light the Terminal Building main parking area, the area to the west around the Fire/Crash/Mail/Cargo Building and Generator Building, and some areas of the fuel farm.

High pressure sodium lamps on metal masts with photoelectric cell controls are to be used in parking areas and 35-foot high poles are proposed along the roads, spaced approximately 190 feet on center.

Since these systems are already purchased, including installation, and the only additional cost is the trenching and mast foundations, it is recommended that the systems be installed as designed, changed only so far as necessary to conform to any changes in layout of roads or parking areas.

Considering the nature and extent of parking requirements at the Point Salines Airport, the main vehicular parking area at the Terminal Building appears adequate and no recommendations are made to provide additional parking. Areas are available for future expansion if such need develops.

4.2.17 Signage

No drawings were found indicating that traffic signs were to be provided, but it is assumed that they were included since they are necessary. Standard traffic signs as used in Grenada should be used.

Also, no drawings were located of roadway directional and informational signs. Again, while a minor item, they must be designed and installed for the circulation system to function properly, even though traffic volumes will be low.

4.2.18 Road from Sugar Mill to Downtown St. George's

The airport construction scheme established the airport access as starting at the Sugar Mill Roundabout located 3.6 miles from the port of St. Georges and 3.8 miles from downtown. The primary road from this point downtown is in a serious state of deterioration with many potholes and an extremely rough bitumen treated surface. It is estimated that patching, minor leveling and providing a 1 3/4 inch plant mix asphaltic concrete overlay would cost in the order of $140,000 per mile.

The entire road system in Grenada is in poor condition and a large scale review of this situation must be carried out as part of the general upgrading of the Grenadian infrastructure. This section of road from St. Georges to the Sugar Mill Roundabout is considered to be an essential part of this necessary program. Thus, the costs associated with its improvement are not included as an airport cost.

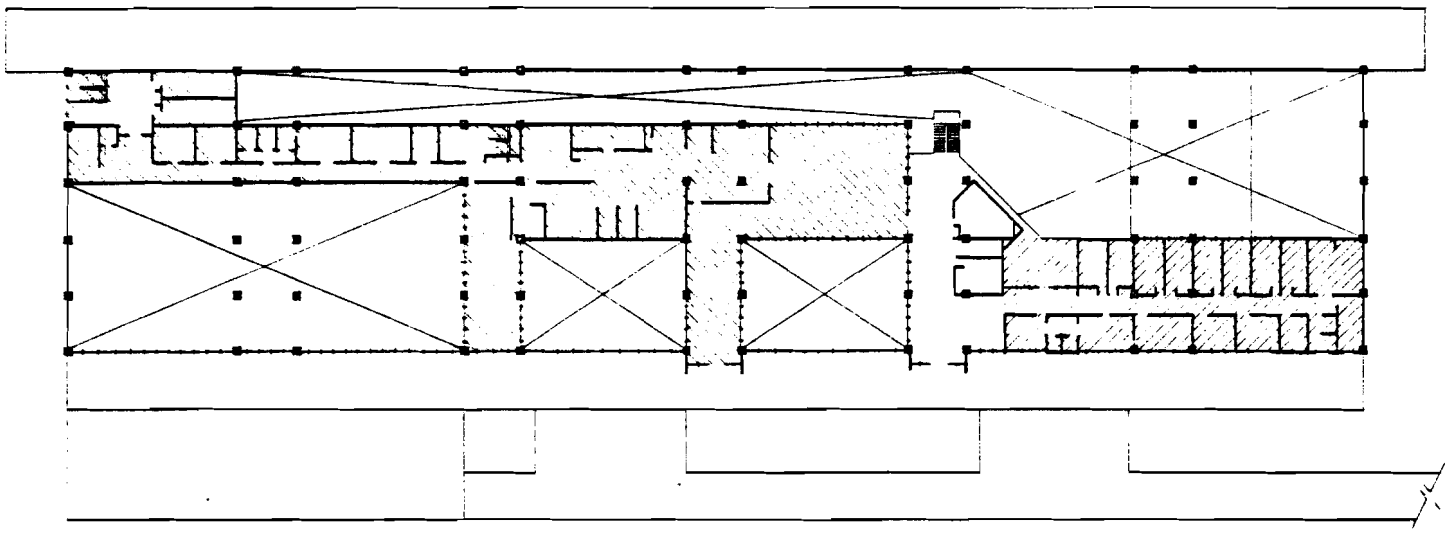
4.3 PRINCIPAL BUILDINGS

This section includes the buildings to be used for passengers, airport management and government functions. They consist of the Passenger Terminal Building, the VIP Building and three adjacent existing buildings - the "Great House", a small office building and a residence/office building. As with the other sections of this chapter, a description of the original design for each one is presented along with a report on the present condition of each and recommendations for any desirable changes.

4.3.1 Passenger Terminal Building

As typical for such buildings, this structure is designed to contain the facilities for the travelling public and their support. In addition there are offices for the management of the airport. Since this is an international airport, facilities for government control of immigration, customs and health are included.

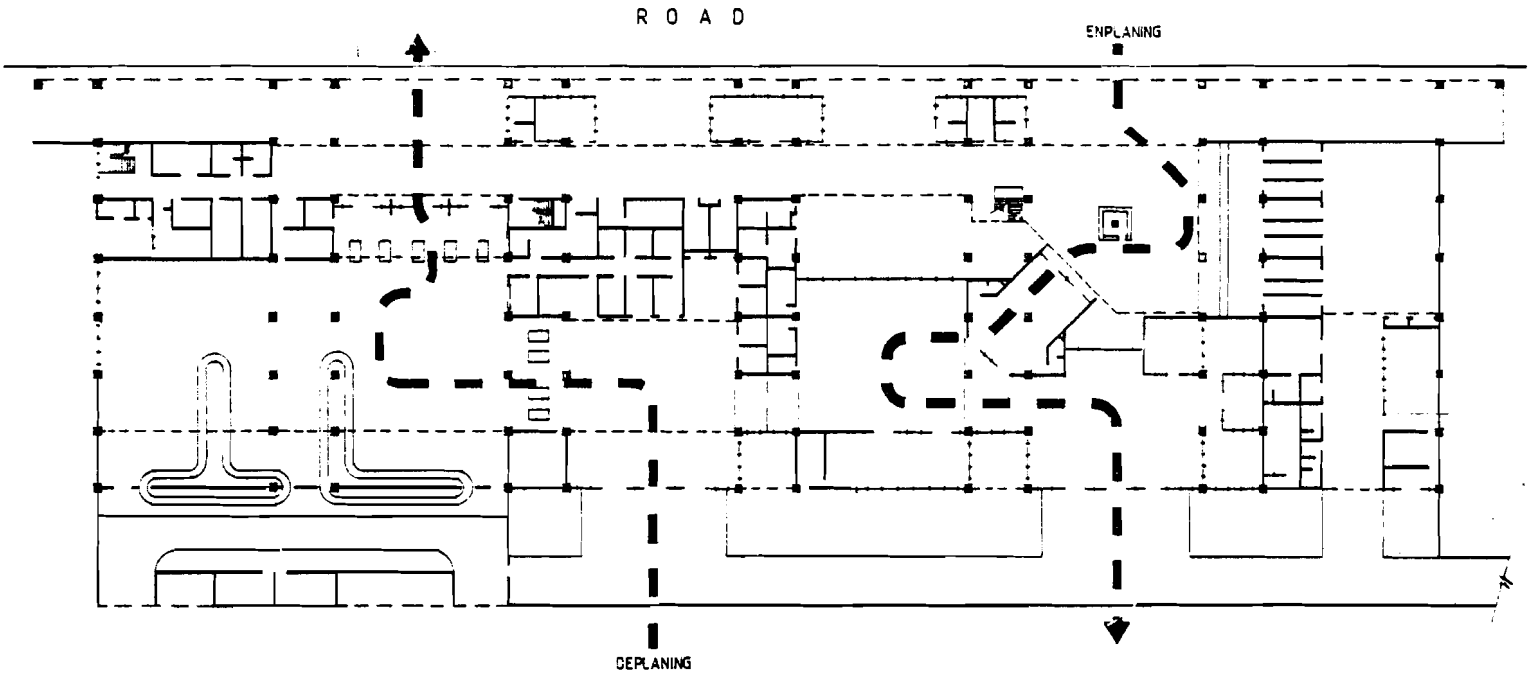
The building has a ground floor and partial upper floor. Large areas of the ground floor are open, due to the mild year round climate, and the major public spaces are generally two floors high. On the ground floor the building is divided approximately in half with the east end devoted to enplaning passenger facilities, including airline ticketing and baggage make-up areas, while the west end houses facilities for deplaning passengers with necessary government control areas and baggage claim facilities an integral part of the layout. (See Illustration 4). The upper floor consists of offices located on the east end of the building and restaurant, bar and kitchen areas occupying the western areas. A longitudinal gallery fronts the north, land side of the building at ground level and three concession areas are enclosed in the central part of the gallery between the building's main entrance and exit. There



OFFICES

RESTAURANT / BAR / KITCHEN

UPPER FLOOR PLAN



LOWER FLOOR PLAN

ILLUSTRATION 4 - TERMINAL BUILDING FLOOR PLANS

is also a covered gallery at ground level on the air-side of the building fronting on the apron. This connects back to the building passenger entrance and exit and continues from the VIP Building gallery on the east down to the projection of the baggage claim cart drive-through on the west end of the building. The gallery provides access to aircraft through "gate" openings. An observation deck fronts the building on the upper floor air-side.

The building has a steel frame consisting of six major 18-meter wide transverse bays with sloping roofs capped by monitors; the bays are separated by two-story high flat roofed transverse 6 meter wide sections. Upper floors and roofs are formed of precast concrete flat slab sections spanning between the steel framing. The building is laid out on a 6-meter by 6-meter column grid. Exterior solid walls are concrete block masonry as are typical interior partitions. Glass window walls enclose a great deal of the building and divide up large areas of the interior. Exterior walls from the upper floor line are sheathed in metal siding and faced with stucco below this level. Smooth membrane roofing covers the roof areas. (See Illustrations 10 to 20).

Terrazzo is used typically throughout as a floor finish; plaster for wall surfaces; and, acoustical panels, for ceilings. Toilet rooms and kitchen areas have ceramic tile on the walls.

Enclosed areas are cooled by air conditioning systems which are typically ducted from units which serve each major functional area of the building.

Included in the building are cabinets and counters for the airlines, offices and concessions; kitchen preparation, storage, cooking and serving equipment; a public address system; a flight information system with multiple displays; a telephone inter-communication system; baggage conveyers and two baggage claim conveyers.

The building has an area of approximately 103,000 square feet; this is a pro-rated area allowing discounted amounts for the upper part of the two-story spaces, unenclosed and covered spaces and decks.

The overall building is approximately 50 percent completed. The primary steel structure, floors and roofs are in place. The north gallery framing and roof deck is approximately 70 percent complete; the south gallery has not been started. Masonry walls and partitions are essentially completed. No window walls have been installed; no exterior metal siding is in place; exterior stucco is about 90 percent completed, and the roofing is about 50 percent finished. No terrazzo flooring has been placed on the upper floor and that in place on the lower floor must be finished by polishing. Interior wall and ceiling plaster is almost completed. No acoustical ceiling is in place. Electrical and communication system conduit is generally completed and a few high light fixtures are in place, but no wiring or devices have been installed. Plumbing system piping is in place; no fixtures have been installed. The air conditioning systems have not been started. No cabinets, counters, kitchen equipment or baggage conveyers have been installed.

Some minor damage to the building occurred in the intervention and later use by the military, but overall the building construction is in good condition. Cased stacks of precast concrete planks were used as barricades and these suffered some damage. Some finish materials present in the building but not installed were used for temporary partitions and protection and were damaged. Considering the circumstances, the damage was minimal and the fabric of the building in place is essentially unharmed.

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The master plan for the airport prepared by the Cubans called for a terminal building approximately half the size of the one presently being constructed and the smaller size is what is required by the traffic forecasts for the airport (See Chapter 3); however, the building construction has advanced to the point where rearrangement of spaces to halve the sizes of each area would cause so much demolition that the cost savings for not completing half the building would be offset by the cost of demolition and reconstruction of the remaining half to be finished; therefore, it is recommended that certain portions of the building be left unfinished and the remainder of the building be completed. This will result in a terminal building larger than actually required, but it will also allow addition or expansion of functions within the building envelope if requirements develop in the future. Contributing to this recommendation is the fact that all of the materials and installation for the electrical, communications, plumbing and mechanical systems and the cabinet work, conveyer systems and kitchen equipment have already been purchased under the Plessey contract although only a minimal amount has been installed.

The following modifications are recommended to the original design of the building:

- Leave the upper floor offices area uncompleted and in its present state of finish. Space for meteorogical and aeronautical information services offices is available in the airline area of the ground floor which is a logical location for these functions. Airport management offices could occupy the existing buildings on the ridge which are not as convenient but are available for use. The office area can be sealed off relatively easily.

- Do not complete the restaurant, bar and kitchen areas of the upper floor. Food service requirements for passengers can be supplied by the two snack bar areas on the ground floor. Aircraft catering can be supplied from a remote restaurant by contract for the limited needs foreseen. The original design separates these areas from the rest of the building with mainly glass window walls which can be completed to seal off the areas, physically and visually.

- Do not finish the portion of the west bay of the building devoted to baggage claim, and do not install one (of two) baggage claim conveyor. Forecasts indicate that one conveyor can handle the traffic and the second conveyor and space are not needed. The bay would have to be partitioned off (an added expense) but its location on the end of the building with delivery access would make it usable for warehousing and storage.

- Do not construct the three concession enclosures under the north gallery. These are not yet begun, and space for the minimum concessions required can be found in the overlarge government office area and other concession areas which are also too large.

- Leaving certain areas unfinished means that a great deal of equipment (such as the baggage conveyer and kitchen equipment) which has already been bought will not be needed. These could be re-stocked at practically no savings, sold to other concerns, or stored against a future requirement for completion of a deleted function.

- Omit the gallery on the south side of the building at the edge of the apron. Covered boarding of aircraft was not originally proposed (and is not necessary). The omission of the gallery will leave passengers exposed for only a few feet more. Construction of the gallery and related covered walks to the building entrances has not started, and available steel framing and precast concrete plank roof deck material can be stored for future use.

Since separate air conditioning systems are designed to serve specific areas, the equipment and ductwork for the office and restaurant/kitchen areas need not be installed, and can be stored for future use, re-stocked or sold.

Window walls surrounding unfinished areas would be installed since they have already been purchased. The interior of the glass could then be coated to block view into the unfinished spaces.

The recommendations for reduction in the finished terminal areas will leave a usable and adequate building. The pro-rated usable area of the building remaining will be about

70,000 square feet (for comparison with the originally approximately 103,000 square feet). This is more space than required for the terminal, but it exists and further reductions will not provide any appreciable savings.

Because materials and installation for systems in the building and other construction meterials have already been purchased, it is estimated that only approximately $500,000 can be saved in the initial construction cost by the changes recommended. This is a minimal saving, but reduction of finished areas and deletion of areas will reduce the cost of continuing maintenance and operation of the building and this reduction is appreciable over a period of years.

The Terminal Building designs contain a number of flaws and these should be re-examined by architects and engineers. An example is the layout of the airline ticketing area which is (1) set up for 6 equally used airlines, a situation which will not occur, and (2) has an excessive 6 baggage conveyer belts to the baggage make-up area. Some items do not lend themselves to re-design at this late date (the unnecessary enclosure of the baggage claim cart driveway already in place, for example) but the entire building should be reviewed for additional reasonable changes to increase efficiency and minimize maintenance and operation costs.

4.3.2 VIP Building

This building is designed to serve the government ceremonial and protocol functions for arriving and departing important persons. It is located directly to the east of the Passenger Terminal Building.

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The building contains about 5,000 square feet of enclosed and finished space. It has a covered entrance on the south apron side leading to a covered gallery running along the north edge of the apron as an extension of the Terminal Building gallery; this gallery ends at a parking area east of the VIP Building

Besides the reception and lounge area, the building has toilet room and kitchen areas. It has a central cooling system. Construction consists of masonry bearing walls and a precast concrete plank flat roof deck system. Interior finishes are elaborate.

The concrete foundations of the enclosed building area are about 80 percent completed. No floor slab has been poured.

This entire building is considered unnecessary, and it is recommended that the building and related covered gallery be omitted.

However, the government functions that the building was designed to serve, are necessary ones and these should be provided for in the Terminal Building with a formal reception room(s), lounge(s), and appropriate private toilet room.

4.3.3 Miscellaneous Buildings

There are three existing buildings located along the ridge above and overlooking the Terminal Building area to the northwest. Adjacent to the control Tower/Technical Block is the so-called "Great House" which was the older large house of the owner of a major portion of the property on which the airport stands. Further to the northeast along the road leading to the "Great House" is a small office building apparently constructed

and used by the Cubans as a political control and propaganda office. Still further to the northeast near the beginning of the spur road is a residence, probably built as a guest house for the "Great House", serving as an office building for the Airport Project Manager.

The "Great House" appears to be somewhat run down and it suffered some minor damage in the fighting. It is a one-story masonry building with a number of small additions "tacked on" over a period of time. It appears to be a comfortable medium-size residence.

The small office building is of masonry construction, essentially consisting of two fairly large rooms with adjacent toilet room and storage areas. It appears to be in good condition although it has suffered some minor damage.

The residence/office building contains three bedrooms and a living room all opening off an enclosed gallery running the length of the building and overlooking the Terminal. In addition, a kitchen and three bathrooms open off the principal rooms. Construction is masonry with a pitched shingled roof. The building is in good condition, needing only minor repairs to interior finishes.

No airport-related use for the "Great House" is envisaged, and it is recommended that the Government decide if there is another use to justify the building's existence and/or repair. The small office building and residence/office building should be used for required offices for airport management. Although the location will be somewhat less convenient, these offices can replace those in the Terminal Building which should remain unfinished.

4.4 UTILITY SYSTEMS

The airport development is served by electric power systems, water supply systems, sewage disposal systems and telephone communications systems. These are all basic to the operation of the airport. The Plessey contract includes providing and installing a substantial amount of these systems; much of the material and installation have already been purchased and the installation work is well advanced.

4.4.1 Electric Power Supply

Normal power is delivered to the site via an overhead line to a point approximately 60 feet north of the Generator Building. This line will extend underground to three 1000 KVA, 11 KV - 440/220 oil filled, pad-mounted transformers at the Generator Building.

As is customary, standby emergency power is provided for essential operations at the Airport only through provision of three 150 KVA generators. Operating in parallel, they provide 450 KVA of power to essential elements in the Generator Building, Terminal Building, Fire/Crash/Mail/Cargo Building, Control Tower/ Technical Block and apron lighting.

Normal power is delivered to all buildings on the airport via underground cable from the Generator Building, except for the warehouse and Maintenance Area which are supplied directly from utility company lines.

Emergency power for the Non-Directional Beacon (NDB) equipment and airfield lighting systems is supplied by separate generators at the NDB and Airfield Ground Lighting (AGL) Buildings.

The future Very High Frequency Omni Directional Range with Distance Measuring Equipment (VOR/DME) system will be supplied by underground cable and emergency power will be supplied by a generator.

All of the cable, generators, transformers, switching gear, controls, etc., for the normal and emergency power systems are contained in the Plessey contract.

Power cable from the Generator Building to the Terminal Building and Fire/Crash/Mail/Cargo Building are installed; 80 percent of the cable to the AGL Building is in place. No other power cable is installed. Transformers, generators, switch gear and control panels are presently installed in the Generator Building. The connection from the overhead main line to the Generator Building is not yet in place.

It is recommended that the electric power system as designed be completed. Only minor additional costs for trenching, some cable duct, etc., will be incurred.

4.4.2 Water Supply Systems

Water is supplied by a main from the public system. There is a large concrete cistern providing the reserve necessary for fire protection. A steel tank, located on the height north of the Terminal Building, and pumps provide the necessary operating pressure.

The maintenance area and warehouse are supplied by a separate main, and the fuel farm has a separate spur main also.

The mains are in existence, and the distribution lines are about 80 percent completed, the cistern and tank are in place.

Since the system is essentially complete, what little remains to be done should be finished.

4.4.3 Sewage Disposal Systems

All of the buildings of the central area of the airport around the Terminal Building are served by a piped underground collection system which crosses the runway and extends to the peninsula between Hardy Bay and Grand Bay, where a treatment lagoon is to be constructed. The lagoon is designed as a concrete lined lozenge-shaped basin with a concrete lining consisting of precast panels. The outfall line from the lagoon for treated effluent is to Hardy Bay.

All other remote areas are to be served by individual septic tanks and effluent disposal in dry wells. The sewer collection lines are about 80 percent completed. No work has begun on the lagoon.

The lagoon appears to be oversized for the reduced scope of the Terminal Building which is the major contributing element. It is recommended that the design for the lagoon be reviewed, the size required established, and sufficient size for the initial construction be built. The lagoon can be increased in size in the future as necessary. Consideration should be given to using a membrane liner for the lagoon instead of the proposed precast concrete panels to produce a cost saving. The lagoon location is fairly far to the south on the peninsula and this uses up what can be valuable land, as discussed in Section 4.8 below. The location should be moved as far north toward the runway as possible considering topography, its relation to collection systems and outfall line location.

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4.4.4 Telephone Communication Systems

Commercial telephone lines for the airport are being provided by the Grenadian Telephone Company run underground to the vicinity of the Terminal Building. The internal airport telephone and intercommunication system are a part of the Plessey contract including cable, racks located in the Technical Block and PABX equipment in the Terminal Building. As emergency back-up for the commercial cable service to St. Georges, a radio link between the Airport and the telephone company is being provided by Plessey to a receiving tower at the telephone company.

The commercial cable is in place, about 50 percent of the internal underground cable has been installed and the radio receiving tower has been erected by the telephone company. No other equipment has been installed although conduit has been extended into the buildings.

It is recommended that the system as designed be completed except that unfinished areas of the Terminal Building should be omitted.

4.5 AERONAUTICAL OPERATIONAL FACILITIES AND SERVICES

Under this heading, Airfield Lighting, Air Navigation Aids, Air Traffic Control Tower and Technical Block, Aeronautical Information Services and Meteorological Services are discussed. The provision of these essential operational facilities and services is vital to the safe, effective and efficient operation of Point Salines International Airport (PSIA). As a node in an international air transportation network it is mandatory that the equipment, systems and procedures recognize internationally adopted standards and recommened practices.

4.5.1 Airfield Lighting

At present, air transportation in and out of Grenada is provided through Pearls Airport. Due to site and facility limitations, operations at Pearls Airport are restricted to daylight hours and Visual Meteorological Conditions (VMC). Due to the route configuration and the scheduling restrictions of the only air carrier serving Grenada (LIAT), all passengers from points of origin north of Barbados, destined for Grenada must overnight in Barbados, thus denying the traveller the basic advantage of aviation (uninterrupted direct service from origin to destination). Approved airfield lighting will provide for safe and reliable night operations. This single feature of the total modernization program will create large benefits.

The airfield lighting system proposed for PSIA has been reviewed and satisfies International Civil Aviation Organization (ICAO) standards and the operational objectives. The system will consist of the following:

(a) An Aerodrome Light Beacon, rotating, giving green and white flashes and

mounted on the Airport Traffic Control Tower.

(b) Runway Edge, Threshold and End lights, High Intensity, controlled remotely from Airport Traffic Control Tower (ATCT) with 5 brightness steps.

(c) Taxiway Edge Lights. Elevated omnidirectional 45 watt blue fittings.

(d) Apron Edge Lights. Elevated omnidirectional 45 watt blue fittings.

(e) Lighted Wind Cones, 8 feet externally lighted wind cone assemblies, to be located near the thresholds of Runway 10/28. They will have obstruction lights and will be controlled from the panel in the ATCT.

(f) Obstruction Marker Lights. Single unit lights will be used to mark installations located in the airport area. Double unit lights at off-airport area locations for instant change-over to a reserve lamp. These double unit lights will be automatically controlled by a photo-electric switch.

(g) Omnidirectional Simple Approach Lighting System, 1000 feet long with crossbar.

(h) Precision Approach Path Indicator (PAPI). Designed in accordance with ICAO recommendations. An eight unit installation (4 units each side of runway) is proposed.

(i) Apron Flood Lighting, five 1500 watt tungsten halogen lamps mounted on 60 - foot masts.

As previously indicated normal power will be delivered to the site via overhead lines to a point 60 feet north of the Power Generating Station thence underground to the Power Generating Station, to three 1000 KVA - 440/220 V oil filled, pad mounted, transformers and thence via underground cable to the AGL Substation. Emergency power for the AGL Substation will be furnished by an 87.5 KVA generator. All airfield lighting circuits will be distributed from the AGL Substation. All runway, taxiway, approach, PAPI and apron edge lighting circuits will be fed through constant current regulators and will be remotely controlled from the Airport Traffic Control Tower.

At the present time, 80 percent of the underground power and communications cables between the Power Generator Station and the AGL Substation are in place. The following table indicates the status of the Airfield Lighting.

TABLE 4-1

STATUS OF AIRFIELD LIGHTING

	Percent Installed			
	Power Cable	Transformer Bases	Transformers	Fixtures
Aerodrome Beacon	100	---	---	0
Runway Lights	70	70	0	0
Apron Edge Lights	100	100	0	0
Wind Cones	0	0	0	0
Obstruction Lights	0	0	0	0
Approach Lights	100	100	100	0
PAPI	100	100	100	0
Taxiway Lights	0	0	0	0
Flood Lights	0	0	0	0

The AGL Building is a square one-story building containing approximately 1,500 square feet. It consists of two rooms designed to house the AGL systems control equipment. Construction consists of a light poured-in-place concrete frame supporting a flat precast concrete plank roof deck and concrete block masonry exterior walls.

The building is almost completed; glazing of openings and installation of air conditioning have yet to be done. It suffered very minor damage and possibly could use a fresh coat of exterior paint.

It is not possible to develop any detailed comment on the quality of the equipment being furnished nor on the workmanship of the installation crews since the condition of the

equipment warehouse and storage areas did not permit a detailed inspection and little installation has been completed. However a cursory inspection indicated that some of the materials observed are not suitable for the corrosive salt air of the island. For example, some pad mounted transformers are already rusting.

As indicated above, the plan for Airfield Lighting will adequately meet the forecast requirements of PSIA through the year 2000. The existing contracts with Plessey Airports Ltd. and Metex Corporation implement the plan. All items are considered necessary, and no additional expenditures are forecast to complete.

4.5.2 Air Navigation Aids - Recommended Master Plan Revisions

Airfield Lighting, when operational, will modernize air transportation to Grenada from a day-only level of operations to day-and-night operations but will do nothing to increase the reliability of service by extending operations from Visual Meteorological Conditions (VMC) limitations to periods of time when ceilings and visibility are below those permitted under Visual Flight Rules (VFR). The requirement for reliability increases with increases in traffic volume. The benefits from increased reliability are exponentially proportional to the increase in traffic.

The Air Navigation Aids to be discussed in this section are Non Directional Beacon (NDB), Doppler Very High Frequency Omnidirectional Range with Distance Measuring Equipment (DVOR/DME), Very High Frequency Direction Finder (VDF), Instrument Landing System (ILS) and Microwave Landing System (MLS).

The NDB is a low/medium (200-400KHz) radio navigation aid which provides the pilot heading information to or from the NDB. The NDB will permit the establishment of an instrument approach

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Procedure at PSIA reducing minima below VFR. NDB's are standard in the Caribbean area and are popular with air crews. The NDB is inexpensive to operate and maintain, highly reliable, and can be monitored with a simple receiver. The NDB has, however, disadvantages. It is adversely affected by atmospheric conditions and its accuracy is limited since it provides bearing not tracking information and provides no distance information. In spite of its deficiencies the NDB should be a primary nagivation aid for PSIA and its installation as the initial aid for the airport is recommended. The procurement and installation of a standard approved NDB is included in the Plessey contract, therefore no additional funds will be required to meet this requirement.

At present, the antenna tower has been erected, the transmitters and standby engine generator are in place, but not installed. No power cable has been brought to the NDB building, nor has the cable between transmitters and antenna been installed. The electronic installation program is approximately 65 percent complete.

The NDB building is one-story, rectangular, containing approximately 630 square feet. It was designed to house the NDB transmitter and controls and standby engine generator. Construction is the same as that of the AGL Building.

The building is essentially complete and has sustained only minor damage. The air conditioning has yet to be installed, and a fresh coat of exterior paint is needed.

The Master Plan recommends that a DVOR/DME be installed to serve both as an enroute aid and as an instrument letdown facility. This aid is a comparatively sophisticated, static free electronic device. Since it provides distance and bearing

information and track guidance it pinpoints the position of an aircraft in polar coordinates (rho/theta) around the aid and permits economic and efficient air networks to be established. The justification for the doppler version of the aid (the first D in DVOR/DME) is to accommodate the terrain problems encountered at the site selected by the planners.

At this time the only work accomplished toward the establishment of the facility (other than site selection) is the procurement of a stand-by engine-generator under the Plessey contract.

A VOR/DME facility will be required by the year 2000, however its establishment is not required in the initial stages and may be deferred. There are at present only two VOR's in the Windward and Leeward Islands (St. Lucia and Antigua); NDB is the primary aid. It appears that the planners' site selection was premised on a map study which may not have resulted in the selection of the most effective site. It is recommended that before any action is taken toward the procurement of a VOR, a site selection search be conducted using portable VOR site search gear. Purchase of the VOR/DME should be deferred; the engine-generator may be stored or sold.

The Master Plan suggests that since no radar is contemplated for the surveillance of aircraft, a VDF be installed to locate aircraft and provide aircraft, through a voice link, positional information. No data on lost aircraft have been located that would justify the procurement of this device and the cost and time required to train controllers to use it. It is recommended that this device be eliminated from the plan.

The Master Plan also indicates that by 1990 there will be a requirement for precision approach and landing aids (ILS or MLS). The traffic forecasts indicate that precision approach and landing aids will not be required at PSIA until after the start of the 21st. century. For the immediate future an NDB coupled with the PAPI will provide adequate longitudinal and vertical guidance for approach and landing. If a higher level of longitudinal guidance is required, that should be met through the establishment of approach procedures using a properly sited VOR/DME. In addition, due to the physical configuration of the airport, the full advantages of an ILS or MLS installation could not be realized. Therefore, it is recommended that plans to establish an ILS or MLS be cancelled.

4.5.3 Air Traffic Control Tower and Technical Block.

The Air Traffic Control Services to be provided by the Government of Grenada will be rendered through two interconnected facilities (a) An Air Traffic Control Tower (ATCT) and (b) An Aeronautical Information Service (AIS). Whereas the ATCT will be discussed in this section, the AIS will be discussed in section 4.5.4. In addition to the ATCT, this section will address the Technical Block.

The functions of the ATCT are to provide for the safe and expeditious handling of air traffic on and in the vicinity of the airport, to control the movement of other vehicles on the surface of the airport, to alert the Crash/Fire/Rescue Service and participate in its activities, and to assist in the dissemination of Meteorological data. To provide these services two console positions will be established in the ATCT Cab, an Aerodrome Control position and an Approach Control position. Both positions will have access to the following subsystems:

(a) VHF air-ground-air Aerodrome Control with local antennae.

(b) VHF air-ground-air Approach Control with local and remote antennae.

(c) VHF Surface Movement Control with local antennae.

(d) VHF (121.5MHz) Emergency, Search and Rescue, with local and remote antennae.

(e) Dedicated Interphone Service, both local and point-to-point.

(f) Emergency (Red Phone) Service (Fire Station).

(g) Closed Circuit Television (CCTV) from Meteorological (MET) office.

(h) MET displays (observations).

The remote antenna farm will be located on St. Catherine mountain and a UHF link will be established to interconnect the antenna farm with the ATCT. A radio link will also be established between PSIA and the Grenada Telephone Company to carry the point-to-point dedicated interphone traffic. A 12 channel recorder system will record all voice communications to and from the tower cab.

The Technical Block, located below the ATCT cab, will contain administration office, an electrical and electronic maintenance and repair work room and a parts and equipment storage area.

Normal power for the ATCT and Technical Block will be furnished via underground cable (none of which is presently installed) from the Power Generator Station. Emergency Power will be supplied from a system of three 150 KVA generators

operating in parallel to provide a total of 450 KVA of power to essential elements in the generator station, Terminal Building, SAR/Cargo/Mail Building, apron lighting as well as the ATCT and Technical Block.

The transmitters, receivers, consoles, interphones, links, recorders, displays, spares, test equipment and tools required in the Tower Cab, Terminal Block and Remote Antenna Farm will be furnished under the Plessey contract. None of this equipment has been installed nor has it been possible to physically inspect the hardware. Study of the operational requirements and a review of Plessey contract documents dictates that the equipment proposed to be furnished will meet the requirements.

The Control Tower/Technical Block building stands on a high ridge of land just below and to the south of the "Great House" and due west of the Terminal Building. It consists of a four-story octagonal tower connected by a short passageway to a rectangular one-story building designed to house offices, equipment and personnel support functions. The Tower has a ground area of about 900 square feet, and the Technical Block contains approximately 2,100 square feet.

The Tower top level is the control area "cab" with sloped walls of glass on all faces, surrounded by a narrow walkway on the exterior. The cab is accessed by a steel stair rising from the ground level through the supporting tubular area. The Technical Block is symmetrical about a center entrance lobby leading to passage to the Tower. The west area of the building has offices, kitchenette and eating areas and a toilet room. The east area contains equipment and control rooms.

The building has masonry exterior bearing walls. The Technical Block is roofed with precast concrete deck planks. The Tower cab roof framing and supporing mullion columns are steel. The exterior of the building is finished with stucco. Interior concrete block masonry partitions and exterior wall surfaces are plastered; terrazzo finish flooring is used throughout; ceilings are typically plaster.

The building is about 80 per cent complete. The Tower stair, glazing of the cab and all other openings, and air-conditioning remain to be installed. The building suffered only minor damage and interior and exterior painting is the major remedial work needed.

Three operational comments are appropriate:

1. The mullions supporting the cab roof are very thick and will restrict the air traffic controllers visibility.

2. The overhanging roof of the tower cab will excessively limit the amount of sky that the air traffic controller can see from a fixed position.

   However, the above failings are not considered sufficient to warrant the expensive action it would take to eliminate these deficiencies.

3. Terrain limits the ability of the air traffic controller to continuously monitor aircraft approaching the airport from the west, the predominant approach direction.

As previously indicated the removal of sufficient terrain to establish line-of-site is recommended (See Section 4.2.4).

4.5.4 Aeronautical Information Services/Meteorology - Need for Automatic Ceilometer

Aeronautical Information Services/Meteorology (AIS/MET) will provide services which may be categorized as follows:

(a) Communications - AIS/MET will function as the point-to-point (fixed) data communications service for both the Air Traffic and Meteorological Services. The Air Traffic Services requirement for point-to-point voice communications will be met directly by the ATCT.

(b) Preflight Briefing - AIS/MET will provide air crews with information concerning changes in serviceability of navigational aids, changes in condition of aerodromes and associated facilities, collision hazards, weather conditions reported or forecast at departure, destination and alternate aerodromes and enroute, Notices to Airmen (NOTAMS), and aeronautical charts.

(c) Weather observations - Take and file periodic and special weather observations.

(d) Flight Plan Filing - Accept and transmit to ATCT, flight plans ground filed by air crews.

The AIS/MET facility will be housed on the first floor, east end, of the Terminal Building. The following subsystems and circuits will be terminated in the AIS/MET quarters:

(a) CCTV (camera & monitor) circuit to ATCT.

(b) Meteorological sensing and display equipment for:

  (i) Wind direction and velocity.
  (ii) Barometric Pressure.
  (iii) Duration and rate of rainfall.
  (iv) Temperature.
  (v) Humidity.

(c) Aeronautical Fixed Telecommuniations Network (AFTN) Grenada/Kansas City.

(d) Meteorological LTT circuit between Point Salines and Barbados Regional Meteorological Office.

The CCTV and the meteorological sensing and display equipment will be furnished and installed under the Plessey contract. The equipment described in the Plessey contract should meet the above stated requirements. However, there is a need for a means of measuring the ceiling and therefore an automatic ceilometer should be installed. It is estimated that this requirement could be met at a cost of $11,000. The AFTN and MET circuits would be furnished under a lease arrangement with Grenada Telephone Company and Cable & Wireless (W.I.) Ltd. Other than the procurement of the Plessey furnished hardware, no work has been done in the AIS/MET area. It is recommended that immediate action be taken to describe the services required from Grenada Telephone and from Cable & Wireless and to negotiate agreements with these carriers.

4.6 SUPPORT FACILITIES

Except for the primary utility systems, these facilities include the installations required to support the aeronautical activities of the airport: The crash-rescue-fire and cargo and mail areas; the fuel farm; the government hangar; maintenance shop area; the warehouse; the refuse disposal area; and the construction offices and camps.

4.6.1 Crash/Fire/Mail/Cargo Facilities

Included in this classification are the area containing the fire, mail and cargo facilities west of the Terminal Building and the rescue boat area on Bagadi Bay. The area west of the Terminal Building contains the Crash/Fire/Mail/Cargo Building, a fire training tower and hose drying racks. The rescue boat area contains a boat shed and launching ramp.

The concrete paved area surrounding the Crash/Fire/Mail/Cargo Building adjoins the Terminal Apron. The building consists of an 1,800 square foot central, high clearance area housing two open emergency vehicle parking bays, an open vehicle maintenance bay and one enclosed cargo warehouse bay; the 1,400 square foot west lower wing contains the emergency crew offices, quarters, kitchen and toilet facilities; the 1,400 square foot east wing is designed for mail handling.

The building has a steel frame supporting a pitched asbestos-cement covered roof. Exterior walls are concerte block masonry with plaster finish. Floors in the west wing are finished with terrazzo; concrete paves the vehicle bays and is the finish flooring for the cargo and mail areas.

The concrete paving south of the building is in place. The building is about 80 percent complete; roll-up doors, finished ceilings and glazing have yet to be installed. There is only minor damage resulting from use.

Off the west corner of the Crash/Fire/Mail/Cargo Building is a proposed fire training tower, four stories high with a ground area of 400 square feet, poured-in-place concrete frame and masonry exterior walls. No work on this tower has been started.

Directly north of the fire training tower are two parallel elevated poured-in-place concrete troughs approximately 100 feet long designed for drying fire hoses. Work on these hose drying troughs has not begun.

At the west end of the runway embankment crossing Hardy Bay is the beach location for a shelter and launching ramp for sea rescue boats. Unable to find any drawings describing this facility, the verbal description of the Project Manager is the basis for the estimate of scope and cost.

It is recommended that the Crash/Fire/Mail/Cargo Building be completed as designed. The areas are not excessive or very elaborate. The fire training tower can be deleted. One exists at the main fire station in St. Georges and can be used for training there. Hose drying facilities are necessary and the troughs should be constructed as designed, although it appears that the design could be simplified to save a minor amount of cost. The boat shed area must be built and the estimated costs to complete assume a minimal facility.

4.6.2 Fuel Farm Facilities

Located in the valley northeast of the Terminal Building Area is a large development to provide aircraft fueling storage facilities. The location is near the water on the north side of the peninsula to facilitate supplying the storage tanks from tankers anchored off the coast. Supply to aircraft on the apron will be by tank trucks over the connecting roads. The facility, as planned, provides for marine supply to storage tanks, control of the fuel and dispensing to the trucks.

The facility design proposes two 500,000 gallon vertical cylindrical storage tanks, two 250,000 gallon tanks of the same type and two smaller similar tanks whose proposed capacity could not be determined. According to information from the Project Manager, it was proposed that the two largest tanks be used to store diesel fuel for national use, that the two medium tanks to be used for aviation fuel and the two smallest tanks for bulk lubricants storage.

The marine supply system includes buoyage, lines, pumps and controls. Tank and fill piping and controls provide a complete system including filters, valves, gauges, pumps, vehicle fill stand, meters, etc.

The Cuban design shows a complete internal road system giving access to the truck fill stand, the marine pump house and the storage tanks. As required for safety, the tanks are surrounded by earth dikes. The main area is surrounded by double fencing forming a perimeter security corridor, and single fencing forms a corridor to the beach.

A number of buildings are proposed for the area. No detailed design plans were found, but overall fuel farm drawings show the following: marine receiving station, 250 square feet; marine pumphouse, 450 square feet; distribution station, 200 square feet; entrance guardhouse, 125 square feet; lubricant storage building, 3,300 square feet; office building, 280 square feet; and a pump station, 1,000 square feet. The truck fill stand is shown, 1,500 square feet in size, and it is assumed this is a shed only.

An elevated water supply tank is included and a septic tank system is proposed for sewage disposal from the area. Exterior lighting is included.

Two 500,000 gallon tanks and two 250,000 gallon tanks are presently in place. A single fence surrounds part of the area. Some rough grading of the main area and dikes has been accomplished. The tanks apparently suffered no damage based on a cursory visual inspection. The fenced area is presently a military communications center.

No detailed inspection or analyses of the tanks have been carried out. The engineering designs should be available from the firm which provided and constructed them, and the structural design should be reviewed for adequacy. It is assumed that they are structurally adequate for storage of fuel.

The fuel farm for the airport should be provided by a concessionaire under a leasing agreement with the Government of Grenada. Under this arrangement the Government of Grenada would furnish the land as well as certain buildings, the two 250,000 tanks, which are in place, and other facilities at the existing location of the fuel farm.

Estimates of fuel requirements for aircraft indicate that the 250,000 gallon storage tanks will initially have considerable excess capacity. Since they are available, it is recommended that they be used but that appropriate actions be taken to minimize evaporation losses. A floating internal roof should be installed on each tank and the tanks should be painted white (finish coating) to reduce the fuel evaporation rate.

Storage for aviation gas, general aviation and other smaller aircraft should be provided. The Cuban planning originally called for four steel horizontal tanks of approximately 6,500 gallons each. The concessionaire could furnish the required two tanks of appropriate size, relieving the Government of this capital expenditure.

Piping and control systems are a part of the Plessey contract. These systems are more extensive than required for the Airport since they are designed to serve the large tanks now in place. The existing contracts with Plessey to furnish and install piping, pumps, fittings, valves, etc. and with Metex for fuel trucks will require modification to meet the requirements of the oil company selected to perform the fuel function.

The concessionaire would use the facilities as made available by the Government of Grenada and will provide those additional facilities necessary for a complete fueling service of the airport. It is recommended that the smallest bulk lubricant tanks not be installed and that buildings be held to a minimum. The piping and control systems are already purchased and their installation paid for, and these should be installed as designed. The dikes must be completed. Interior circulation roads other than those used by the tank trucks (discussed in 4.2 above) should receive a double surface treatment in lieu of a paved wearing surface.

Single fencing should be completed around the main area and corridor to the beach. A minimal office/laboratory building should be erected in a location to control main gate access; the lubricant storage building should be built; redesigned minimal shelters for pumps, controls and fill stand should be installed. The water tower (already paid for) should be erected and an adequate septic tank installed.

The other two existing 500,000 gallon tanks could be used by the Government of Grenada for non-airport purposes. Some reference has been made to a need for expanding the nation's diesel fuel reserve supply, due to the sometimes erratic delivery by tanker.

4.6.3 Government Aircraft Facilities

There is a hangar to house and provide for maintenance of an airplane to be owned by the Grenadian Government. The hangar is located on the east of the small apron toward the west end of the runway. It is a square building approximately 60 feet on a side. Construction consists of a steel structural frame sheathed in corrugated asbestos cement panels on three walls and the pitched roof; the west apron front is open. At the side are offices, a kitchenette and toilet room partitioned off by concrete block walls; there are no ceilings. The building was completely finished, has been heavily used during the intervention and has sustained considerable damage as a result. It is recommended that the restoration of the building take place at the time a use for the building develops; such use might be by a fixed base general aviation operator or by an airline for maintenance of light aircraft.

It is our understanding that the Cubans furnished a light aircraft for the Government of Grenada but that it is no longer on the island.

4.6.4 Maintenance Facilities

A maintenance area exists. It is a fenced area, unpaved, containing a number of buildings which eventually would serve as the support for maintenance of buildings and grounds and airport vehicles. Paving of the area was planned, as well as upgrading of the buildings after completion of the construction of the airport.

The area contains buildings used for vehicle fueling, vehicle repair, shops and offices. The buildings are mainly of wood construction with the vehicle maintenance shop and shed being steel frame with some masonry walls. Some of the buildings have been badly damaged. It is recommended that the buildings be

restored, the area be paved, the perimeter fencing be repaired, a new entrance to the area be built and area lighting be installed. Some of this work can be deferred to the end of the construction period, but the aim should be to develop a suitable permanent area as a base for maintaining the airport. Thought should be given to re-locating and using buildings and facilities from the construction office and Grenadian construction camp areas.

4.6.5 Warehouse Facilities

A warehouse building used by Plessey for storage of equipment exists. It contains about 6,800 square feet, has a steel frame and is sheathed in asbestos cement panels on walls and sloping roof. The building sustained minor damage. Plans called for this building to serve as a permanent warehouse facility for the airport. Although storage space is always needed, it is hard to justify the size of this building to support operation of the airport. However, the cost for restoration is minimal, and it will undoubtedly be used during construction. No further expenditures are recommended such as for paving the surrounding area, unless some specific use for the building develops in the future.

4.6.6 Refuse Disposal Facilities

An elaborate area for handling disposal of solid waste was planned. Located near the maintenance area, it would contain, in a fenced area, an incinerator covered by a shelter, a toilet building for workers, an above-ground cistern and pumphouse, a vehicle and tank wash stand and a wheel disinfection drive-through. The incinerator has already been purchased and installation paid for. It is recommended that it be installed adjacent to the maintenance area and be protected by a shelter as planned. The vehicle wash stand should be constructed in the maintenance area where the existing water supply, toilet facilities and septic tank can take care of cleaning and personal hygiene requirements. No other facilities are needed.

It is important to note that the incinerator is required to meet international requirements for health standards; it is an ICAO mandated provision.

4.6.7 Construction Facilities

Three areas containing construction support facilities exist: the construction office area located northwest of the Terminal Building, the Grenadian construction camp north of and the Terminal Building, and the Cuban construction camp located beyond the fuel farm on both sides of the original access road. The first two areas contain mostly prefabricated wood buildings. The buildings suffered some damage, as did the equipment contained in them. The Grenadian camp housed construction workers and had kitchen, dining and toilet/wash facilities. These areas should be restored, as required, for use in completing the airport.

The Cuban area contains a number of semi-permanent and permanent buildings. Office, shop, living and recreation facilities are reasonably elaborate. The buildings and equipment sustained a fair amount of damage. There is no justification for expending any money on rehabilitation since the facilities are not required for airport construction. It is recommended that the Grenadian Government explore other uses for the area. One possibility might be to consider its use, and further development, as a new campus for the St. Georges Medical University.

4.7 EQUIPMENT AND FURNISHINGS

The project includes a great deal of equipment, material and furniture needed to support the operation and maintenance of the airport. This is movable material not ordinarily thought of as a fixed part of an installation, including a number of vehicles of various types. All of this was contracted for from Plessey and Metex, with the exception of furniture for offices; total cost of the items amounts to approximately $3,250,000.

4.7.1 Roads and Grounds Equipment

Plessey is furnishing a tractor, a sweeper and a cutter, all of which are necessary for maintaining airfield paving, roads, parking areas and grassed areas. The cost is approximately $50,000.

4.7.2 Emergency Equipment

These are vehicles for use in various emergency situations. Metex is furnishing a rapid intervention vehicle for use in crashes and airfield accidents, and two fire trucks. Plessey is supplying an ambulance. A number of boats are needed for sea rescue, but information on quantity, type or supplier for these other than the Project Manager's opinion that they should be rigid bottom inflatable types was not available. Cost of the vehicles is about $600,000; all of these and the boats are necessary for operation of the airport.

4.7.3 Ramp Service Equipment

This consists of various types and quantities of movable equipment generally required to handle passenger aircraft on the apron. Plessey is furnishing all of the items.

They consist of 2 ground power units, 2 air start units, 4 tow tugs, an aircraft air conditioning unit, two wide body aircraft tow tugs, 2 different types of passenger stairs, 10 baggage carts, a water service unit and a toilet service unit. The approximate cost is $440,000. LIAT has indicated that it has ramp service equipment available for use at Point Salines. It is recommended that consideration be given to accepting the LIAT proposal for furnishing and operating the ramp equipment. Negotiations will be required with Plessey for the most advantageous disposition of the ramp equipment already purchased. This will eliminate the requirement for the Grenadian Government to provide personnel for the maintenance and operation of these services for which the ramp equipment is required.

It would be to the advantage of the Grenadian Government for the airlines to perform these functions.

4.7.4 Aircraft Fueling Equipment

Aircraft are to be fueled from tanker trucks hauling fuel from the fuel farm. Metex is supplying two 1,000 liter and 4,500 liter capacity vehicles. If Texaco or some other Company operates the fuel concession, they may want to use their own vehicles; it is probable that the Metex vehicles were damaged, and what equipment is available and operational should be determined. In any case, if the fuel function is a concession, Government-owned vehicles should not be used without suitable compensation. The operating agency, Government or private, should own the vehicles used.

4.7.5 Cargo Handling Equipment

This equipment is to be used in handling air freight. Apparently this function was to have been handled by the airport and Plessey is furnishing a container loader, 6 container dollies, a cargo conveyor and a fork lift. The approximate cost of the

equipment is $125,000. If air freight is to be taken care of by the airlines, the equipment should be owned by them. A similar rationale to that contained above in Section 4.7.3, Ramp Service Equipment, applies in this case. Negotiations with Plessey will be required for the most advantageous disposition, although sale to an air freight operation may be a possible alternative.

4.7.6 Catering Equipment

Included in this category is a catering lift vehicle for handling meals to aircraft and all of the kitchen food preparation equipment and restaurant/bar supplies (such as glassware and table silverware). Plessey is furnishing these at an approximate cost of $265,000. It is understood that the catering vehicle was damaged. Information on costs of kitchen equipment and restaurant supplies is not available. As discussed in Section 4.3 above on the Terminal Building, it is recommended that any catering be handled by an off-airport concessionaire and that the kitchen not be completed. The caterer should supply his own vehicle. Kitchen equipment not needed for snack bars in the Terminal Building should be stored or disposed of. It is assumed that the snack bars will be operated as a concession and sale of the restaurant supplies to the operator is recommended.

4.7.7 Building Maintenance

Plessey is supplying equipment and materials needed in continuing maintenance of the airport, at an approximate cost of $200,000. This includes a maintenance vehicle equipped as a mobile workshop, a pavement painting machine, a sand blasting machine, a quantity of paint and a list of equipment ranging from vacuum cleaners to mops to ladders. All of this is needed for maintenance. It is understood that the maintenance vehicle is damaged.

4.7.8 Communications Repair Equipment

Work benches and equipment for maintaining communications equipment are being supplied by Plessey at an approximate cost of $190,000. This material is necessary for on-going maintenance of the systems.

4.7.9 Vehicle Maintenance Equipment

Tools to completely supply a vehicle maintenance shop are being supplied by Plessey at an approximate cost of $15,000. They are essential for maintaining the various airport vehicles.

4.7.10 Furniture

To Cuban designs, Plessey is supplying furniture for the cab of the Control Tower and for the public areas of the Terminal Building. Layouts for the furniture and equipment for offices and operational areas which were to have been supplied by Cuba have been reviewed, but no cost information is available. The Plessey cost is approximately $465,000. It is estimated that the office furnishings will cost an additional $150,000.

4.8 LAND ACQUISITION

Information on the status of acquiring the land for the airport was obtained from some of those persons involved, but not verified by researching documents and files. The Project Manager indicated that no formal acquisition has taken place and no payments had been made to property owners. This was confirmed by a representative of some of the major land owners in the area of development. Apparently the Government originally asked permission to conduct soil tests on the area and then simply began construction. When questioned by land owners about this, the Government sent questionaires to the land owners asking them to set the limits of the land for the airport. It appears that the Government has never defined the area needed, acquired title, nor paid the property owner.

The Project Manager recently included in an update of the project cost the amount of $1,800,000 for land acquisition. The source of this estimate is unknown. It is assumed that the Government will move as quickly as possible to formalize acquisition of the property.

All of the area of the peninsula is not needed for the airport. As shown in Illustration 3, the Cuban layout of the project, the north shore falls outside the perimeter security fence and obviously is not required.

South of the runway, ownership of property should extend a minimum of 500 feet from the runway centerline, but restrictions on development are required beyond that line to prohibit buildings closer that 750 feet from the runway centerline and to restrict the height of any obstruction to below a 7:1 sloping plane beginning at the line 500 feet from the runway centerline.

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4.8.1. Bagadi Bay Beach Area Access

The point between Hardy Bay and Grand Bay is left without an access, although it is not required by the Airport. Alternate solutions to this problem include - (1) a road along the shoreline of the runway embankment across Hardy Bay; or (2) an access by boat across Hardy Bay, which might be appealing to tourists if the scale of development justifies the additional investment and operating costs. In any case, it is a handsome area and should not be neglected; the contour of the land screens airport noise and the beaches are good. All of the beach farther to the west effectively falls within needed airport land.

The alternative that provides road access to Bagadi Bay is discussed in an earlier section of this chapter. The road should of course run outside the Airport boundary and be fenced. Costs for this alternative are included in the recommended completion program.

4.8.2 Land Use Plan - Airport Environs

In the paragraphs above, restrictions on development of the land directly related to the runway are discussed in Section 4.2, restrictions on development at the end of the runway are described, all directly related to aircraft safety. However, for the overall good of the community and the Airport, there are other restrictions which should be considered for the land areas adjacent to the Airport. For instance aircraft noise should be taken into account when considering the highest and best use of the land. It is strongly recommended that the Government commission a land use study for the airport environs which will give equal consideration to Airport needs and adjacent community requirements, as well as long-term implications on tourist oriented land development.

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4.9 COST OF DEVELOPMENT

Considerable time has been expended in estimating the development cost for Point Salines Airport as designed by the Cubans and the amount already expended (sunk cost). This effort has been severely hampered by lack of any hard information in the Cuban area of operations, although the Project Manager has been extremely helpful and has provided as much information as he could. The two exceptions are information available from the Plessey and Metex contracts. Using available project data and documentation, knowledge of comparable work, and information gathered on local conditions and costs, and in many instances educated estimates, costs to complete the Airport to the recommended scope were estimated.

4.9.1 Cost of Cuban Design

The Project Director's most recent estimate of cost for constructing the Airport totals approximately $90,000,000. This includes the above-referenced $1,800,000 for land acquisition, costs for construction plant and equipment, engineering and supervision, and "physical and price" contingencies of about $22,000,000 to cover escalation, inflation, the uncertain cost of money from various resources, and other information developments. This estimate, dated August 1981, was updated since the intervention by the Project Director. The level of magnitude is consistent with our findings, and is, therefore, accepted and used in the subsequent economic analyses.

4.9.2 Sunk Cost

Because of the terms of the Plessey and Metex contracts which call for payment for installation of materials upon shipment and not upon actual accomplishment, the sunk cost and percent of completion of construction, do not equate. In addition, accounts for expenditures in any detail and accuracy were not available,

and no attempt was made to perform an audit of any accounts of expenditures. A short summary of the status of the construction was provided which also estimated funds required to complete the project. This summary, dated November 1983, was prepared by the Project Manager. It estimated the value of work completed as $43,077,000 which is reasonable based on detailed evaluations of all available information.

4.9.3 Costs to Complete the Project

The chaotic state of the drawings and lack of specifications for the project made it impossible to determine in detail the original designs of the Cubans to use as a basis for estimating work to be completed. A detailed listing has been made of all the elements which are considered necessary for the completion of the airport. Using various methods for estimating and calculating values, cost estimates were developed for completing each of the remaining tasks, detailed and recommended in earlier sections of this chapter.

On this basis, construction completion costs are summarized below. As indicated, they include indirect costs which a contractor (or contractors) will incur for supervision, personnel living expenses, construction support, facilities, telephone, taxes, surveying, etc., but exclude estimated overhead and profit.

Chapter 5 addresses various organization schemes for carrying out the completion of construction, and the costs therein which also include contractors' overhead and profit must be added to the construction costs to arrive at the total amount required to complete the airport. (See Table 5.2)

Also, the construction completion costs do not include (1) any sums which will become due to Plessey or Metex on shipment of further material under their contracts: (2) estimated land

acquisition costs as discussed in Section 4.8 above, and (3) direct costs for the Government for administration and overall management.

The estimated construction costs of $15,200,000 do include an amount of approximately $1,200,000 for replacement of the Cuban construction plant and equipment installation (earth-moving equipment, asphalt plant, concrete batch plant, etc.) which it is understood the Cubans have requested be returned to them.

CONSTRUCTION COST	
Raw Construction Cost	
Airport facilities	$ 7,000,000
Existing road to St. Georges	700,000
Indirect Cost	5,500,000
Subtotal	$13,200,000
Contingency (15%)	2,000,000 (1)
Total Construction Cost	$15,200,000
PROJECT COMPLETION COST	
Total Construction Cost	$15,200,000
A-E and Management fees and costs, and Contractor's Overhead and Profit	3,500,000 (1)
Land Acquisition	1,800,000 (2)
Balance of Plessey Contract	2,500,000 (2)
Total Project Completion Cost	$23,000,000 (1)

(1) Varies depending on organization scheme used; see Table 5.2.

(2) These costs are estimates and cannot be accurately determined at present.

5. ORGANIZATION FOR COMPLETING CONSTRUCTION

CHAPTER 5

ORGANIZATION FOR COMPLETING CONSTRUCTION

The background information on the project in Chapter 4 explains the organization which existed for the construction of the Airport. The working of this organization was interrupted by the military intervention and must be replaced in order to complete the construction of the Airport.

5.1 PLESSEY AND METEX CONTRACTS

A major portion of the airport construction was contracted to Plessey Airports Ltd. of Great Britian and Metex Corporation of Finland. The contract amounts are approximately $12,400,000 for Plessey and $2,400,000 for Metex. These contracts called for furnishing materials and also installing a large amount of this material to form complete systems. As has been said before, the contracts called for payment to the firms for both supply and installation upon shipment of the material. The majority of the materials have been shipped and consequently the majority of the compensation has been invoiced, although installation completion for various items varies from no work begun to almost completed.

Included in the contracts are requirements for engineering design for detailed systems being supplied. This work is almost completed. Plessey is involved in almost every aspect of the airport construction except primarily civil engineering work and consequently has a detailed knowledge of the work. Metex's work is related to lighting systems for the airfield and roads in large part and it has knowledge of this construction. The two firms represent a resource and pool of knowledge all of great value in expediting the early completion of the airport.

It is recommended that in any organization for completion of the airport the Plessey and Metex contracts be continued. Assuming the recommendations for changes in scope of work are implemented, the firms should be asked to negotiate necessary changes to the materials presently in their contracts for deletions, additions and quality revisions.

5.2 OVERALL PROJECT DIRECTION

The Government of Grenada does not have the capability within its civil service to direct the necessary architectural and engineering work for required changes to the project, or to supervise the construction required for completion. These functions were being performed by the Cuban MITRANS and UNECA groups, respectively. Grenadian project direction consisted of participating in and keeping abreast of decisions, and of coordinating the work of the project with other areas of Government concern.

It is strongly recommended that the Government's first step be the employment of a professional management firm to represent the best interest of the Government in all technical aspects of the project including the financial ones. The firm should be compensated on a basis not related to the cost of the project in order that its actions and decisions will not be in any way influenced by self-interest. The firm should have experience in the design and construction of airports and in the management of construction projects. This firm should work essentially as a part of the Grenadian Government providing temporary and knowledgeable staff to represent the Government in the project. The existing Government administration for the project would continue to function as it has throughout the project.

Specific tasks for the project management firm would vary with the alternative organization schemes presented below.

5.3 ALTERNATE ORGANIZATION SCHEMES

There are a number of different ways that the completion of the construction can be carried out. Four major variations are identified; each has advantages and disadvantages as discussed and compared below.

5.3.1 Scheme I - Traditional Design and General Contractor Construction

This scheme uses the management firm in an expanded role which is a traditional one in the construction industry in the United Stated. The firm would render advice to the Government as set forth above and, in addition, would serve as the architectural-engineering entity to re-design the facilities as recommended herein, produce plans and specification for the completion of the work, receive bids from general contractors for the construction works other than that of Plessey and Metex, assist the Government in awarding a construction contract and administer the construction contracts of the general contractor, Plessey and Metex.

5.3.2 Scheme II - Architect-Engineer/ Construction Manager Operation

In this scheme the management firm employed by the Government would be qualified to provide the necessary architectural and engineering services for the redesign and completion of the facilities and also the management of the actual construction. Construction management would consist of total services to award multiple contracts, directly employ and supervise labor for

portions of work if in the best interest of the project, and to administer and coordinate the entire construction to completion. The firm would act as adviser to the Government as discussed before, would be employed on a totally professional basis so that its actions would be based on objective analysis of the best interests of the Government, and would be compensated in such manner that it had no vested interest in the cost of construction which might create a conflict of interest between the Government and the firm.

5.3.3 Scheme III - Competitive Design-Build Contract

For the Government, the management firm would prepare terms of reference for a design and construct contract, receive records of qualifications and experience from firms with these capabilities, recommend selection of a firm and assist in awarding a contract. The design-build firm would have the responsibility for the necessary re-design and for the construction (other than Plessey and Metex) and could sub-contract as it sees fit. The management firm would monitor all work of the design-build firm as the Government's representative.

5.3.4 Scheme IV - Negotiated Design-Build Contract

This scheme is identical to Scheme III except that instead of receiving multiple competitive proposals for the design-build contract, the management firm and Government would together select a firm to accomplish this work and negotiate a contract with the selected firm.

5.4 COMPARISON OF THE FOUR SCHEMES

There are advantages and disadvantages to each of the four schemes of organization for carrying out the completion of the Airport. These advantages and disadvantages fall into six categories which are, in descending order of importance, as follows:

- Completion time for the projects;
- Protection of the interests of the Government of Grenada, including financial management and quality control;
- Overall cost to complete the project, including fees;
- Possibilities for use of local construction contractor firms;
- Possibilities for use of directly employed local labor (force account; and
- Starting time for construction.

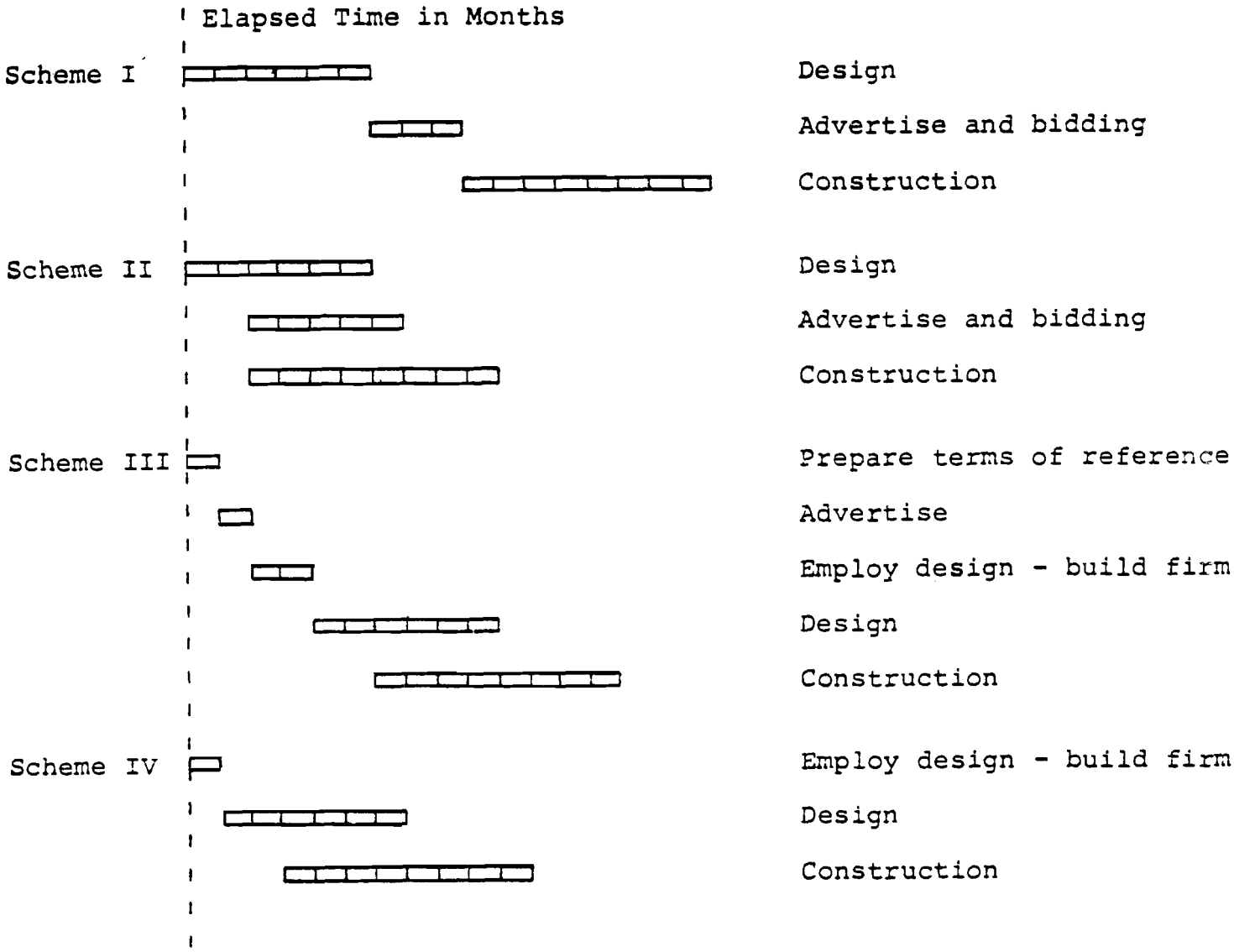
The relative advantages of the four alternative organization schemes for each of these categories are discussed below.

5.4.1 Project Completion Time

Table 5.1 compares the estimates of elapsed time for carrying out the completion of the project for the four organization schemes. The graphic presentation is used for clarity. Reference to descriptions of the Schemes in Section 5.3 above will explain details of the activities represented by the

TABLE 5.1

PROJECT TIME COMPARISON FOR ORGANIZATION SCHEMES



bars. Scheme II offers the earliest completion possibility, followed by Scheme IV.

5.4.2 Risk to the Government of Grenada

Certain schemes will better protect the Government from the possibility of cost overruns and from poor construction quality.

Scheme I with a fixed sum contract awarded to a contractor from a selected list of qualified firms gives the best protection in both instances. In scheme II the Government would rely on the construction management aspect of the management firm to obtain the best quality work by the best means, but the Government would not know at the beginning of construction a construction amount since design and construction are on-going. In schemes III and IV the Government also would not have a fixed construction amount in hand at start of construction because design and construction overlap, and additionally the management firm would not exercise direct control of quality. In Scheme IV it must be assumed that a quality firm is negotiated with and this gives this Scheme an edge on quality control as compared to Scheme III.

5.4.3 Overall Project Cost

The cost to complete the project is affected by the organization set up to carry out the work. Table 5.2 is a cost comparison for the various schemes. The following comments explain the methods of arriving at the costs in the table:

- A.1 Raw Construction Cost: It is assumed that this would not vary from scheme to scheme, although the amount of work accomplished by local contractors or force account would affect the cost; however the amount is difficult to estimate at this time.

TABLE 5.2

COST COMPARISON OF ORGANIZATION SCHEMES

	Scheme I	Scheme II	Scheme III	Scheme IV
A. Construction Cost	$	$	$	$
1. Raw construction cost (1)	7,700,000	7,700,000	7,700,000	7,700,000
2. Indirect cost	6,000,000	5,500,000	6,000,000	6,000,000
3. Overhead and profit	1,370,000(10%)	1,056,000(8%)	1,233,000(9%)	1,370,000(10%)
4. Contingency (15%)	2,055,000	1,980,000	2,055,000	2,055,000
Sub-total	17,125,000	16,236,000	16,988,000	17,125,000
B. Management and Design				
1. Management Firm				
a. A-E design fee	1,713,000(10%)	974,000(6%)	-	-
b. Construction management fee	-	812,000(5%)	-	-
c. Monitoring fee	-	-	849,000(5%)	856,000(5%)
d. Indirect cost (2)	648,000	672,000	336,000	264,000
Sub-total	2,361,000	2,458,000	1,185,000	1,120,000
2. Design-Build Firm				
a. A-E design fee	-	-	680,000(4%)	856,000(5%)
b. Indirect cost (3)	-	-	360,000	360,000
Sub-total	-	-	1,040,000	1,216,000
TOTAL	19,486,000	18,694,000	19,213,000	19,461,000

Note:

(1) Includes $700,000 for improvement to existing road from Sugar Mill to downtown St. Georges.

(2) Scheme I: 6 persons av. x 18 months x $6,000/month; Scheme II: 8 persons av. x 14 months x $6,000/mo. Scheme III: 4 persons av. x 14 months x $6,000/month; Scheme IV: 4 persons av. x 11 months x $6,000/mo.

(3) 6 persons av. x 10 months x $6,000/month

Note:

A. Additional Costs: In addition to the costs listed above, the cost of the following items must be addressed- 1) Land Acquisition; 2) Completion of Plessy Contract. These additional costs cannot be accurately determined at present and could create large financial burdens.

B. Cuban Equipment: If the construction equipment originally furnished by Cuba is available, a savings of $1.2 million may be realized.

- A.2 Indirect Cost: This is lower for Scheme II because no general contractor is involved in this organization and consequently the expatriate costs are lower.

- A.3 Overhead and Profit: The variation is the prediction of the amount which would be arrived at for each scheme. Although competitively bid, the Scheme I contractor would protect himself against circumstances over which he can exercise little control. Scheme II is low because the work would be split into a number of smaller parts and local overhead and profit in aggregate is likely to reduce total overhead and profits. The firm bidding on the work in Scheme III would be doing so competitively and would be able to exercise some control over the project. Negotiation in Scheme IV would not produce the lowest figure when competition is not present, in our opinion.

- B.1 Management Firm: Although percentages are indicated for all schemes to estimate fee amounts, the fee for Scheme II should not be related to the construction cost to avoid a conflict of interest as explained above.

- B.1.a A-E Design Fee: The percentages represent the different amount of work which would be performed in this area under Schemes I and II. Scheme I would involve traditional architectural-engineering services for design, production of drawings and specifications, letting of a contract and administration of

production, while Scheme II would include the design, limited production of drawings and specifications and consultation only on letting contracts and construction.

- B.1.b Construction Management Fee: This is the professional fee which would be paid to the management firm to carry out its functions of arranging for and supervising the construction work through contracts, force account labor, etc. as seems in the best interest of the project.

- B.1.c Monitoring Fee: This is the fee for overseeing the A-E design and construction work of the design-build firm in Schemes III and IV, since there is an inherent conflict of interest for such a firm between quality of work designed and cost of construction.

- B.1.d Indirect Cost: Indirect costs in this item would cover basically expatriate costs for travel, living etc. and office and production expenses.

- B.2.a A-E design Fee: The design-build firm would perform architectural and engineering services and we have estimated the percent of construction cost which would be paid for these. The percentages are less than those for the management firm for those services in Schemes I and II because less production would be required since the architects and engineers would be dealing directly with their own construction people and less formal work would be necessary.

- B.2.b Indirect Cost: This cost is estimated in the same manner as for the management firm's expatriate and production facility costs.

Although there is not a great deal of difference in the total costs shown for each scheme, there is an $800,000 difference between the high and low figures (approximately four percent) and this is of some significance. In this catogory of comparison Scheme II is favored.

5.4.4 Use of Local Contractors

There are no contractors in the country capable of taking on the entire completion project, or the paving, but there are a number of contractors able to contract or sub-contract for installation of parts of buildings and systems. It would appear to be in the best interest of the Government and the economy to maximize local contractors. If this policy was dictated by government, for example, the management firm in Scheme II could be directed to contract with these local firms wherever possible.

In this matter Scheme II offers total flexibility. In Scheme IV, the use of local contractors could be determined in the negotiation stage. It would be a more difficult requirement to achieve in the competitive bidding precedures in Scheme I and II, and almost impossible to control in Scheme I.

5.4.5 Use of Force Account

Using local labor as direct employees on construction would be possible with the organization in Scheme II and would be more difficult to almost impossible in the other Schemes for the same reasons as set forth in 5.4.4 above for employment of local contractors.

5.4.6 Construction Start Time

Reference again to Table 5.1 and to Section 5.3 above indicates that Scheme II would allow the earliest beginning of construction closely followed by that made possible by Scheme IV.

5.4.7 Summary of the Comparison of the Schemes

Table 5.3 shows graphically the advantages of the various organization schemes for carrying out the completion of the airport. From the comparisons detailed above for the six categories considered important, the Schemes were ranked in each category using the number 4 as the best rank. Multiplying the percentages of importance assigned to each category by the rank score, provides a numerical comparison of the schemes that is useful in attempting to objectively quantify and illustrate the comparisons.

The resulting ranking indicates that the best organization for carrying out the completion of the Airport is that of Scheme II characterized by use of a professional organization with experience in architecture, engineering and construction to directly manage the entire project. The overall project cost for this scheme is favorable in comparison to the others; it provides the Government with reasonable protection in the matters of cost overrun and quality control; the work can be accomplished in a reasonable time using this scheme; the organization allows maximum flexibility for using local contractors and force account for carrying out the work; and, it will allow an early construction start. This organization scheme is recommended as the one best suited for carrying out completion of the Airport.

TABLE 5.3

COMPARISON RATINGS OF ORGANIZATION SCHEMES

	Project Completion Time		Risk to the Government		Overall Project Cost		Use of Local Contractors		Use of Force Account		Construction Start Time		Total
	Rank	X 30%	Rank	X 25%	Rank	X 15%	Rank	X 15%	Rank	X 10%	Rank	X 5%	Total
Scheme I	(1)	30	(4)	100	(1)	15	(1)	15	(1)	10	(1)	5	175
Scheme II	(4)	120	(3)	75	(4)	60	(4)	60	(4)	40	(4)	20	375
Scheme III	(2)	60	(2)	50	(3)	45	(2)	30	(2)	20	(2)	10	215
Scheme IV	(3)	90	(1)	25	(2)	30	(3)	45	(3)	30	(3)	15	235

6. ECONOMIC ANALYSES

CHAPTER 6

ECONOMIC ANALYSES

This chapter examines the economic feasibility of completing Point Salines Airport. In the course of the analysis, it was necessary to deal with a number of areas which are themselves not directly connected with the facility, but which would be heavily impacted by availability of the new airport.

6.1 APPROACH

The classic approach to the economic analysis of a transportation project requires that the performance of the improved case be compared to the existing (or null) case, in costs and benefits over time. This is accomplished by developing streams of annual costs and benefits over the analysis period. To simplify calculations, the streams are usually netted, so that only the difference is considered. These netted annual values are then discounted back to the base year (generally the last full year before construction started) at an agreed discount rate. The annual factors used in discounting are based on the rule that future money is worth less than money in hand. The improved case is handicapped because it must overcome the disadvantage of the cost of construction, which is close to the base year and is, therefore, accorded a high discount factor. On the other hand, the improved case generally has higher benefits, due to the construction. Additional traffic may be induced or generated by the new project. This procedure was followed in the analysis of the Point Salines Airport; the present or null case, Pearls Airport, was labelled as Case 1, while the new airport alternative was designated as Case 2. The economic analysis, therefore, centers around the development and comparison of costs and benefits associated with these cases.

6.2 COSTS

From the viewpoint of the analysis of Point Salines Airport there are two general kinds of costs, construction and operating.

6.2.1 Construction Costs

There are two types of construction costs based on time; costs already incurred (sunk costs) and those yet to be incurred. Table 6.1 estimates Point Salines construction costs during the period 1979 - 1983, inclusive, as approximately US $52.4 million. Only one of several estimates which were available was supported by some of the individuals most involved in the construction. Completion costs of 21.1 million are assumed, based on the completion procedures, deletions and revisions detailed in Chapter 4 of this report, indicating a total cost of US $73.5 million.

TABLE 6.1
CONSTRUCTION COSTS
POINT SALINES AIRPORT

ITEM/YEAR	COST IN US DOLLARS (000)	
A. Sunk Costs (1)		
1979	$ 3,377.7	
1980	7,072.2	
1981	11,534.2	
1982	15,509.8	
1983	14,908.4	
Sub-total		$52,402.3
B. Construction Costs		
Construction (2)	$18,700.0	
Plessey contract (not invoiced)	2,500.0	
Land	1,800.0	
Sub-total		$23,000.0
Total		$75,402.3

(1) Based on estimates provided by the Grenadian Government
(2) Estimated by Wilbur Smith and Associates; see Section 4.9.3. Add $1.0 million for October, 1984 early opening.

Table 6.2

OPERATING COSTS - PEARLS AIRPORT, 1983

Type[1]			Salary		Total (EC$)
Salaries / Wages		No.	Each (EC$)	Total	
	Manager	1	13,210	13,210[2]	
	Traffic controller	1	13,210	13,200	
		7	10,504	74,088[3]	
		1	9,204	9,204	
	Baggage handlers	3	5,938	17,814	
	Custodian	1	5,937	5,937	
	Fireman	3	5,916	17,748	151,191
	Housing allowance	-	1,365[4]		1,365
	Uniforms	7	1,120[5]		1,120
Utilities					
	Electricity			32,348	
	Water			1,466	
	Telephone			9,615	43,429
Telex					9,240
Transport					1,965
Supplier					17,066
	TOTAL	24 [6]			225,376
					(US$84,100)

(1) Based on data from Ministry of Civil Aviation and Tourism, Grenada.

(2) Salary to increase to $21,961 + $720 allowance, total $22,681.

(3) Also provide meterological service.

(4) In 1984, 7 officers will be authorized $180 allowance per month, in order to live nearer Pearls Airport.

(5) Includes maintenance of toilets.

(6) Excludes customs and immigration personnel assigned to airport.

6.2.2 Operating Costs - Pearls Airport

The principal basis for the operating cost analyses was the operating expenses of Pearls Airport for 1983 (Table 6.2) and data obtained by visiting Coolidge Airport in Antigua. The latter was helpful but local funding and operational ground rules limited comparisons. For example, Coolidge airport does not pay for its own utilities, and the wages for a good portion of the staff is provided from outside sources and thus does not appear on the operating statements. Further, no data were available from the staff on air cargo and luggage, since they are handled by the airlines. The current operating costs shown for Pearls (US $84,100) are bare minimums and exclude several basic required items, as indicated by subsequent estimated budgets.

The basic technique used in describing future annual operating cost estimates for the airports involved establishing a basic estimate for 1985, and then adding personnel, supplies and services in proportion to increases in the forecasted workload. In the case of Pearls, certain basic additions were made. For example, the basic differences between the Pearls operating estimate for 1983 (Table 6.2) and the estimate for 1985 (Table 6.3) are indicated on the latter table. Expense items which appeared on Table 6.2 are asterisked on Table 6.3. Even in some of these cases, the 1985 total has been increased. On the personnel side, increases are notable in:

Area	Number of Persons
Aeronautical Information Service/ Meterology	4
Maintenance of Navigation	2
Aids and Communications	2
Maintenance , Supply, Janitorial, Laborers, Passenger Security and Administration	15

Table 6.3

ESTIMATED OPERATING COSTS - PEARLS AIRPORT, 1985

Type expense	Number	Total(1)
		(US.$)
Personnel		
* Manager	1	8,470
* Air traffic control	6	29,550
* Air traffic control	6	23,690
Aero information service/meterology	4	16,160
Maintenance of Nav. Aids & Comms.	2	9,850
Electrician	1	4,370
Maintenance men	4	10,750
Supply	2	3,580
Janitor	2	3,130
Laborer	2	2,990
* Fire and rescue	4	8,960
Passenger security	2	3,130
Administration	2	3,730
* Caretaker	2	4,480
* Baggage handlers	4	8.800
SUBTOTAL PERSONNEL	44	141,560
Utilities		
* Electricity		16,790
* Water		750
* Telephone		3,910
Other		
Airport insurance		25,000
* Telex		3,730
* Transport		750
* Supplies		9,300
Training		6,000
* Housing allowance		5,600
* Uniform allowance		2,240
Maintenance of runway, terminal, etc.		10,000
SUBTOTAL OTHER COSTS EXPENSES		84,070
	Total	225,630
	20% contingency	45,130
	Total	270,760

(1) Rounded to nearest multiple of ten.

(2) Seven officers eligible for housing allowance of ($180 per month) in order to live near Pearls

(3) Fourteen officers @ $60.US.(160 EC.) per month.

The advisability of such increases are supported by the fact that the 1984 Budget Request for Pearls will include the following deferred items:

Item	US Dollars
Maintenance of Terminal Building	$ 5,600
NDB Maintenance	1,900
NDB Spart Parts	370
Maintenance of Toilets and Service	1,270
AFTN/MET Maintenance	8,960
Total	$18,700

Pearls Airport presently operates under day light visual flight rules. None of its navigation systems is working. This is the basis for the deferred maintenance requirements indicated.

In the area of supply and services, additions were made for insurance, training and maintenance of runway, terminal, and overall areas. A 20 percent allowance has also been added for contingencies. The result ($270,760) is almost three time the 1983 expenditure for Pearls, even though additions made were considered minimal. Expenses levels estimated for the year 1990, 1995 and 2000 for Pearls are shown by Table 6.4. These levels are based on the assumption that the operation would continue as at present, but at a larger scale. Total expenditures estimated were: 1985 - $270,760; 1990 - $324,530; 1995 - $362,530 and 2000 - $397,360. All costs are in constant 1983 US dollars. Investment in the facility was considered as sunk cost, and no amortization was attempted.

6.2.3 Operating Costs - Point Salines Airport

The step up in complexity from the operation of the small field at Pearls to the huge facility at Point Salines is

Table 6.4

FUTURE OPERATING COST ESTIMATE - PEARLS AIRPORT

	Personnel Increases		Other Increases		
Year	Amount	No and Type	Amount	% of 1985 level	Total (1)
(a)	(b)	(c)	(d)	(e)	(f)
1985	141,560		84,070		270,760 (2)
1990	23,590	2 - Fire & rescue 2 - Laborers 4 - Passenger Security 2 - Maint. of Navigation and Communication Equipment	21,220	25	324,530
1995	8,810	1 - Maintenance 2 - Laborers 2 - Passenger Security	22,860	27	362,530
2000	6,120	2 - Laborers 2 - Passenger Security	22,900	27	397,360

(1) Columns (b) and (d) will not add to column (f), because column (f) includes a 20% contingency allowance, in each case

(2) Composition of costs in Table 7.3 considered on base year.

reflected in estimated operating costs for the latter, as indicated by Table 6.5. For example, while only 24 personnel are presently involved in the operation of the Pearls Airport and only 44 were estimated as needed in 1985, some 92 personnel are seen as required for adequate operation of the Point Salines facility for 1985. The listing of personnel required is self-explanatory, with some exceptions. For example, with the tower separated from the Terminal Building, the Aeronautical Information/Meterology Service will have to be located in the latter.

The recommended manning level is not considered excessive. For example, Coolidge Airport at Antigua, with 174 employees, had 30,880 aircraft operations (landings plus takeoffs) in 1982. Some 92 employees are recommended for Point Salines for 1985, although only 11,120 aircraft operations are anticipated. In other words, the 1985 Point Salines personnel level would be 53 percent of the present Coolidge level, although the Point Salines workload would only be 36 percent of that of the Antigua field. The reason is that it takes a minimum number of people to adequately staff a facility as large as Point Salines.

After the initial staffing is operational, only relatively modest increases are required in subsequent years. This is borne out by Table 6.6 which shows the increases in expense allowances proposed for each of the four forecast years. Total estimated expenses for these years are: 1985 - $458,580; 1990 - $496,670; 1995 - $554,170; and, 2000 - $642,900. It is of interest here that the total of 1985 ($458,580) is equivalent to 67 percent of the Coolidge Airport total for 1982 ($680,400 - spent and committed), and the latter total excludes utilities and significant labour costs.

It will be noted that the expense items listed do not contain an annual allowance for amortization of capital costs.

Table 6.5

OPERATION COST ESTIMATE - POINT SALINES AIRPORT, 1985

OPERATION: 0600-2200 HOURS DAILY

TYPE EXPENSE		TOTAL[1]
		(US.$)
PERSONNEL	No.	
Airport Manager	1	8,470
Deputy/Opns Officer	1	7,610
Air Traffic Control	6	29,550
Air Traffic Control	6	23,690
Air Information Service/Meterology	6	23,690
Maintenance of Navigation/Comms.	8	39,400
Electrical		
Chief	1	5,600
Electrician	4	14,460
Structures and Grounds		
Chief	1	3,730
Equipment operator	1	2,610
Carpenter	1	2,690
Painter	1	2,690
Mechanic	2	5,370
Truck Driver	1	2,240
Plumber	2	5,370
Laborer	4	5,970
Supply	2	3,580
Janitorial		
Chief	1	2,610
Janitor	8	12,540
Fire & rescue		
Chief	1	4,100
Firemen	12	26,870
Security		
Chief	1	4,100
Passenger	6	11,200
Other[2]	8	12,540
Administration[3]		
Secretary	1	2,990
Clerk	2	3,730
Switchboard	4	6,720
Sub-total personnel	92	274,120

Table 6.5 (Cont'd)

OPERATION COST ESTIMATE - POINT SALINES AIRPORT, 1985

OPERATION: 0600-2200 HOURS DAILY

	TYPE EXPENSE	TOTAL
		(US $)
	Sub-total personnel (Brought Forward)	274,120
OTHER	Maintenance of Runway, Buildings, Area,	25,000
	Electricity	22,390
	Water	730
	Telephone	3,900
	Airport Insurance	30,700
	Telex	3,730
	Transport	750
	Supplies	9,330
	Training(4)	9,000
	Uniforms	2,500
	Sub-total Other Direct Expenses	108,030
	Total	382,150
	Plus 20% contingency(5)	76,430
	Total	458,580

(1) Rounded to nearest multiple of 10

(2) Assumes additional support by local police

(3) Assumes accounts maintained elsewhere

(4) Assumes 3 personnel per year @ US $3,000 each

(5) At 20% of total, before contingency

Table 6.6

FUTURE OPERATING COST ESTIMATE - POINT SALINES AIRPORT

	Personnel Increases		Other Increases		
Year	Amount	No. and Type	Amount	% of 1985 level	Total
(a)	(b)	(c)	(d)	(e)	(f)
1985	274,120	(Base Year)	108,030	-	458,580
1990	15,880	4 - Fire and Rescue	15,860	15	496,670
		2 - Janitorial			
		2 - Passenger Security			
1995	17,200	2 - Controllers	30,700	28	554,170
		1 - Plumber			
		4 - Laborers			
		2 - Janitors			
		1 - Switchboard / PA			
		2 - Passenger Security			
2000	32,240	1 - Plumber	41,680	39	642,900
		2 - Laborers			
		3 - Janitors			
		4 - Maint. of Nav./Com.			
		2 - Clerks			

(1) Columns (b) and (d) will not add to columns (f), since the latter contains a 20% allowance for each year.

(2) Composition of 1985 cost shown by Table 7.3 considered as base year.

This will be handled later, under sensitivity testing. It should also be pointed out that Plessey and Metex are to provide training on all equipment which they install.

The Metex contract for the airfield lighting includes training for operation and maintenance of these installations. Similarly, the Plessey contract includes training for the installations for which they are responsible. Thus, the initial required training for the maintenance of the airfield lighting, the air traffic control, communications and meteorology equipment as well as the mechanical and electrical equipment furnished by Plessey is provided.

The transfer of the airport traffic controllers and flight briefing personnel from Pearls Airport to the Point Salines Airport will serve to provide the trained personnel required initially. Similarly, trained firemen will be transferred from Pearls Airport to Point Salines Airport.

In the longer term, as additional or replacement personnel are required, training for the aeronautical services and fire fighting services is available in the Caribbean area as well as in the U.K. or U.S.

In the other areas of mechanical and electrical equipment, on-the-job training assigned to maintenance and operation will be carried out, and no formal training in these areas is recommended

With these provisions, the allowance for training is considered generous.

An additional point should be made. The Coolidge Airport Manager in Antigua indicated that he had increased his manning level by 35 percent when he moved recently to the new terminal building. This total includes 48 people in security; and includes area policing. His previous personnel strength would therefore have been 129. Since the proposed Point Salines level includes relatively few security personnel, and relies upon support by local police, the overall staffing level is considered adequate.

6.3 BENEFITS

Since the Point Salines Airport is easily the largest endeavour which the Government of Grenada has undertaken, and since one of its principal impacts will be upon tourism (which, in turn, is one of the two principal industries in the country), the repercussions from the opening and operation of the field should be felt throughout the economy. This section of Chapter 6 estimates those effects but starts with the more obvious benefits, fees to be collected at the airport.

6.3.1 Airport Landing Fees

In Chapter 3, the number of future aircraft operations was estimated. The number of landings derived in that estimate was used in Table 6.7 to develop forecasts of landing fees for both Case 1 - Pearls Airport Operational, Point Salines Airport uncompleted and Case 2 - Pearls Airport Closed, Point Salines Airport Completed. This table shows Case 2 landing fee receipts for year 2000 of $281,100 for Case 2 versus $135,400 for Case 1. The table also shows the difference in landing fee receipts for the two cases, which will be taken as a benefit for Case 2.

6.3.2 Airport Parking Fees

Past experience at Pearls indicates that this does not represent a good potential for airport revenue. For example, records show that for 1982, only EC$2240 (US$836) was collected for parking fees, based on 5121 landings. On the same basis, and using the number of landings indicated in Table 6.7, parking fees were forecast as follows:

Table 6.7

FUTURE LANDING FEE ESTIMATES - POINT SALINES AIRPORT

CASE 1 - POINT SALINES AIRPORT UNCOMPLETED

Aircraft	Fee(1) U.S.$	1985 No.	1985 Fees(2)	1990 No.	1990 Fees	1995 No.	1995 Fees	2000 No.	2000 Fees
General Aviation	7.46	3,600	26,900	4,700	35,100	5,500	41,000	6,275	46,800
Embraer	11.66	670	7,800	800	9,300	900	10,500	1,100	12,800
AVRO 748	41.51	2,560	53,100						
Fokker 28	58.30			950	55,400	1,050	61,200	1,300	75,800
TOTAL		6,830	87,800	6,450	99,800	7,450	112,700	8,675	135,400

CASE 2 POINT SALINES AIRPORT COMPLETED

Aircraft	Fee U.S.$	1985 No.	1985 Fees	1990 No.	1990 Fees	1985 No.	1985 Fees	2000 No.	2000 Fees
General Aviation	7.46	3,625	27,000	4,615	34,400	4,750	35,400	5,900	44,000
Embraer	11.66	605	7,100	670	7,800	1,000	11,700	1,125	13,100
AVRO 748	41.51	1,150	47,700						
Fokker 28	58,30			825	48,100	1,200	70,000	880	51,300
Boeing 767/737	107.84	168	18,100	168	18,100	336	36,200	336	36,200
Boeing 727/757	177.61			168	29,800	768	29,800	336	59,700
1011	457.09							168	76,800
Case 2 Total		5,548	99,900	6,446	139,200	7,454	183,100	8,745	281,100
Case 1 Totals			- 87,800		99,800		112,700		135,400
Differences			11,100		39,400		70,400		145,700

(1) Fees based on Amendment to Air Navigation (Landing Charges) Regulations (SRO 3), March 19, 1982, converted to US dollars

(2) Fees rounded to nearest dollar

YEAR	CASE 1	CASE 2
	(US$000)	
1985	1.1	0.8
1990	1.1	1.0
1995	1.2	1.2
2000	1.4	1.4

Since the difference in results between the two cases was not significant, no benefits were assumed. The basic difficulty in forecasting receipts from parking of planes is that relatively few planes have been parked at Pearls in the past, and the incidence of such future parking at Point Salines is uncertain.

6.3.3 Fees for Navigation Aids and Communication Use

Based on the performance at Pearls in 1982 ($42,632 collected, 5121 landings), it was assumed that the average fee would be $8.33 per landing. For Case 2, this would result in the following fees: 1985 - $46,200; 1990 - $53,700; 1995 - $62,100; and, 2000 - $72,800. However, since the number of landings for Case 1 was very similar to that for Case 2, no significant difference in receipts existed, and no benefit was assumed for Case 2.

6.3.4 Rental Space

Although Pearls Airport is so constrained in size that rental space is skimpy, this will not be the case at Point Salines. A total of some 4920 square feet is expected to be available, as follows: bank - 150; gift shops - 150; snack bar - 800; car rental - 100; mail/telegrams - 100; lockers - 20; and, airlines - 3600. Assuming that 75 percent of this space would be rented by 1985 (with 100 percent leased by 1990), and using a rate of 75 percent of that currently charged by Barbados

authorities at the new airport ($10.61/ft^2/year), receipts would be as follows: 1985 - $39,200; and for 1990, 1995 and 2000 - $52,200 each.

6.3.5 Expenditures by Stopover Visitors in Barbados

Induced benefits include expenditures outside Grenada, as well as within the country. For example, using data in the 1983 OAS Attractions Development Plan for Grenada[1], it was estimated that (based on origin) 45 percent of Grenada-bound stopover visitors have had to overnight in Barbados in the past. With the new airport, this will not be necessary, since it will have night landing capability.

There are two categories of such visitors - tourists and non-tourists. Credit was taken only for tourists, with benefits for future years derived by subtracting Case 1 estimates from Case 2 values. An expenditure rate of $50 per day was assumed, based on data provided by Grenada tourism personnel.[2] Estimates for years indicated are as follows: 1985-$45,000; 1990-$337,500; 1995-$900,000; and 2000-$1,125,000.

6.3.6 Expenditures by Tourists in Grenada

Benefits were assumed under this category only for tourists. The bulk of non-tourists were assumed to be returning Grenadians, who would normally stay with relatives. Again, the number of tourists generated by the Point Salines Airport was estimated by subtracting Case 1 from Case 2. Average expenditures per day were taken at $50.00, and the length of stay assumed was 8.5 days.[3] Tourists estimates were netted between Cases 1 and 2, with the following results (in thousands): 1985-2, 1990-15, 1995-40 and 2000-50. Benefits for the same years (in million of dollars) were: 1985-0.85; 1990-6.4; 1995-17.0 and 2000-21.3. To this should be added a 10 percent service charge and a 7.5 percent tax.

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(1) OAS Attractions Development Plan - 1983, p. 24

(2) Caribbean Tourist Research and Development Centre, Barbados, Grenada Visitor Survey - 1982, Vol. 8, All Respondents

(3) Ibid.

6.3.7 Employment Due to Increased Air Freight Capacity

The ready availability of air cargo space for shipment of agricultural products should increase the degree of employment in that industry, as described in the chapter on forecasting. However, data were lacking upon which to base an estimate. Four growth rates were, therefore, arbitrarily assigned: 1985- 2 percent; 1990 -3 percent; 1995 -4 percent; and 2000 - 5 percent. Assuming that the number employed in farming would remain at about the same level as at present (7,700), and with wages of $400 per year and a 10 percent tax rate, the percentage increase indicated would yield wages/taxes as follows: 1985- $61,600/$6,160; 1990 -$92,400/$9,240; 1995 -$123,200/$12,320; and, 2000 -$154,000/$15,400.

The possibility for increased employment in the manufacture of clothing due to the increased availability of air freight is better in the clothing industry than in agriculture, but the base is small, only 310 employees. Nevertheless, assuming growth rates of 3, 5, 7 and 9 percent (of the base) for the year 1985, 1990, 1995 and 2000, respectively, with average wages of $1455 and a 20 percent income tax bracket, the following wage/tax receipts would result: 1985 -$13,100/ $2,600; 1990 -$23,120/$4,600; $32,000/$6,400; and $40,740/$8,100.

6.3.8 Vehicle Operating Costs

The distance from Pearls Airport to the St. Georges area is around 25 miles, compared to 6 miles for a similar trip from the Point Salines Airport. The savings in the operating costs of vehicles over the two distances were calculated for Case 1 and Case 2, with Case 2 results then subtracted from Case 1. A cost of $0.38 per mile was used for vehicle operation,

with 3 passengers assumed per vehicle, calculated against the total number of passengers predicted for the forecast year. Savings for these years were determined as: 1985 - $227,200; 1990 - $245,800; 1995 - $243,200; amd 2000 - $278,800. No attempt was made to cost savings in passenger time.

6.3.9 Baggage, Air Cargo and Mail

In most aspects, baggage and air cargo are handled by the airlines. This is the system which is proposed for Point Salines. Accordingly, any savings realized would accrue to the airlines. The same applies to mail.

6.4 ANALYSIS OF COSTS AND BENEFITS

The critical question to be answered from the national viewpoint is how much of the $50 a day in benefits due to the additional generated tourist expenditures in Grenada would have to be allocated to the Point Salines Airport in order for benefits to equal costs. This question was answered by sensitivity testing. Two basic conditions were evaluated: Alternative A including all construction costs, e.g., sunk costs; and, Alternative B including only new construction costs, i.e., those yet to be incurred.

6.4.1 Methodology

Sunk construction costs were taken in the year of occurrence; new construction costs were assumed to occur in 1984. A $10.6 million cost was assigned in 1995 for airport rehabilitation. The length of the analysis period varied with the year of occurrence of construction costs but all periods ran through 2014. Only those benefits were taken which could be most directly attributed to the airport, e.g., landing fees, rental space, savings in vehicle operating costs, and induced

employment in agriculture and industry. Discount rates of 5, 10 and 12 percent were used with the objective of determining how much of the $50 a day expenditure would have to be allocated to the airport in order for benefits to equal costs. All values used were in 1983 constant U.S. dollars. The results of the analyses are shown by Table 6.8. In each case, the Benefit Cost Ratio (B/C Ratio) - the present value of benefits divided by the present value of costs, net present value (NPV) - the present value of benefits less the present value of costs, and, the Internal Rate of Return (IRR) - the interest rate at which NPV is zero are indicated.

6.4.2 Results of Sensitivity Testing

As indicated by Table 6.8, when all construction (sunk) costs are considered, benefits from generated additional tourist expenditures do not justify construction of the airport unless (1) a five percent return on investment is considered adequate, or (2) almost all benefits are assigned to the airport, using the 10 percent discount rate.

However, when only completion costs are considered (Alternative B), the situation is much different. With all three options, only a relatively small percentage of generated tourist expenditures need to be allocated to the airport to offset the estimated construction costs of $24 million (12, 24 and 32 percent of the $50 per day tourist expenditures, for discount rates of 5, 10 and 12 percent, respectively). It is therefore, apparent that if only costs-to-complete are considered, the project is feasible. Computer printout tables which support the values summarized in Table 6.8 are included in Appendix B.

Table 6.8

SENSITIVITY TESTING OF TOURIST EXPENDITURE ALLOCATIONS

A. With All Construction Costs

ALT.	DISCOUNT RATE	B/C RATIO	IRR PERCENT	PORTION REQUIRED $50/DAY U.S. DOLLARS	PERCENT
1A	5	1.0	5	$19	38
2A	10	1.0	10	$42	84
3A	12	1.0	12	$55	110
B. With Only New Construction Costs					
1B	5	1.0	5	$ 6	12
2B	10	1.0	10	$12	24
3B	12	1.0	12	$16	32

NOTE: Based on iterative computer runs to determine percent of $50/day tourist expenditure required with discount rates indicated and - (1) B/C ratio of 1.0, (2) NPV equivalent to zero, and (3) IRR equal to the assumed discount rate (value of money). See Appendix B for computer printouts.

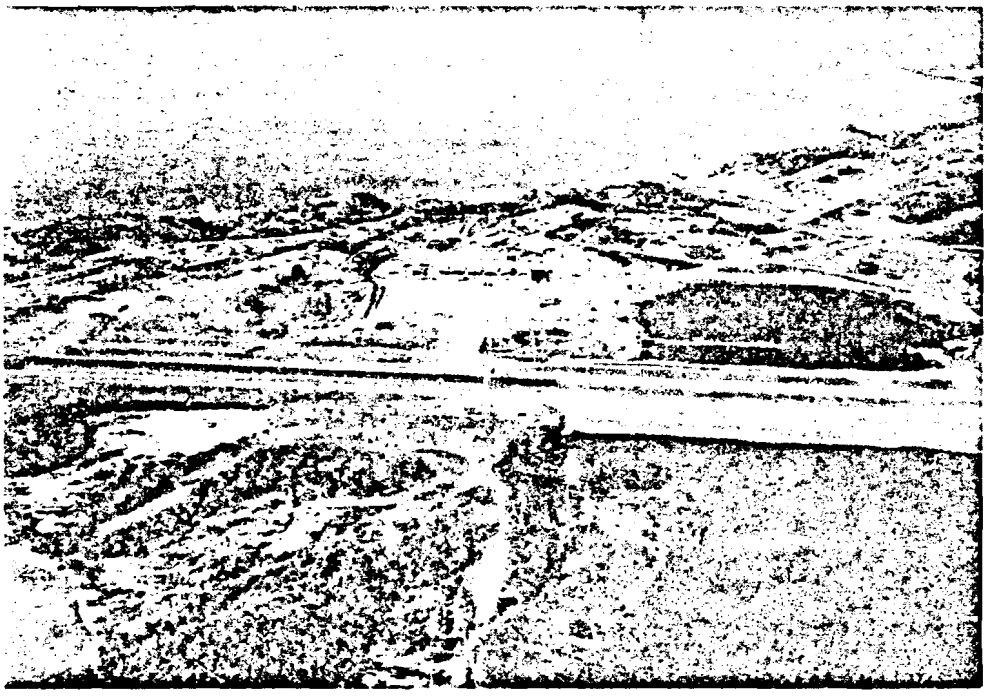
6.4.3 Conservative Nature of Analyses

It should be pointed out that the analyses described in the foregoing are extremely conservative. This observation is based on the following factors:

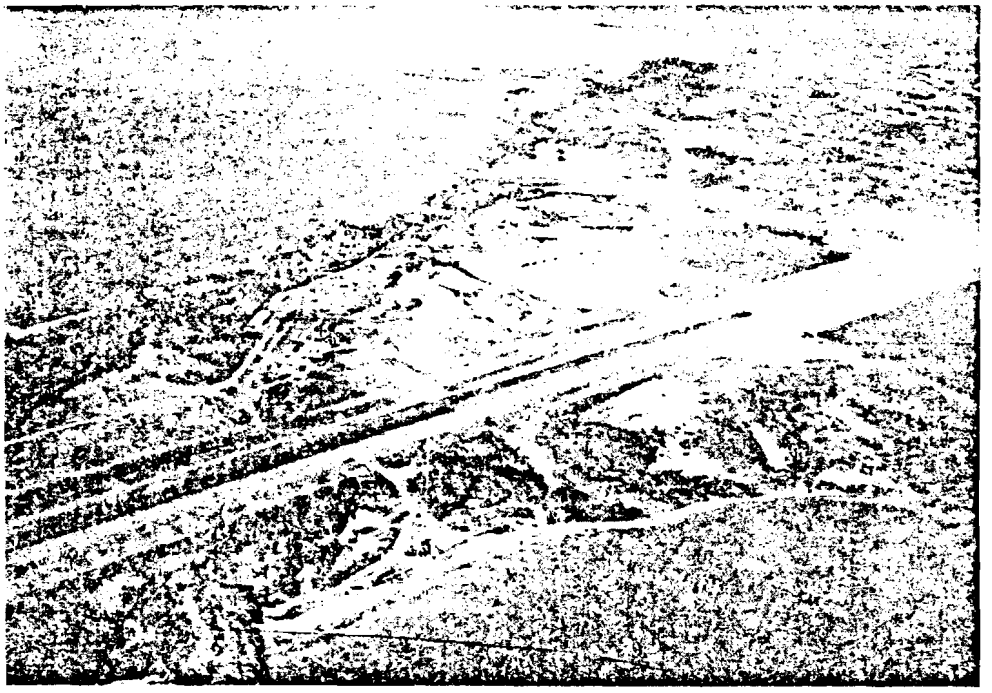
- Forecasts. The entire analysis hinges upon the forecast of future Grenadian air passenger activity. The present forecast is less than 70 percent of the next lowest estimate cited. See Chapter 3.

- Multiplier. No benefit has been taken for the multiplier, or ripple effect, of tourist expenditures. In an interview on December 21, 1983, a Grenadian official indicated that their current estimate of this multiplier is 1:1.4. The reason that it is not higher is that there is considerable leakage due to the importing of goods to support tourists while in-country.
- Contingencies. Allowances have been made for contingencies in cost estimates.
- Airport Rehabilitation. An allowance of $10.6 million was made in 1995 for rehabilitation of the new airport. No such allowance was made for Pearls Airport.
- Salvage. No allowance was taken for the salvage value of the new airport, at the end of the 30-year analysis period. Although the discount factor applied at that time would reduce the present value of the salvage value to a very low level, it would still represent a benefit to the system. By not taking the benefit, the analysis is more conservative.
- Increased Expenditure. It is highly probable that expenditures per tourist will increase in real terms over time. No benefit has been taken for this.
- Future Benefits. Annual costs and benefits were held constant at the year 2000 level for subsequent years. This represents additional conservatism, since tourist visitation is expected to continue to increase.

APPENDIX A



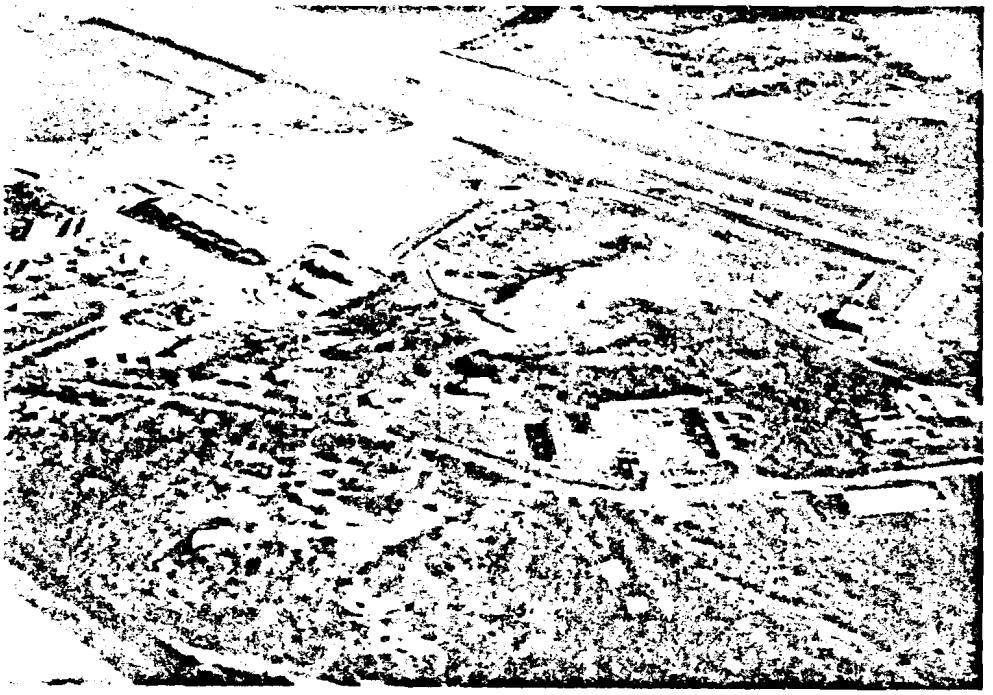
5a - Central area looking north, Terminal area in center of picture.



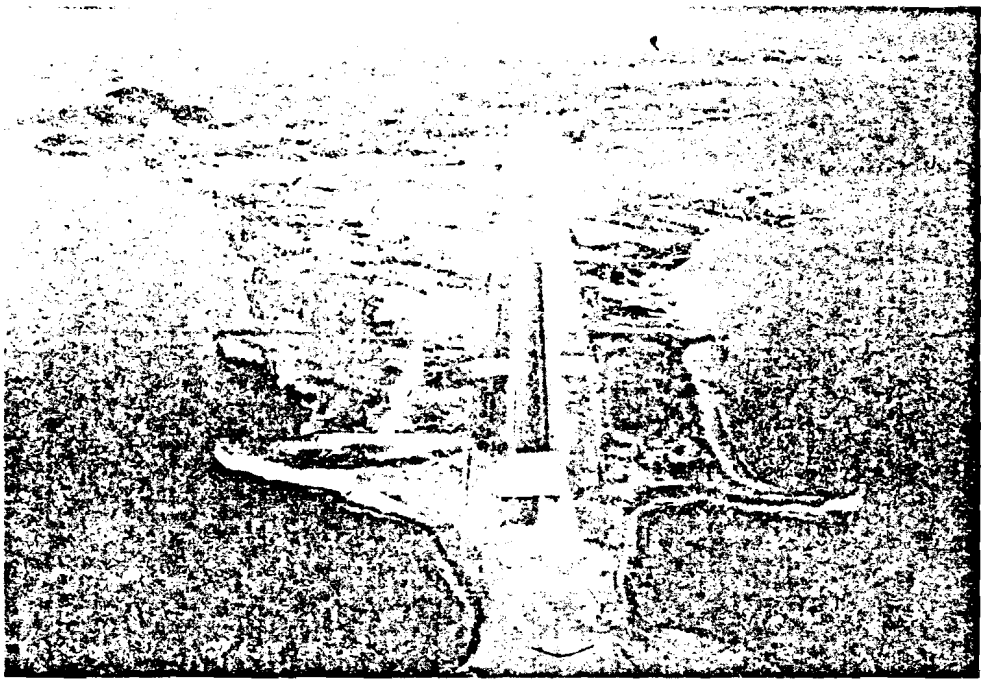
5b - Looking to northeast, Grand Anse Bay at upper center

ILLUSTRATION 5 - AERIAL VIEWS OF THE AIRPORT

BEST AVAILABLE COPY



6a - Central area looking southeast



6b - Looking due east from end of peninsula

ILLUSTRATION 6 - AERIAL VIEWS OF THE AIRPORT

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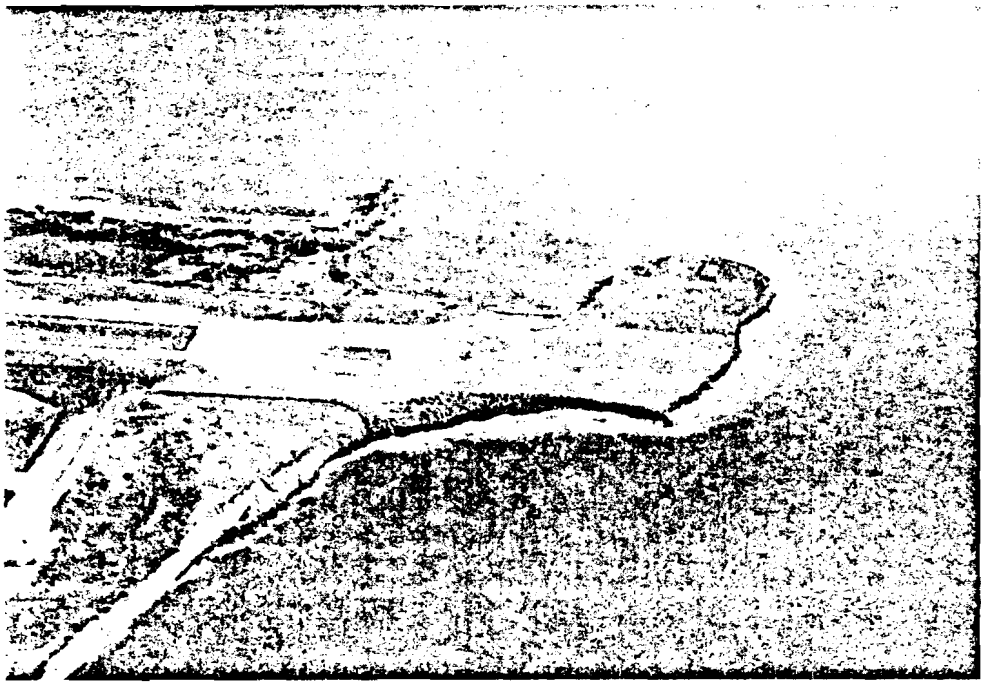

7a - West end of runway and tip of peninsula

7b - Hardy Bay and terminal area looking northwest

ILLUSTRATION 7 - AERIAL VIEWS OF THE AIRPORT

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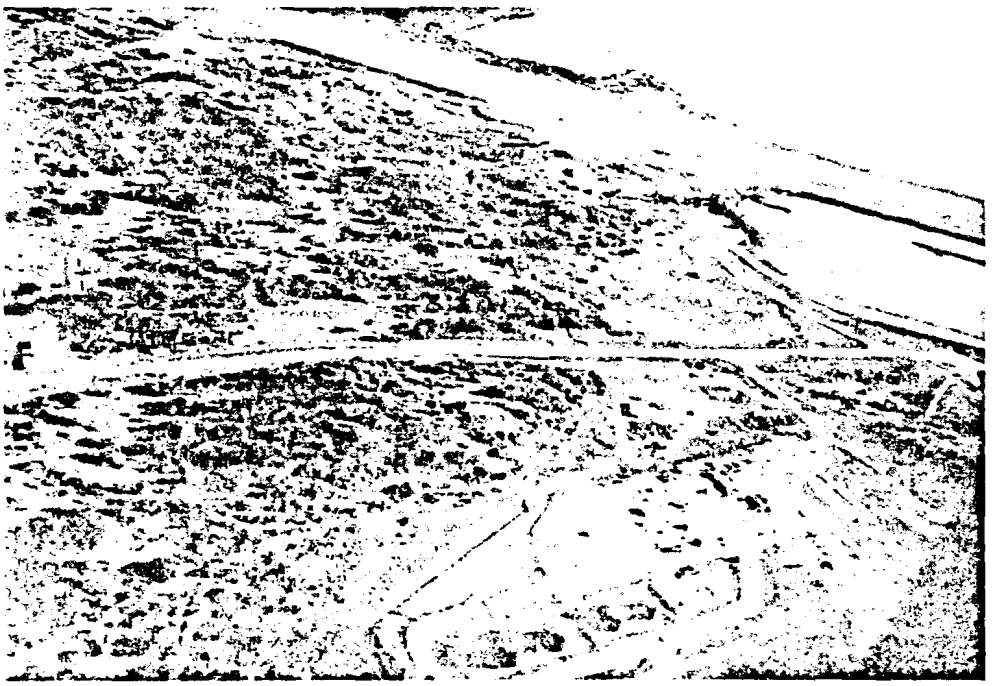

8a - Fuel farm looking southeast, runway east end at upper left

8b - Cuban construction camp; view is directly to left of picture 8a above

ILLUSTRATION 8 - AERIAL VIEWS OF AIRPORT

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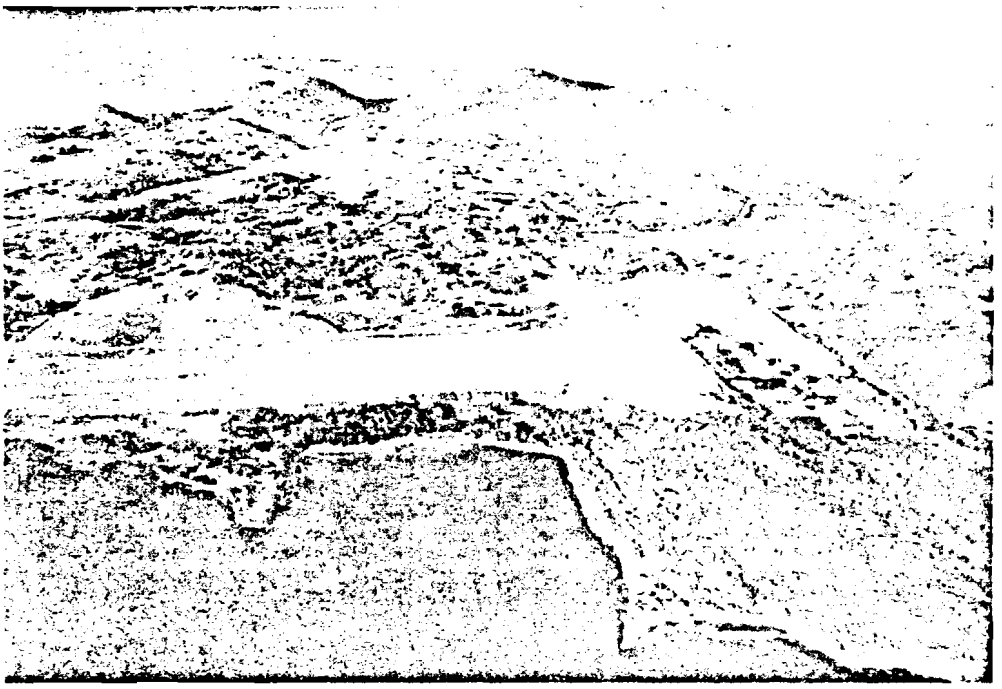

9a - East end of runway, True Blue Medical University buildings at center right

ILLUSTRATION 9 - AERIAL VIEW OF AIRPORT

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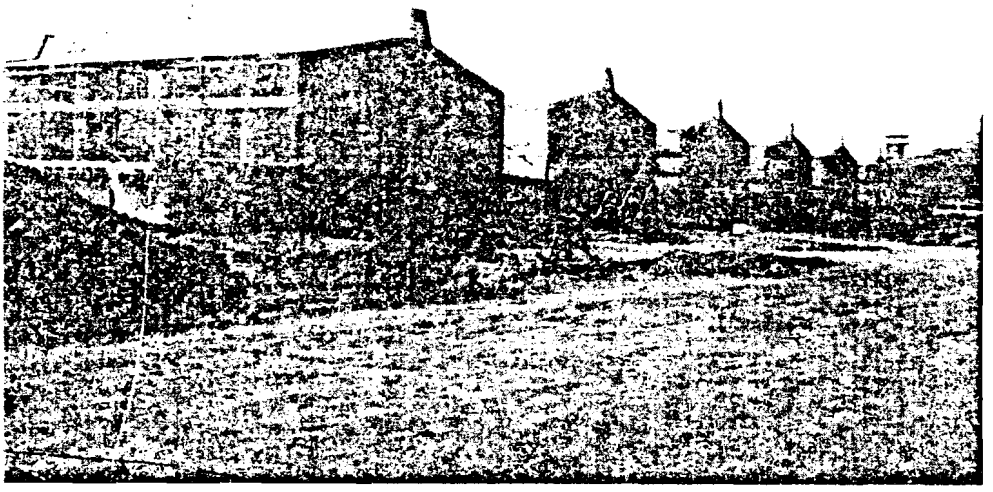
10a - North front looking southeast
from ridge



10b - North front from east

ILLUSTRATION 10 - TERMINAL BUILDING EXTERIOR VIEWS

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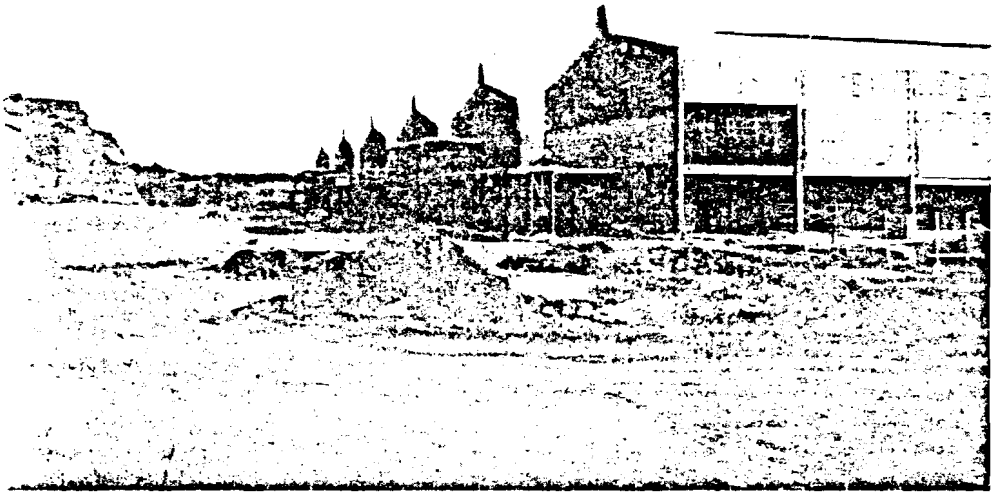
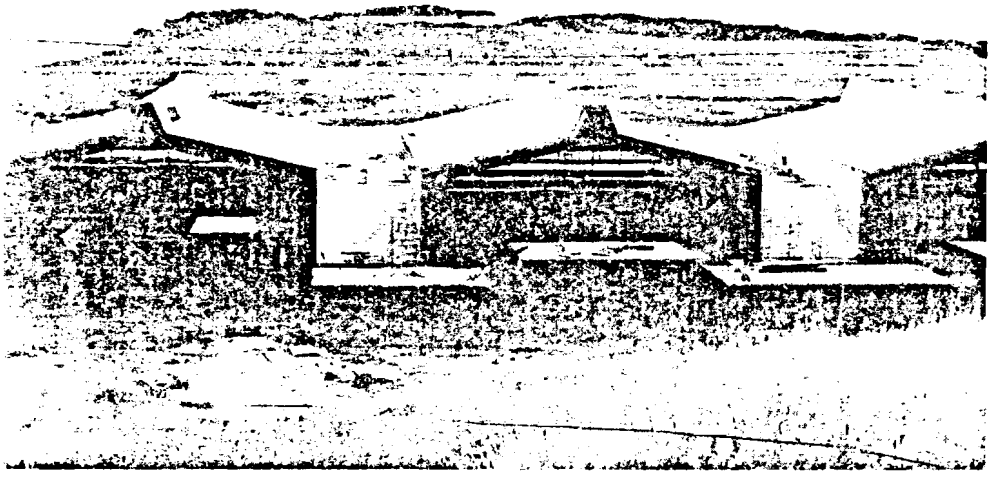


11a - North front from west



11b - North front looking south from ridge

ILLUSTRATION 11 - TERMINAL BUILDING EXTERIOR VIEWS

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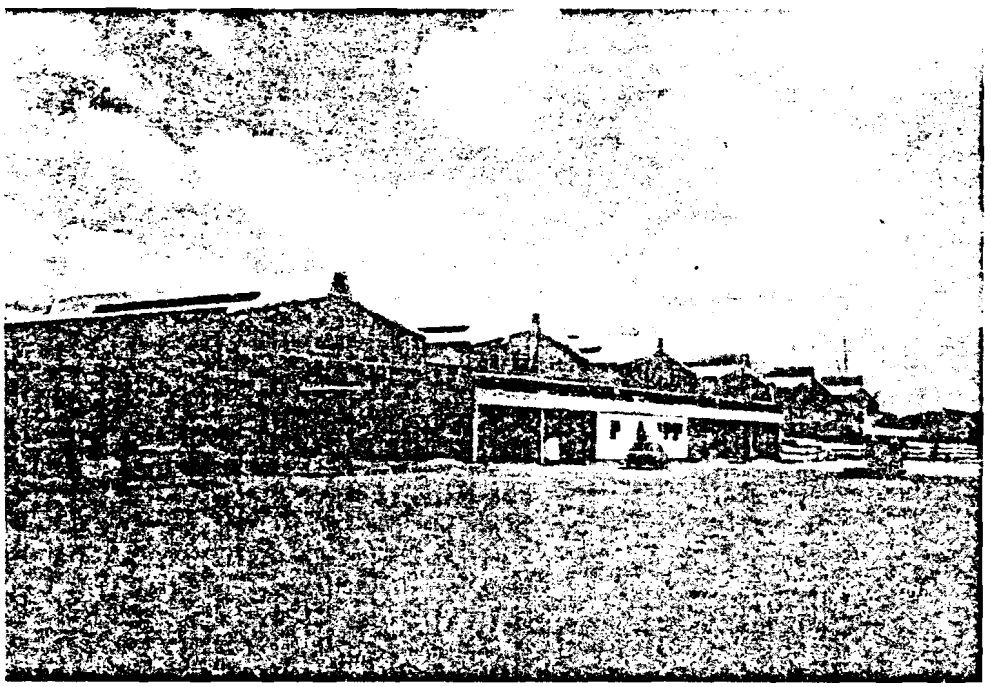
12a - Apron front looking northeast from Control Tower



12b - Apron front looking northeast from apron

ILLUSTRATION 12 - TERMINAL BUILDING EXTERIOR VIEWS

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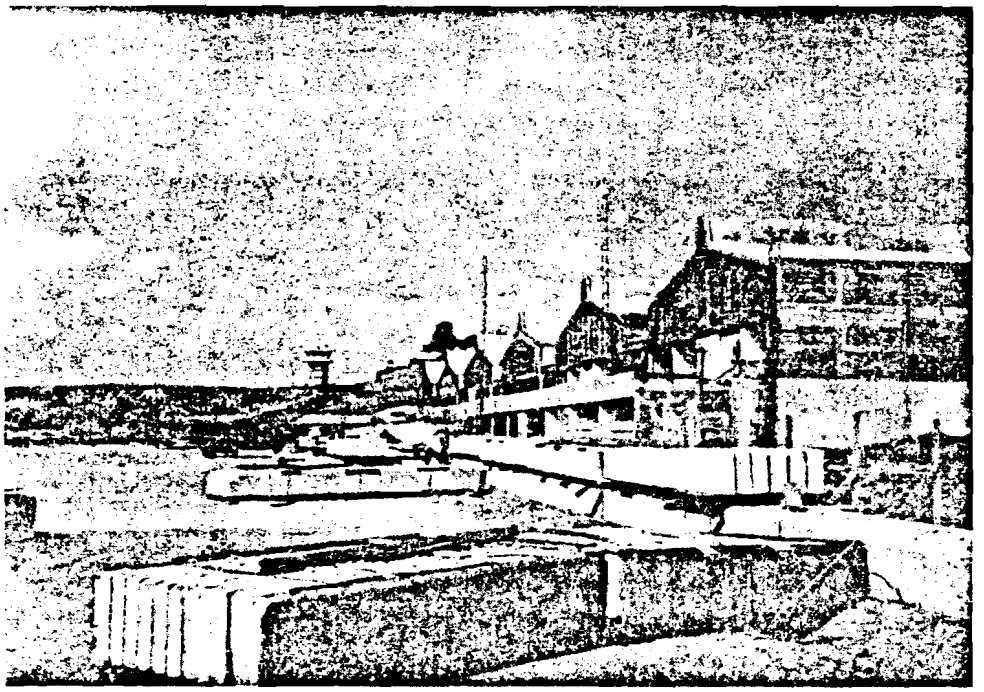
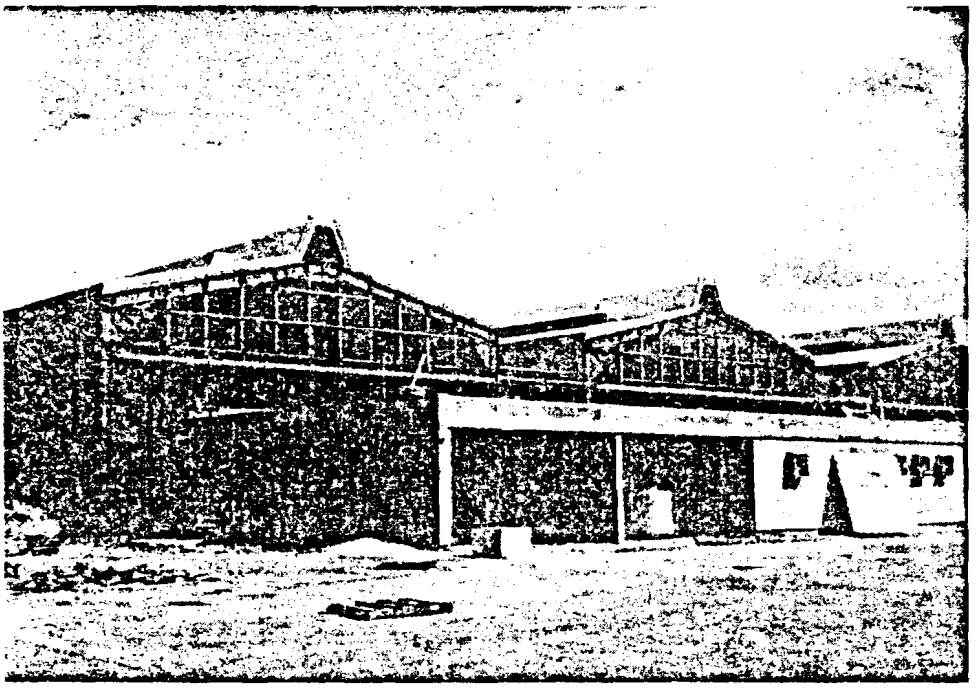


13a - Apron front looking northwest



13b - Apron front west end, baggage cart drive-through projects in front

ILLUSTRATION 13 - TERMINAL BUILDING EXTERIOR VIEWS

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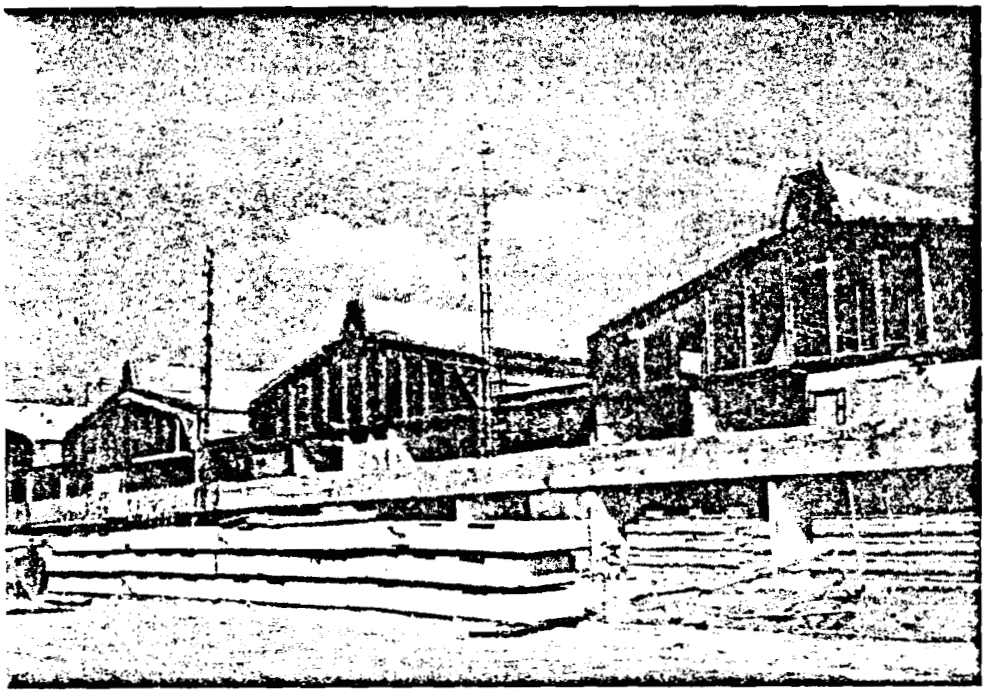
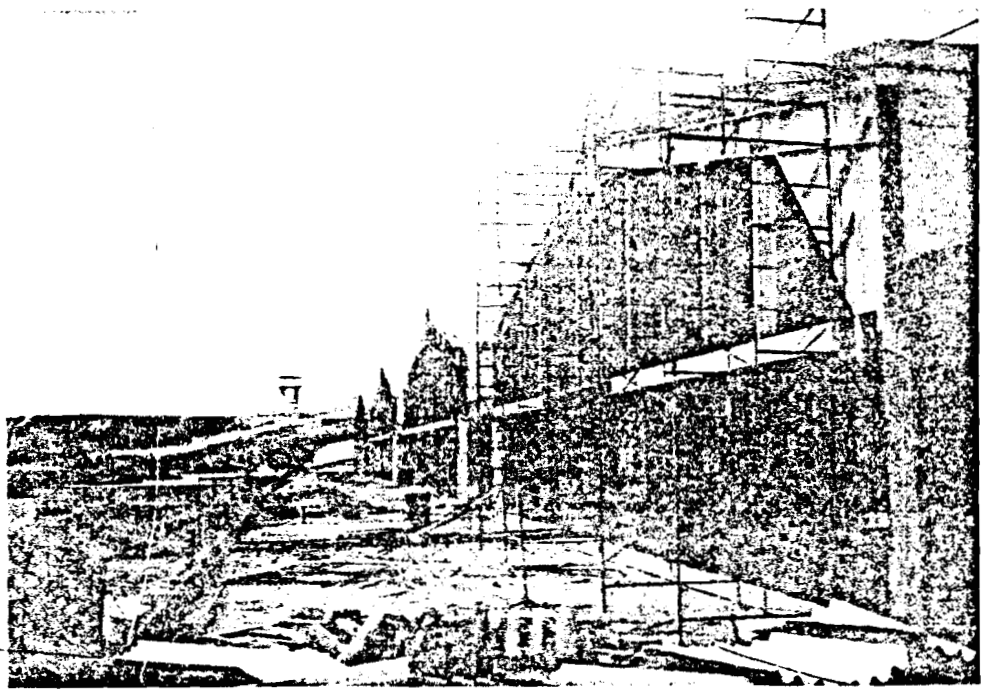


14a - Apron front showing one-story projection



14b - Observation deck on apron side looking west

ILLUSTRATION 14 - TERMINAL BUILDING EXTERIOR VIEWS

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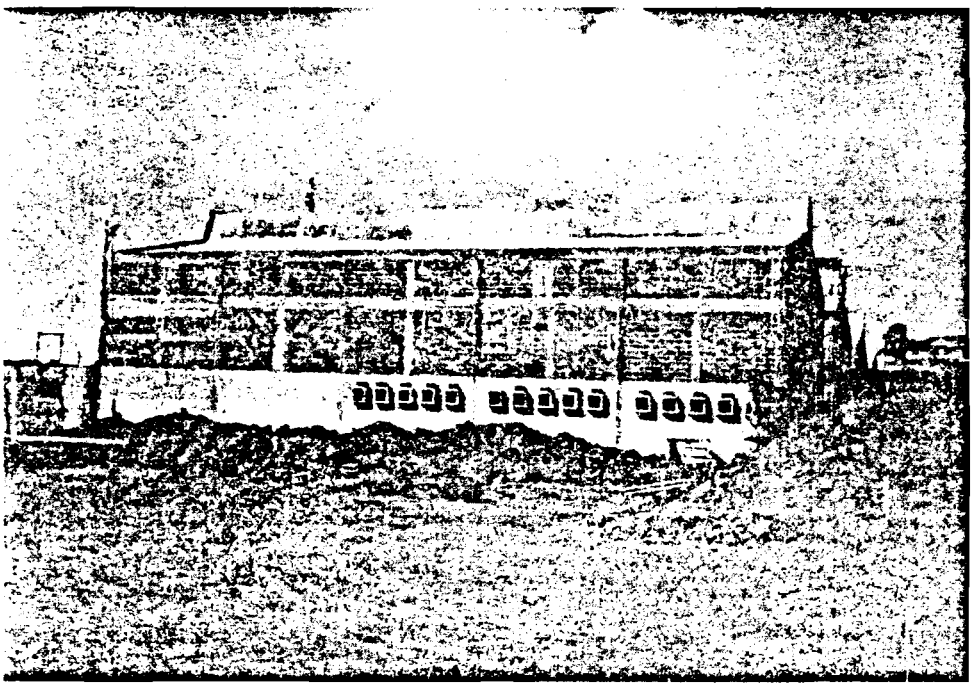
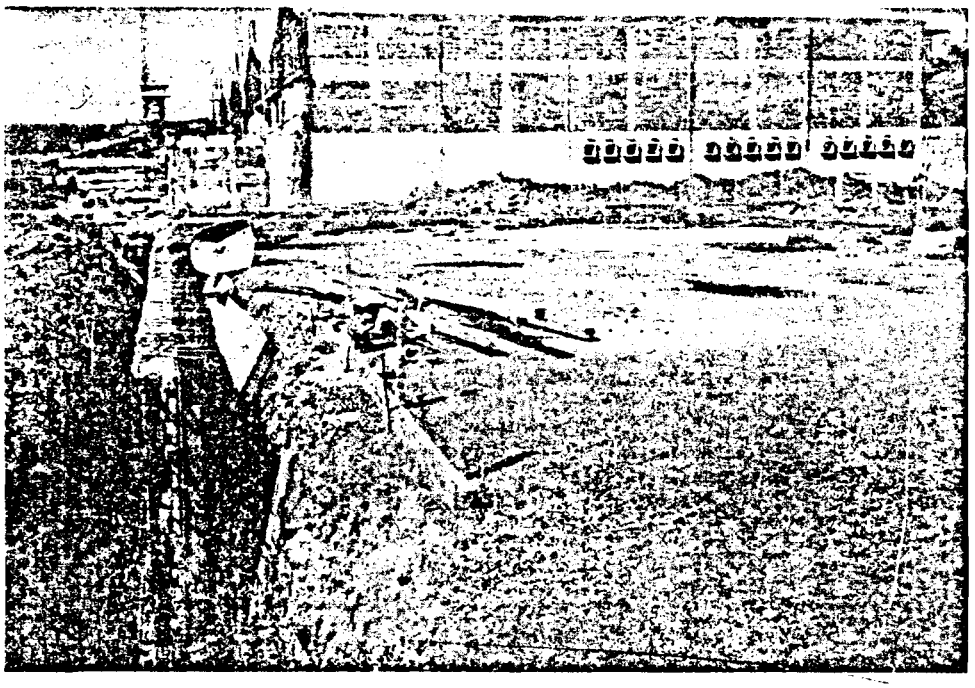


15a - East end of building



15b - East end of building in background, VIP Building foundation wall at left

ILLUSTRATION 15 - TERMINAL BUILDING EXTERIOR VIEWS

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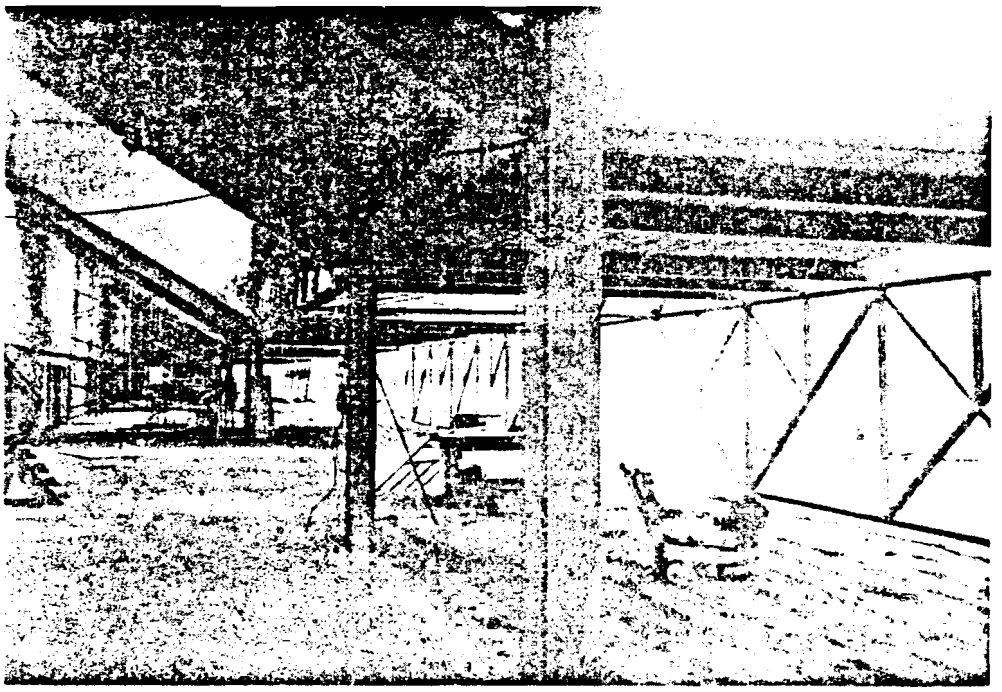
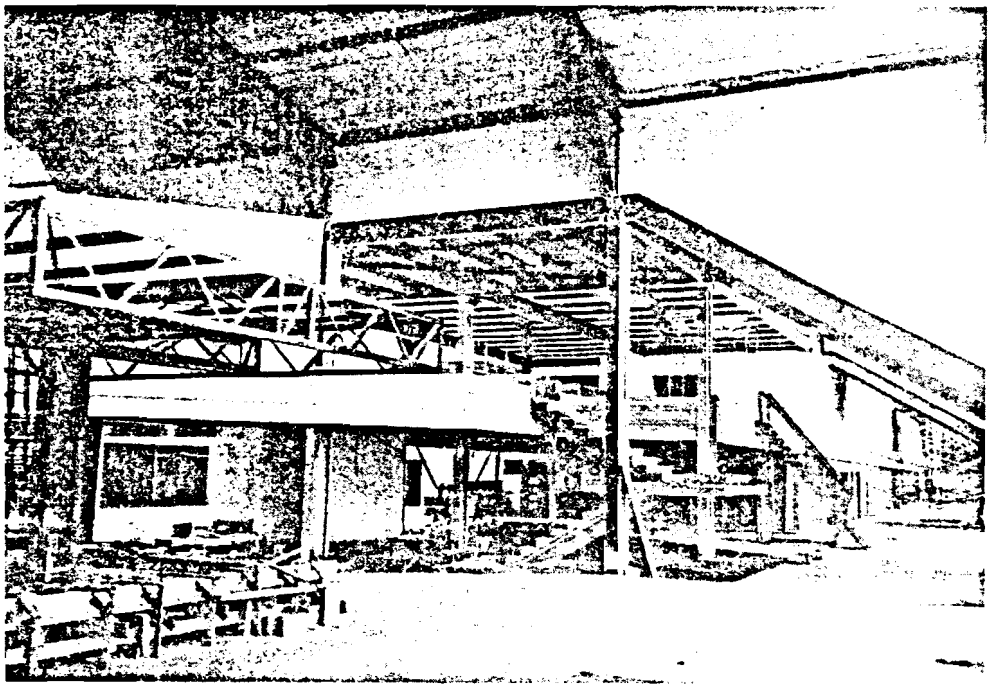


16a - North front gallery and walk looking west from ticketing lobby



16b - Ticketing lobby, stair to upper floor at center left

ILLUSTRATION 16 - TERMINAL BUILDING INTERIOR VIEWS

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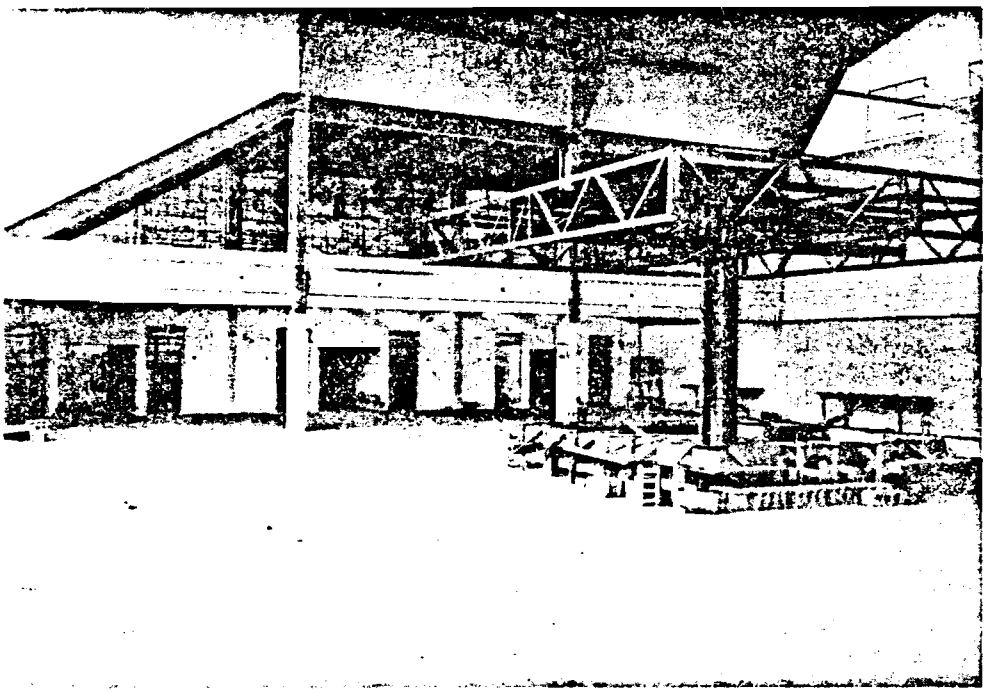
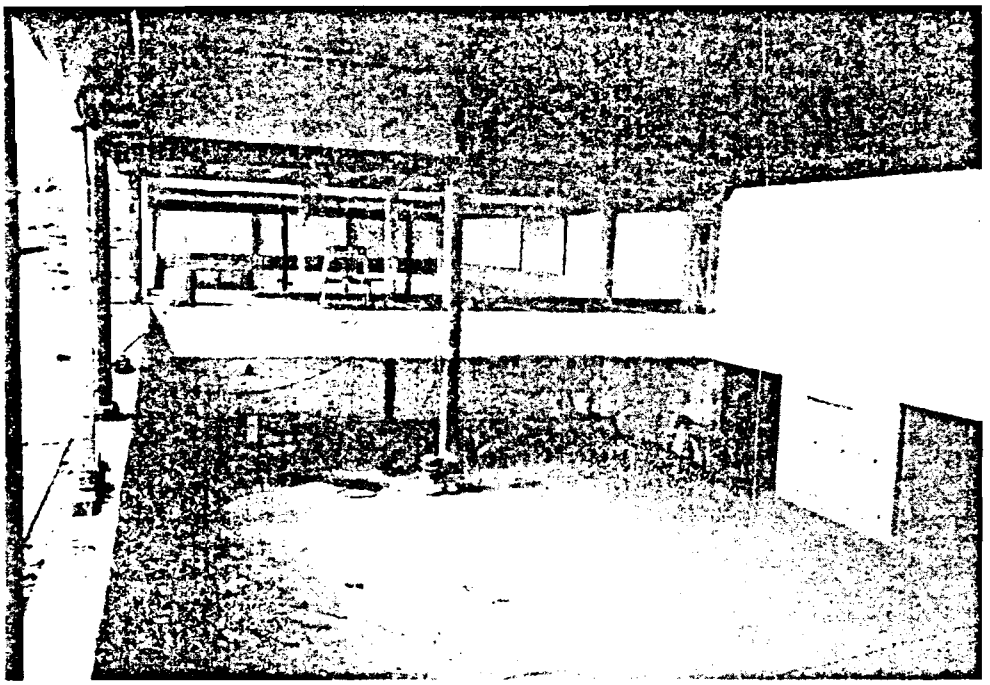


17a - Ticketing lobby from in front of stair



17b - Deplaning passenger areas from upper floor restaurant area, immigration lobby in foreground

ILLUSTRATION 17 - TERMINAL BUILDING INTERIOR VIEWS

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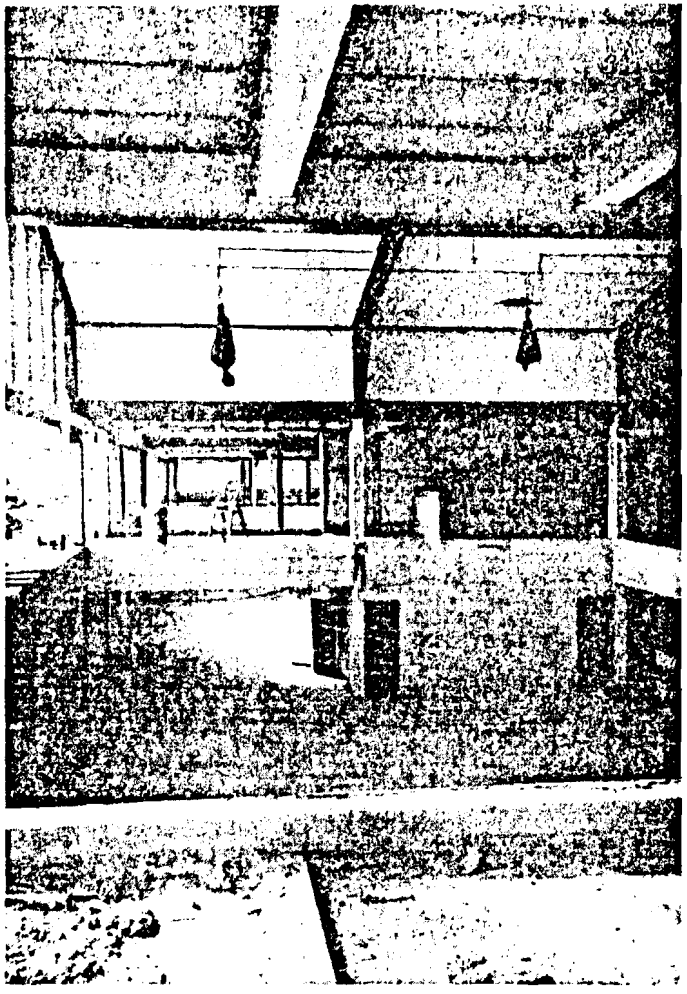
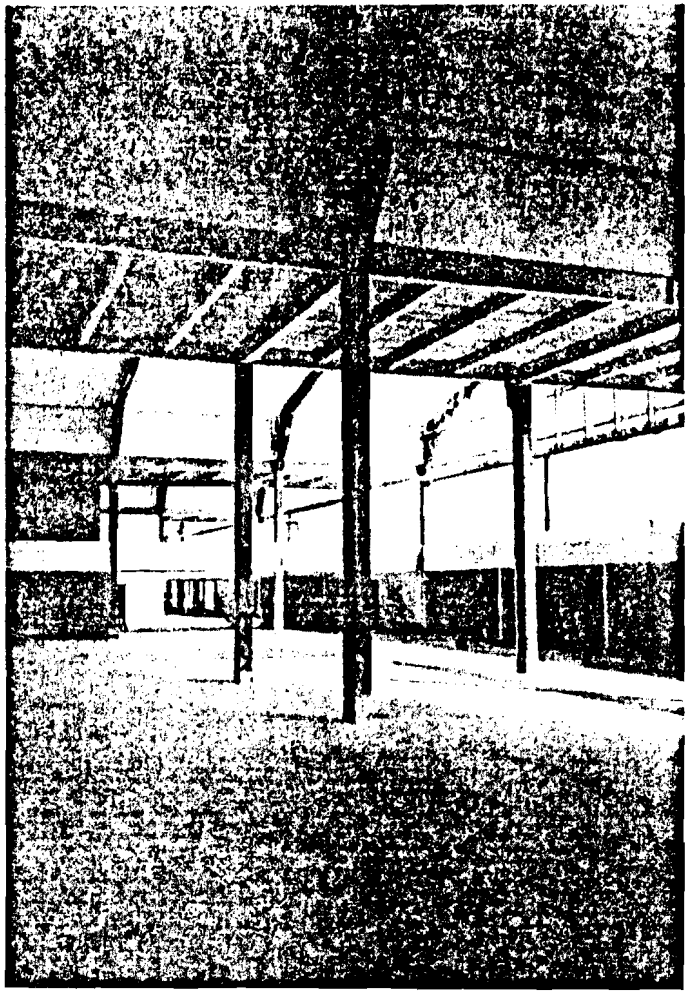


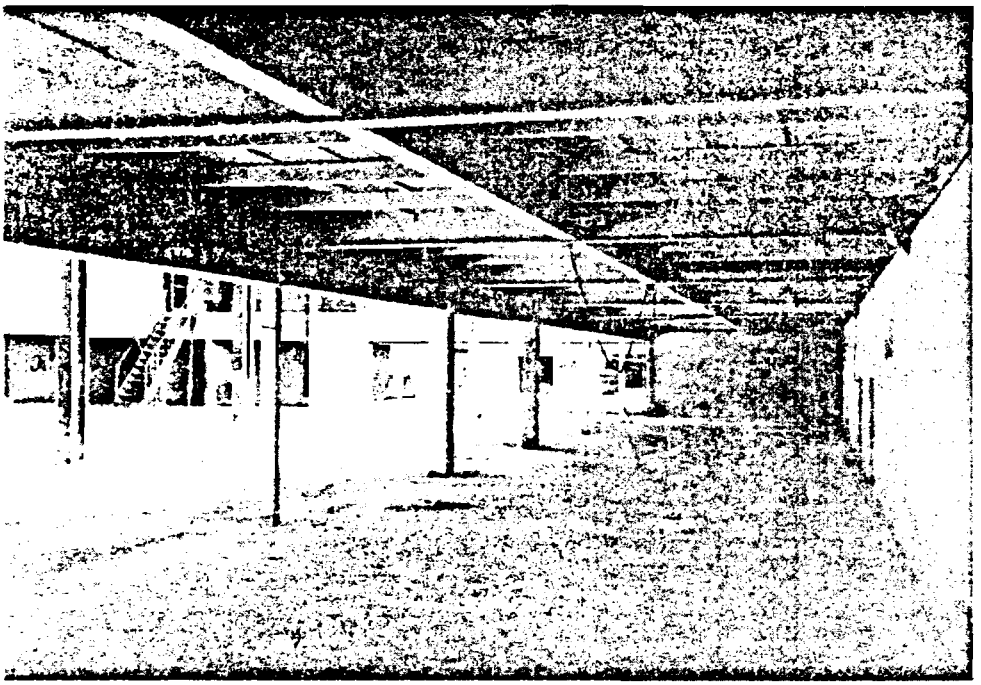
18a - Enplaning passenger waiting area from upper floor corridor to deck



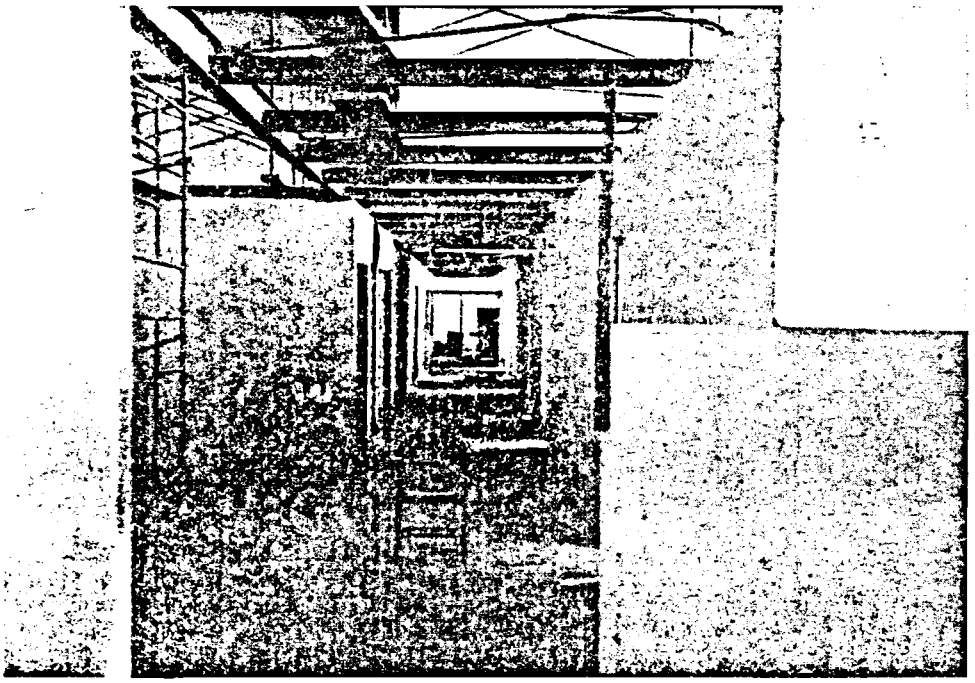
18b - Baggage claim area looking to immigration lobby at rear

ILLUSTRATION 18 - TERMINAL BUILDING INTERIOR VIEWS

BEST AVAILABLE COPY



19a - Baggage claim area from point next to cart drive-through on right



19b - Upper floor office corridor

ILLUSTRATION 19 - TERMINAL BUILDING INTERIOR VIEWS

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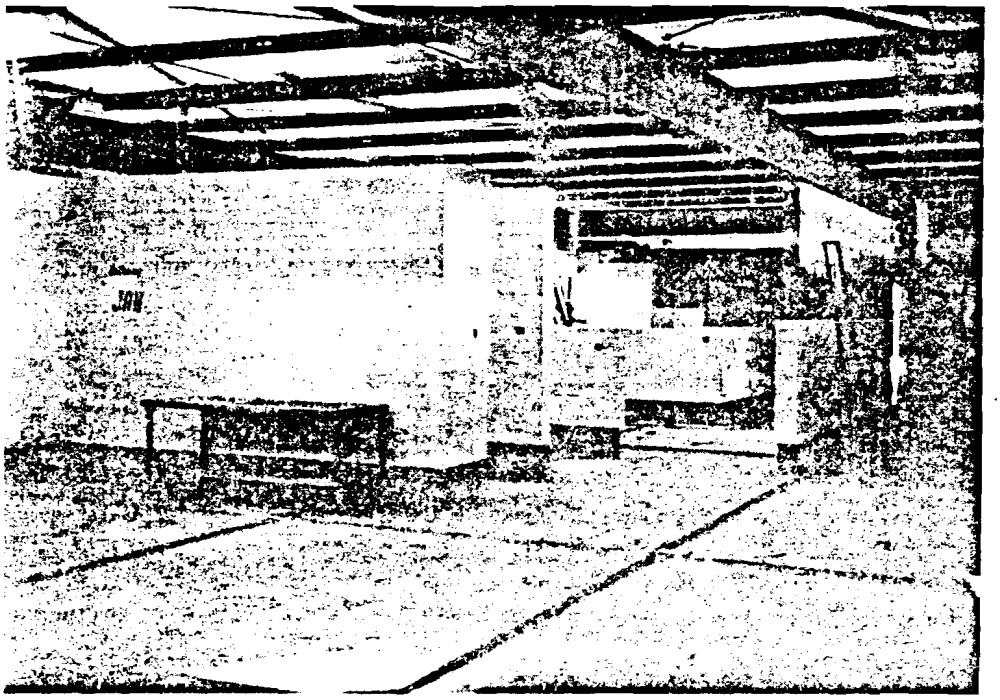

20a - Upper floor kitchen area

ILLUSTRATION 20 - TERMINAL BUILDING INTERIOR VIEW

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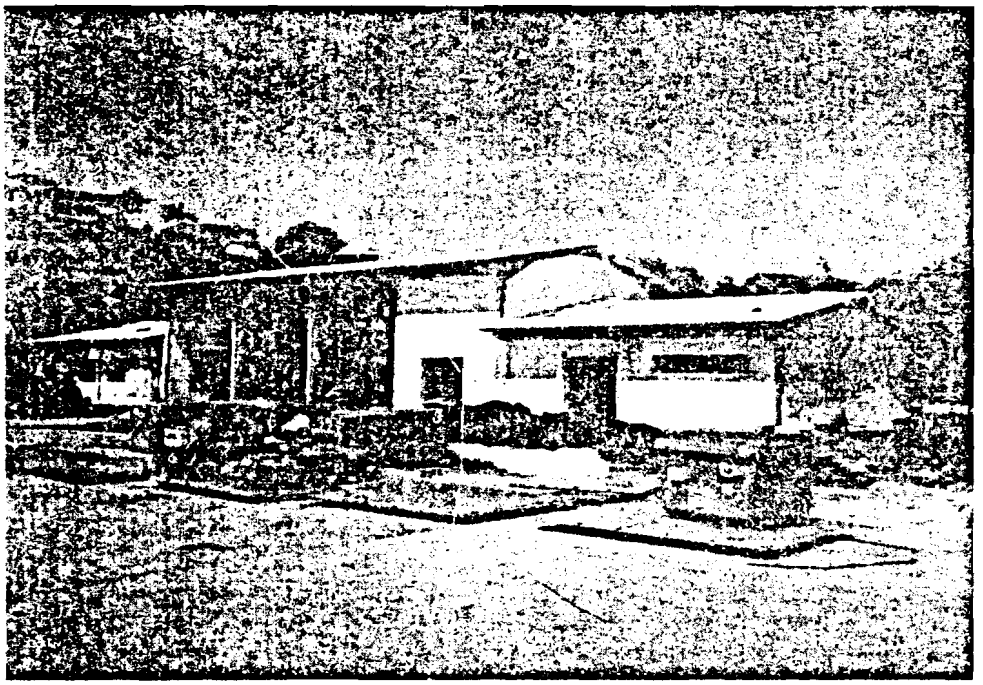
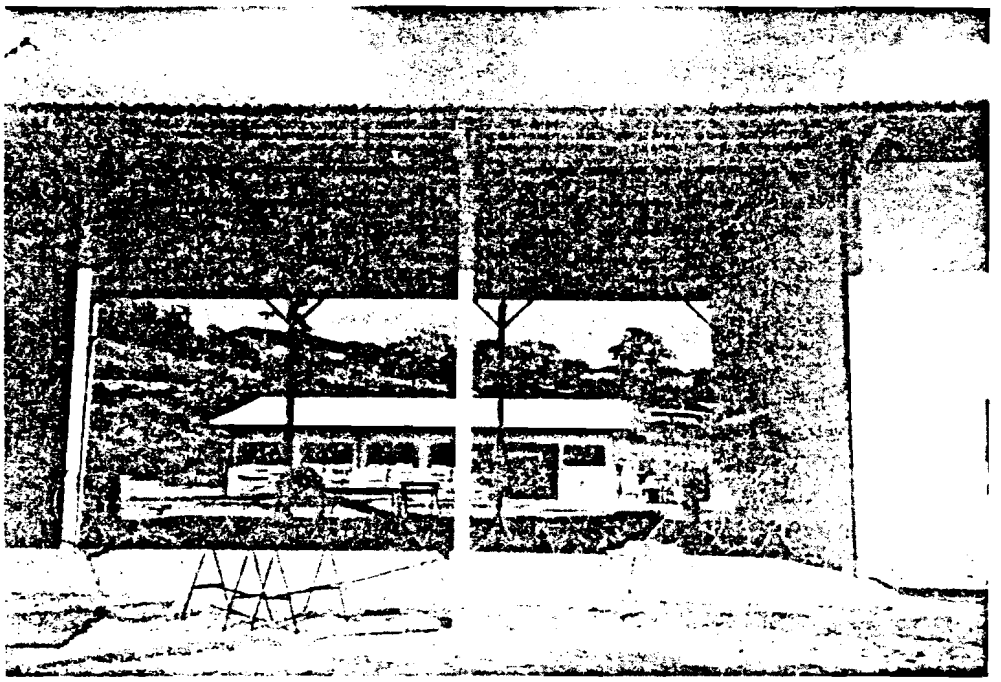
21a - Area looking south from ridge, Generator Building in front



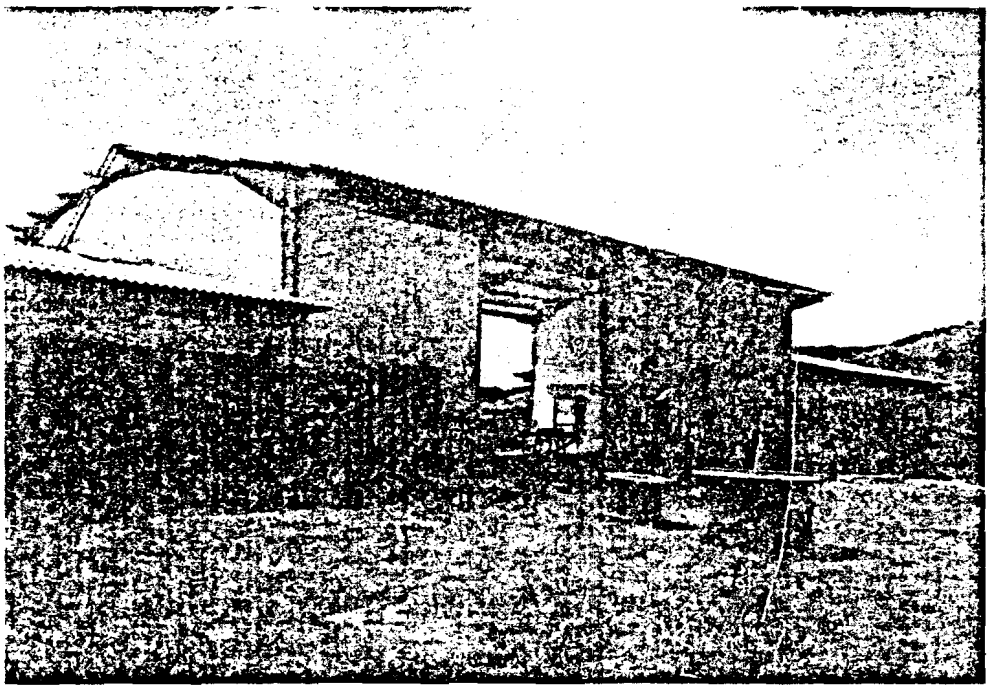
21b - Apron side of building, "Great House" on hill upper left

ILLUSTRATION 21 - CRASH/FIRE/MAIL/CARGO BUILDING VIEWS

BEST AVAILABLE COPY



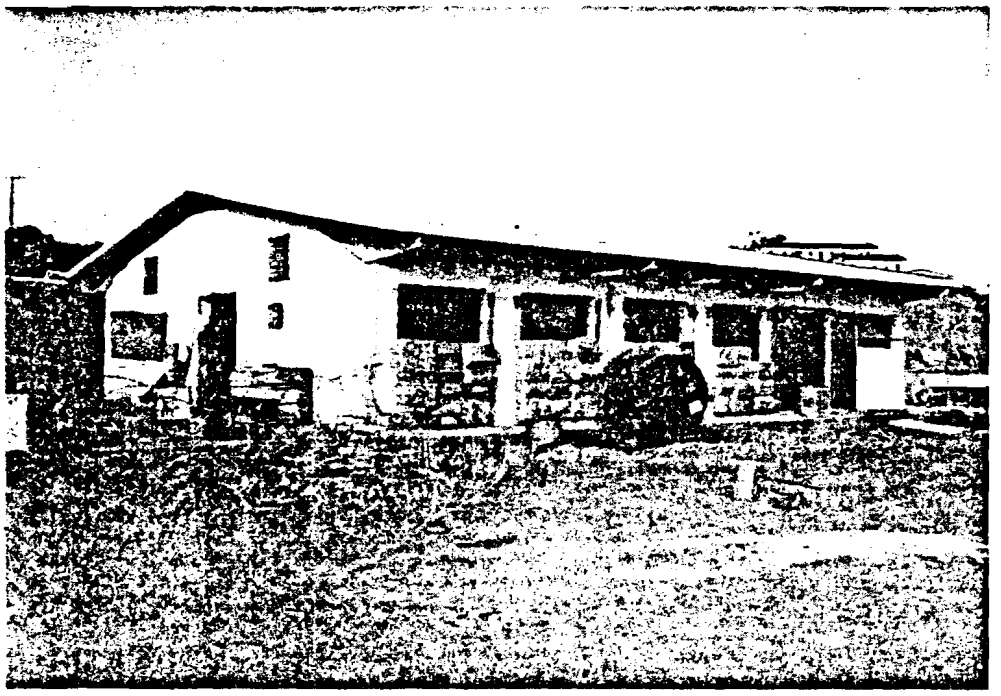
22a - View from apron through vehicle bays to Generator Building



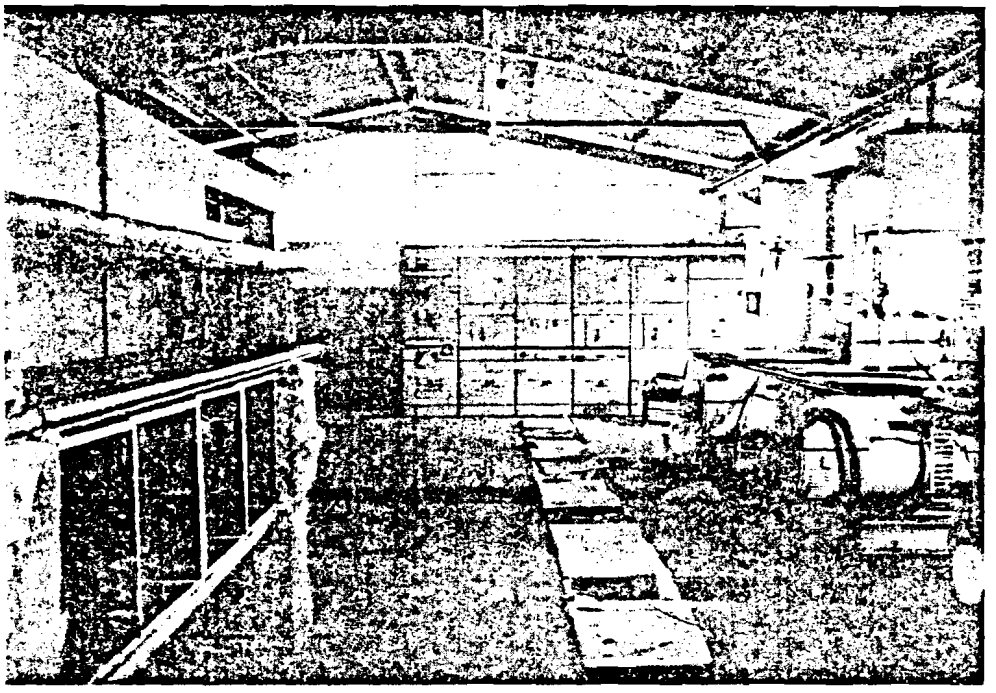
22b - North side

ILLUSTRATION 22 - CRASH/FIRE/MAIL/CARGO BUILDING VIEWS

BEST AVAILABLE COPY



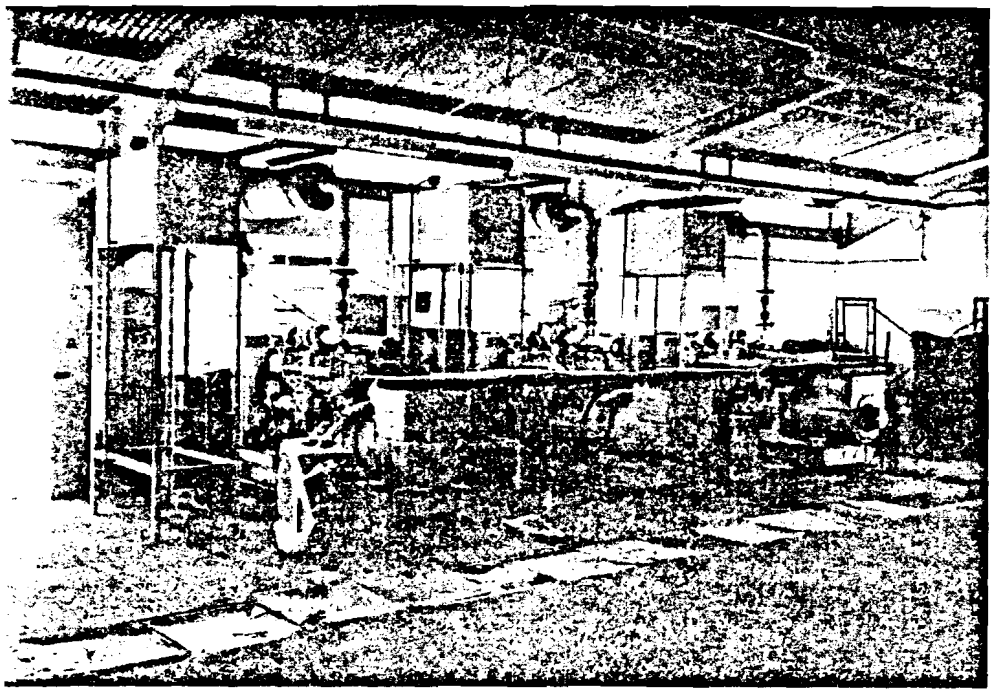
23a - South front



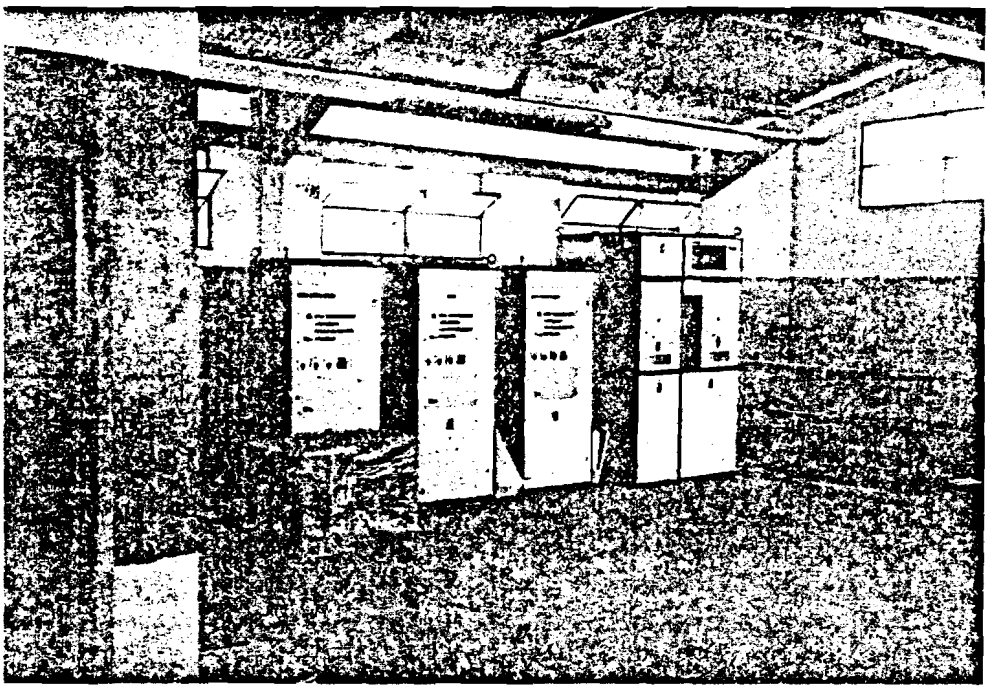
23b - Interior, switch gear in background

ILLUSTRATION - 23 VIEWS OF GENERATOR BUILDING

BEST AVAILABLE COPY



24a - Interior showing generators



24b - Interior showing controls

ILLUSTRATION 24 - VIEWS OF GENERATOR BUILDING

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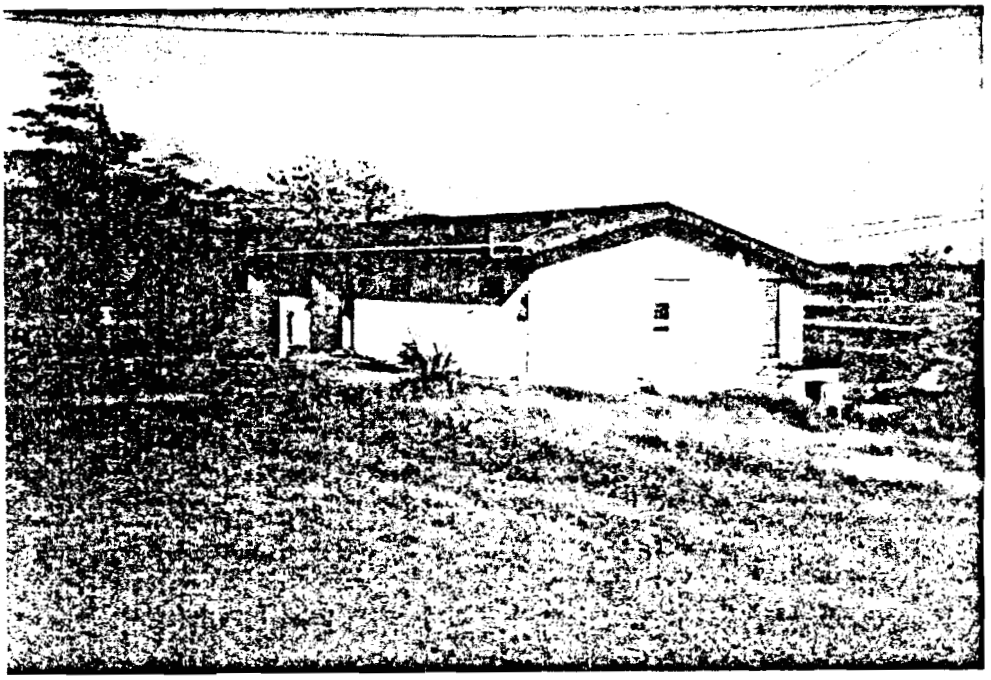
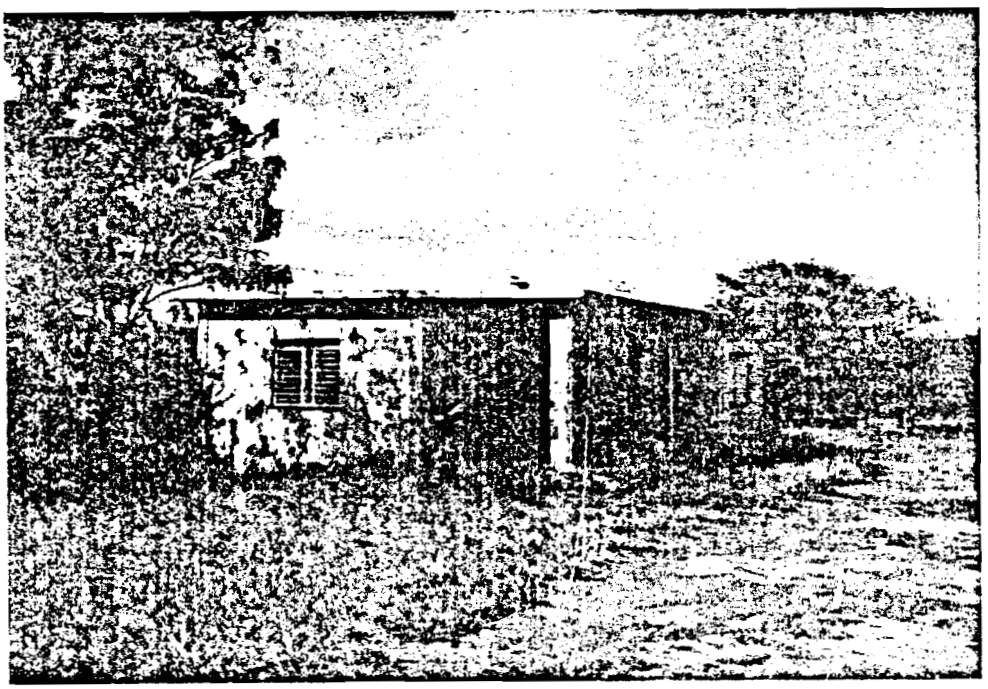


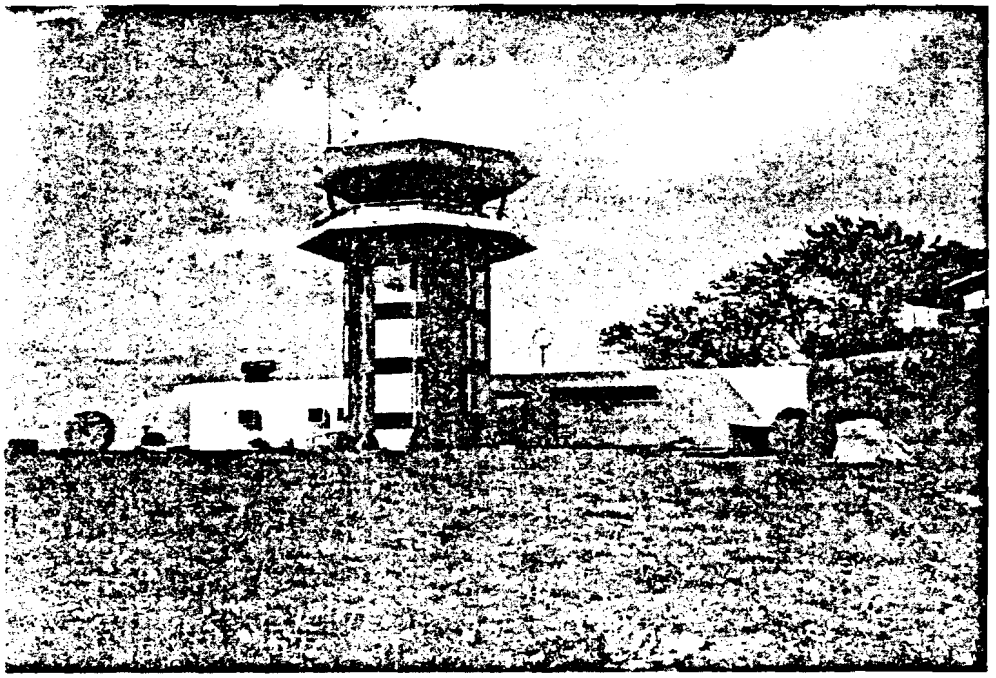
25a - Residence/Office Building, the Project Director's office



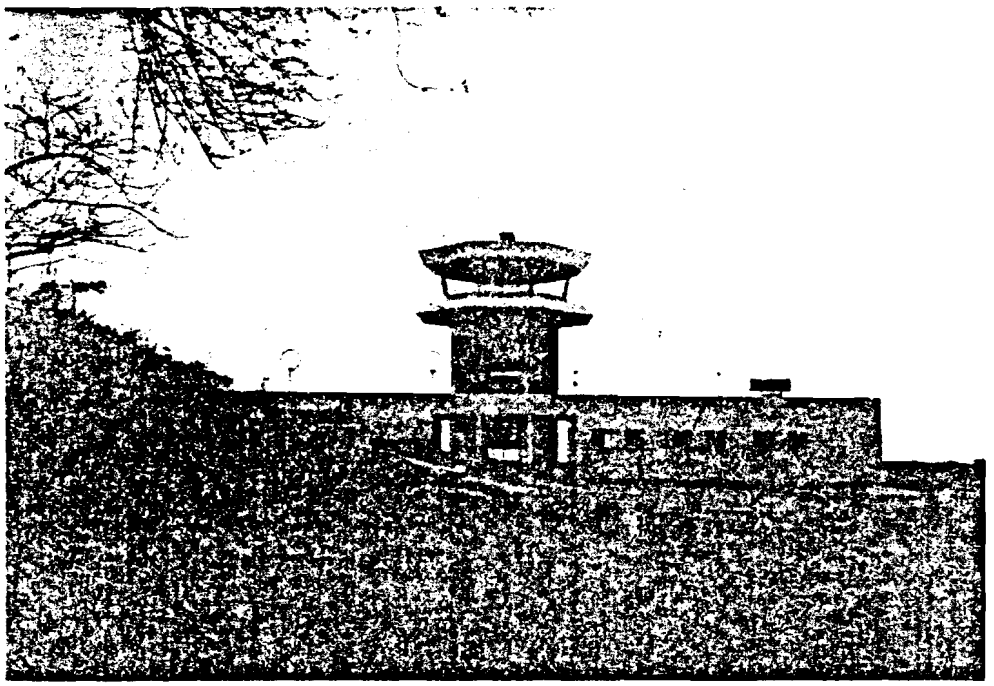
25b - Small office Building, formerly Cuban control headquarters

ILLUSTRATION 25 - VIEWS OF OFFICE BUILDINGS

BEST AVAILABLE COPY



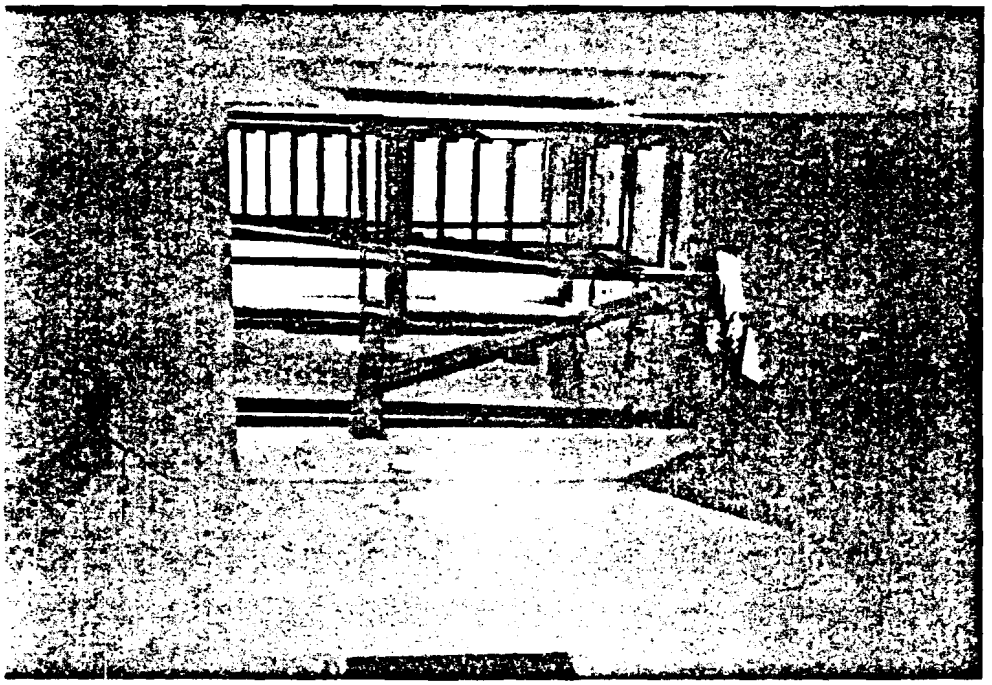
26a - Exterior south side



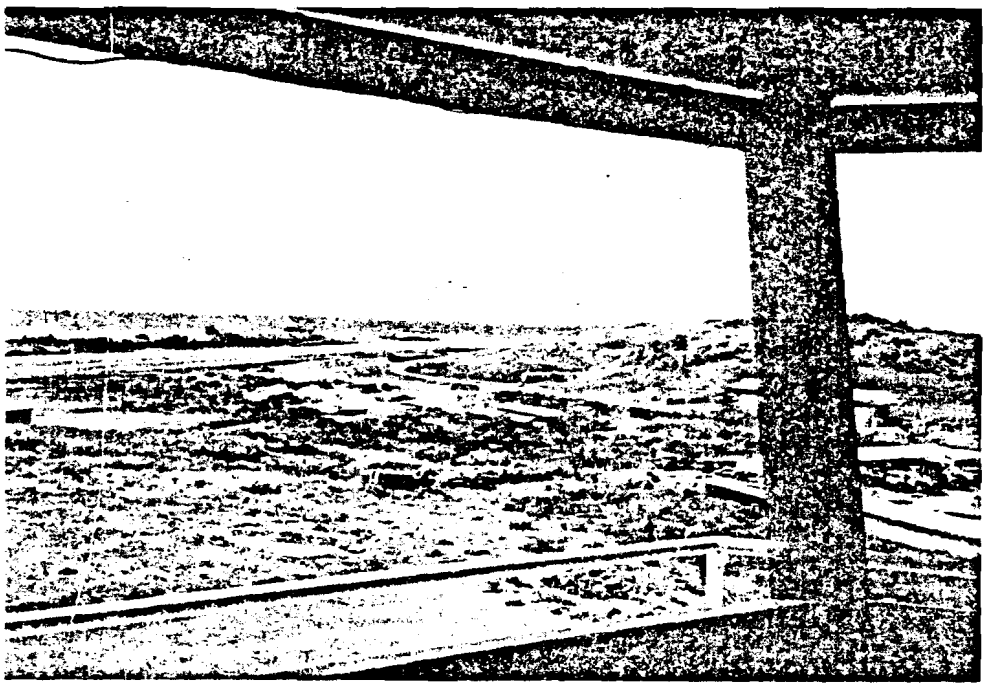
26b - Exterior north side

ILLUSTRATION 26 - VIEWS OF CONTROL TOWER/TECHNICAL BLOCK

BEST AVAILABLE COPY



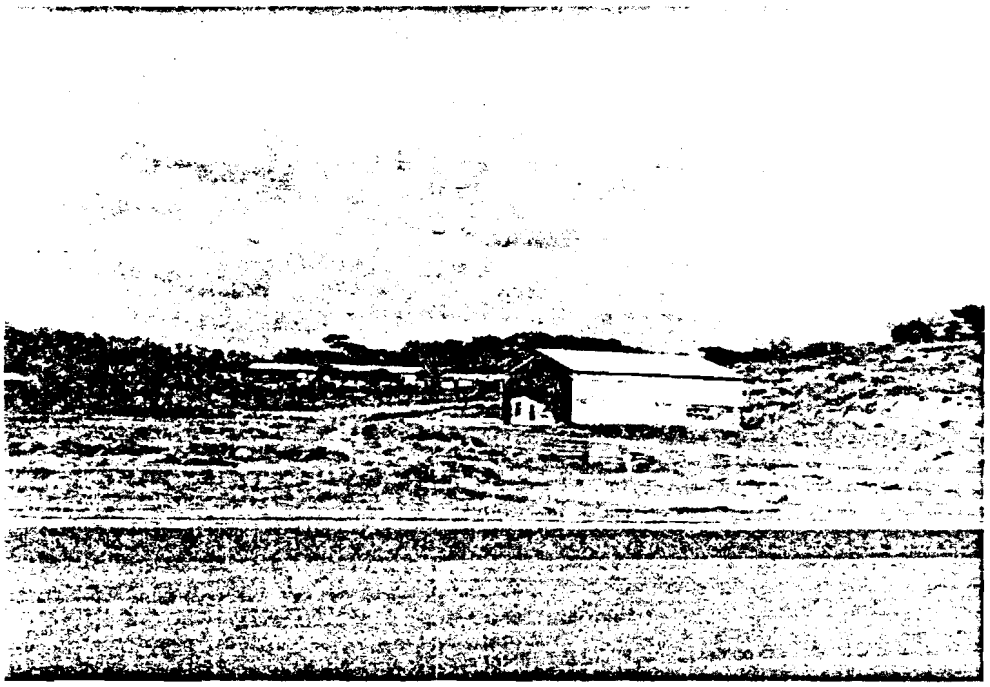
27a - Corridor from Technical Block to control Tower showing temporary Tower stair



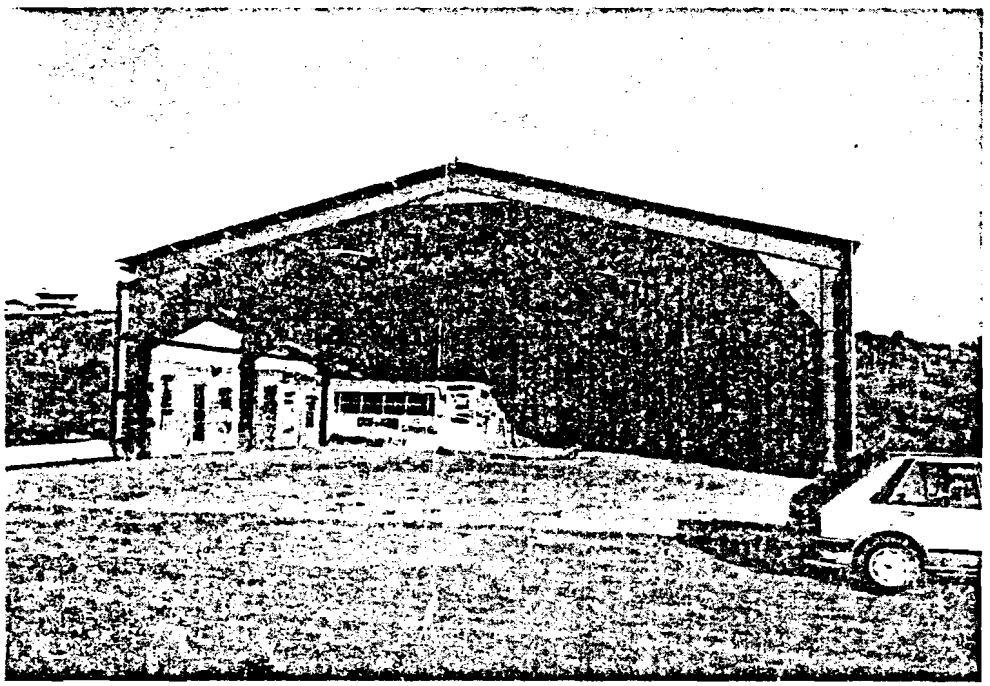
27b - View from Tower control cab showing supporting column corner

ILLUSTRATION 27 - VIEWS OF CONTROL TOWER/TECHNICAL BLOCK

BEST AVAILABLE COPY



28a - Looking northeast from runway

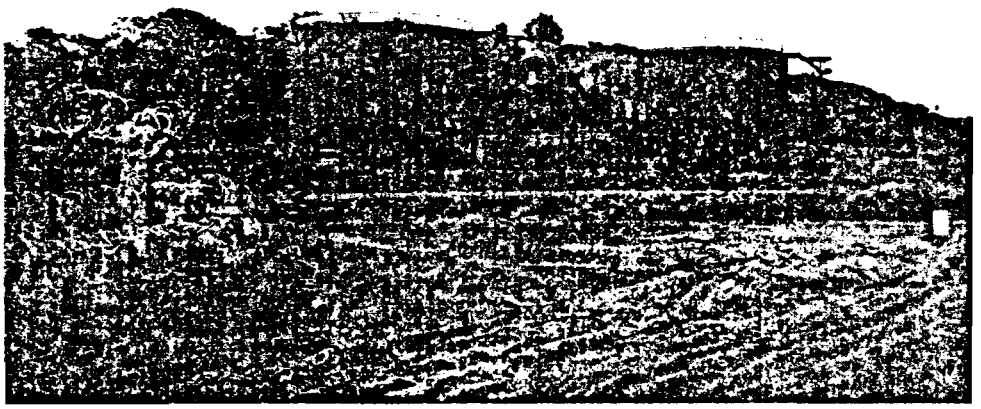


28b - West front view from apron

ILLUSTRATION 28 - VIEWS OF GOVERNMENT HANGAR

BEST AVAILABLE COPY

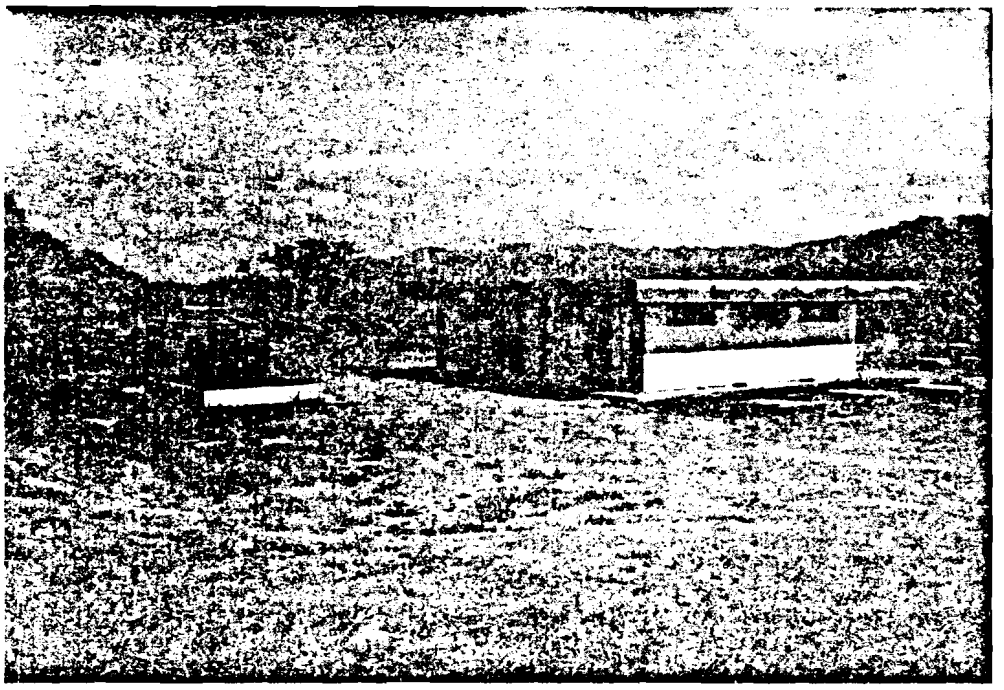
29a - Four storage tanks looking across fenced area



29b - Two larger storage tanks, fenced area to left

ILLUSTRATION 29 - VIEWS OF FUEL FARM

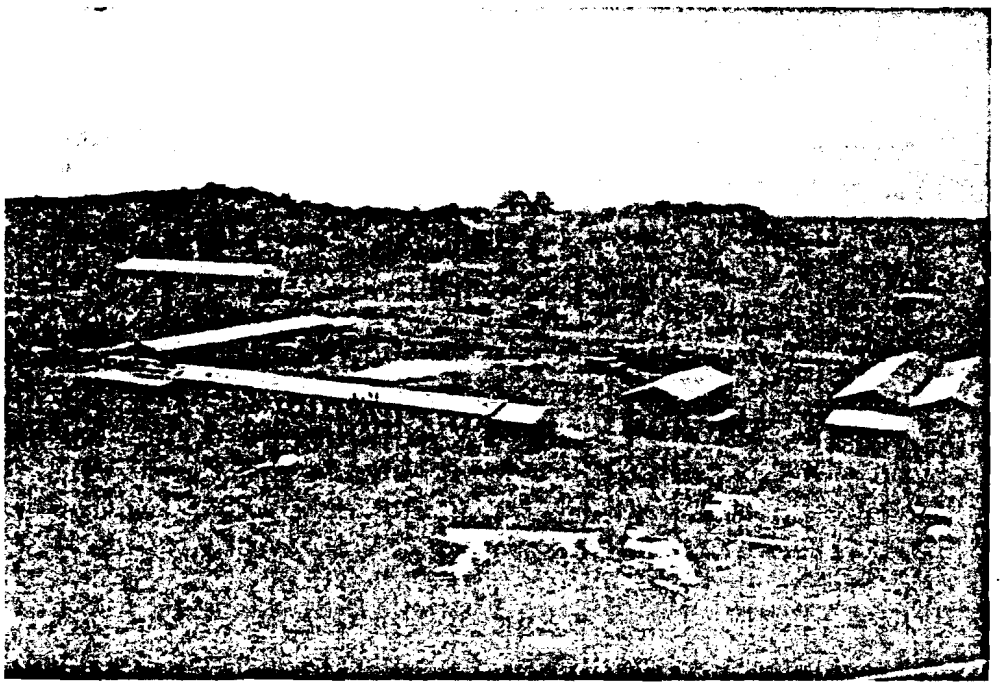
BEST AVAILABLE COPY



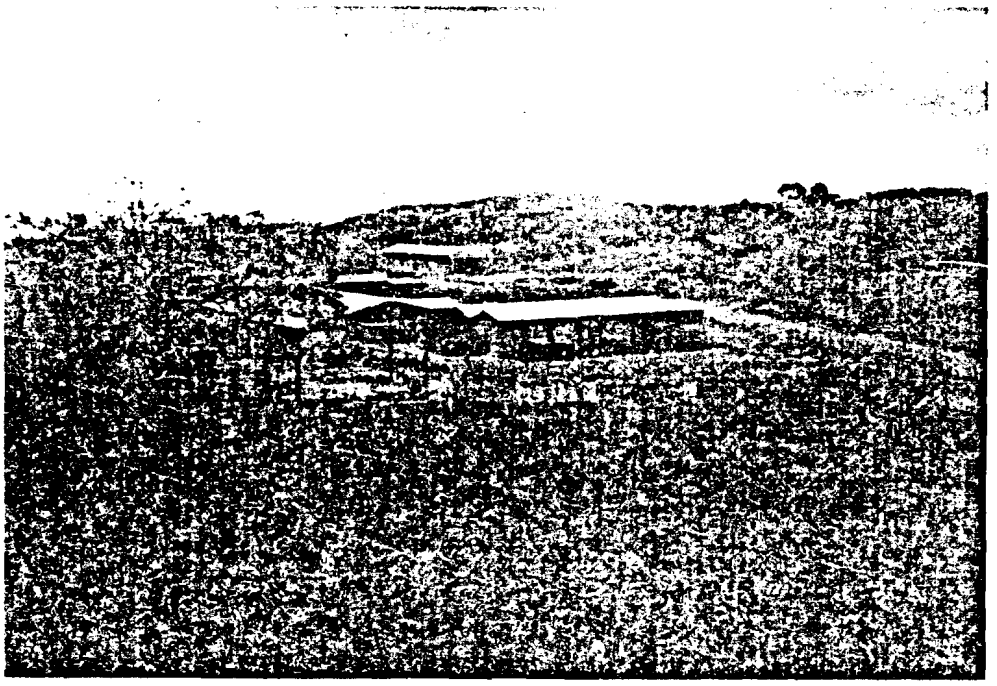
30a - Looking northeast, generator fuel tank at left

ILLUSTRATION 30 - VIEW OF AGL BUILDING

BEST AVAILABLE COPY



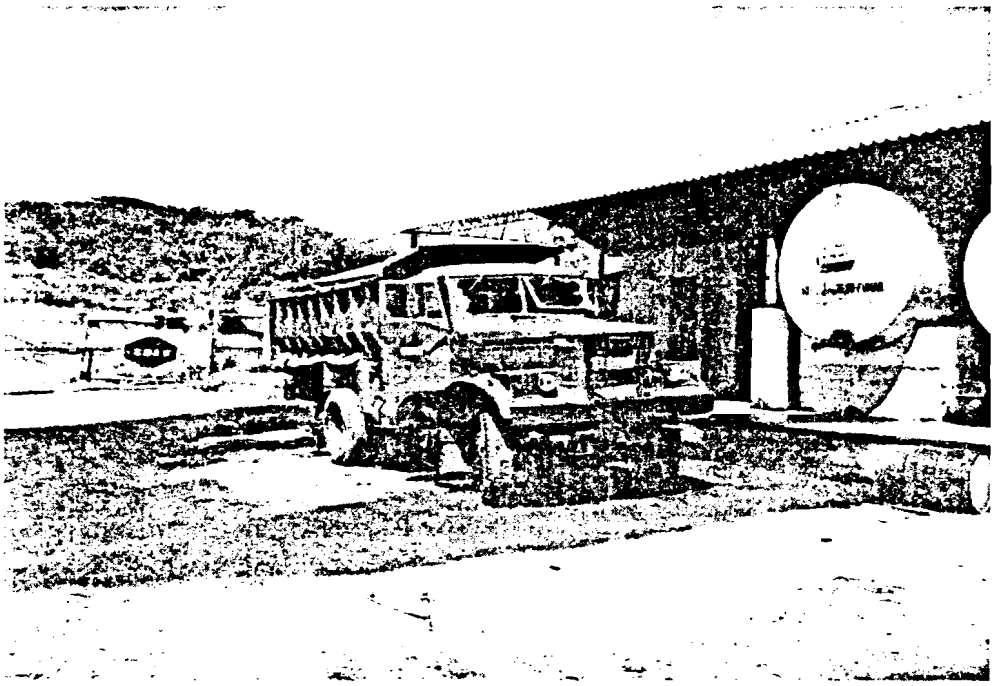
31a - Looking northwest from Control Tower area, warehouse at upper left



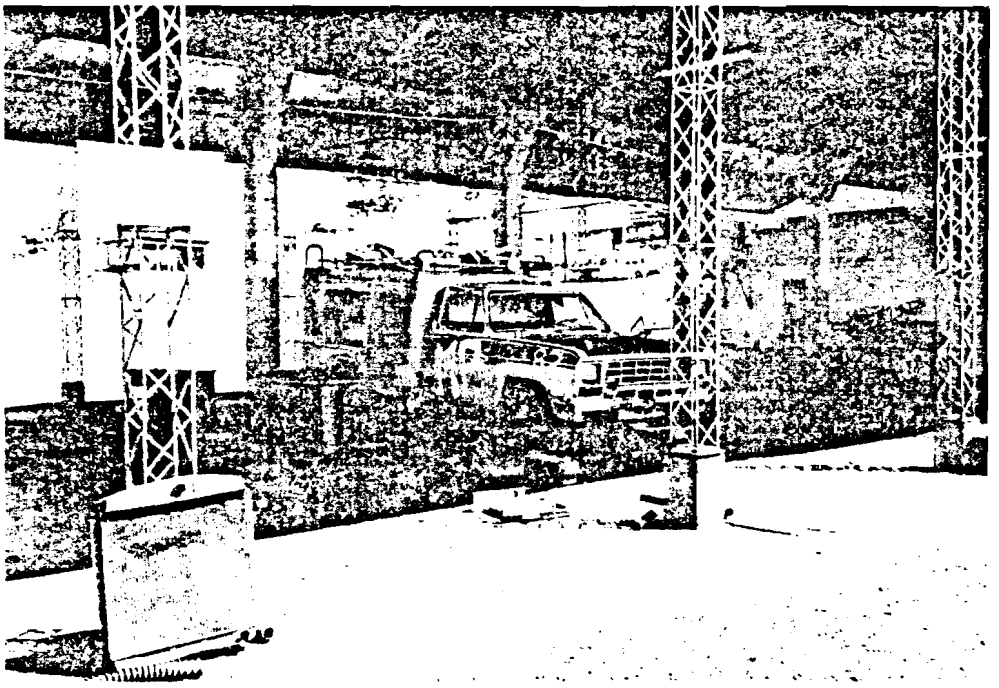
31b - Looking west from road to Control Tower, warehouse in background

ILLUSTRATION 31 - VIEWS OF MAINTENANCE AREA

BEST AVAILABLE COPY



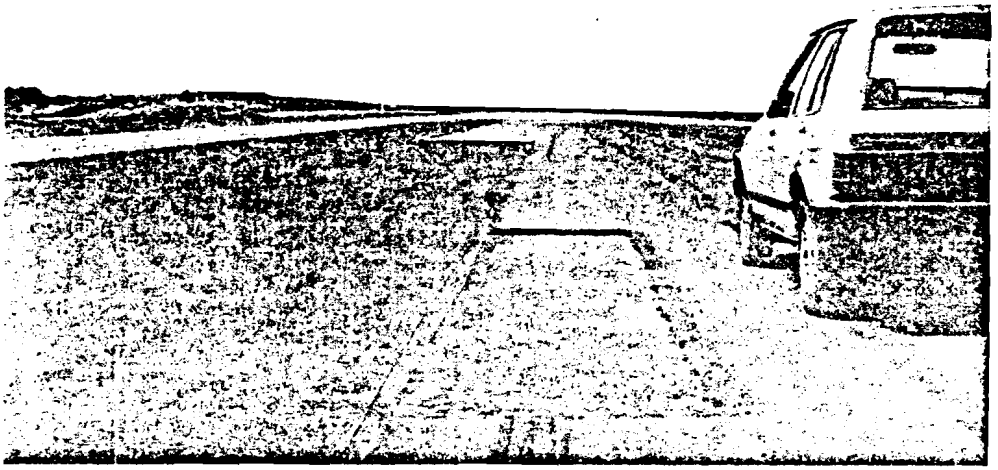
32a - Vehicle fueling area



32b - Vehicle maintenance shed

ILLUSTRATION 32 - VIEWS OF MAINTENANCE AREA

BEST AVAILABLE COPY

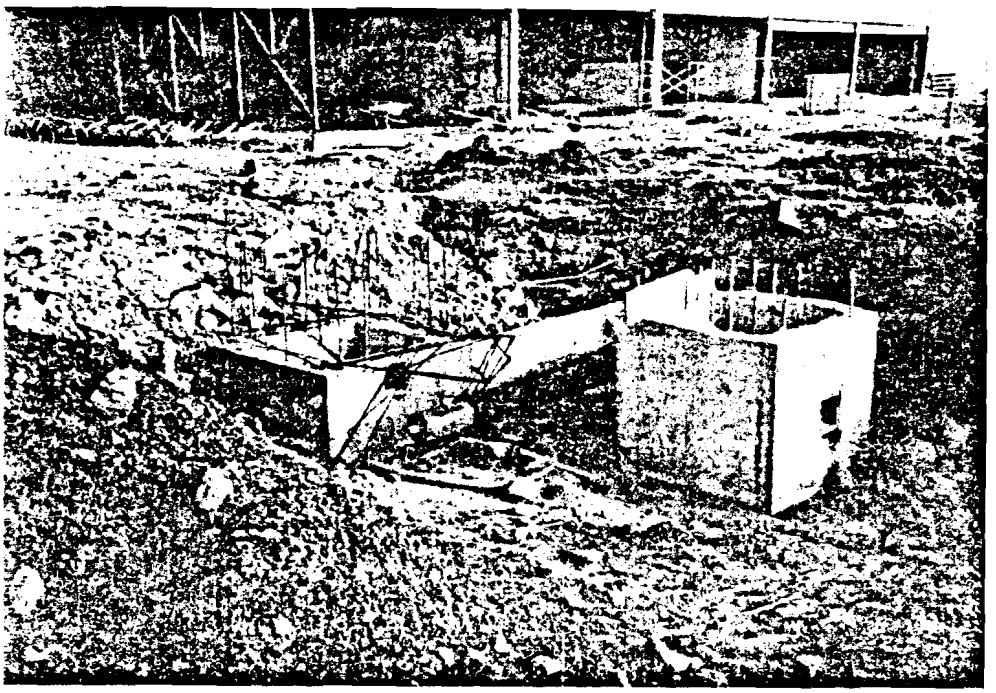


33a - Runway showing partially completed surface course

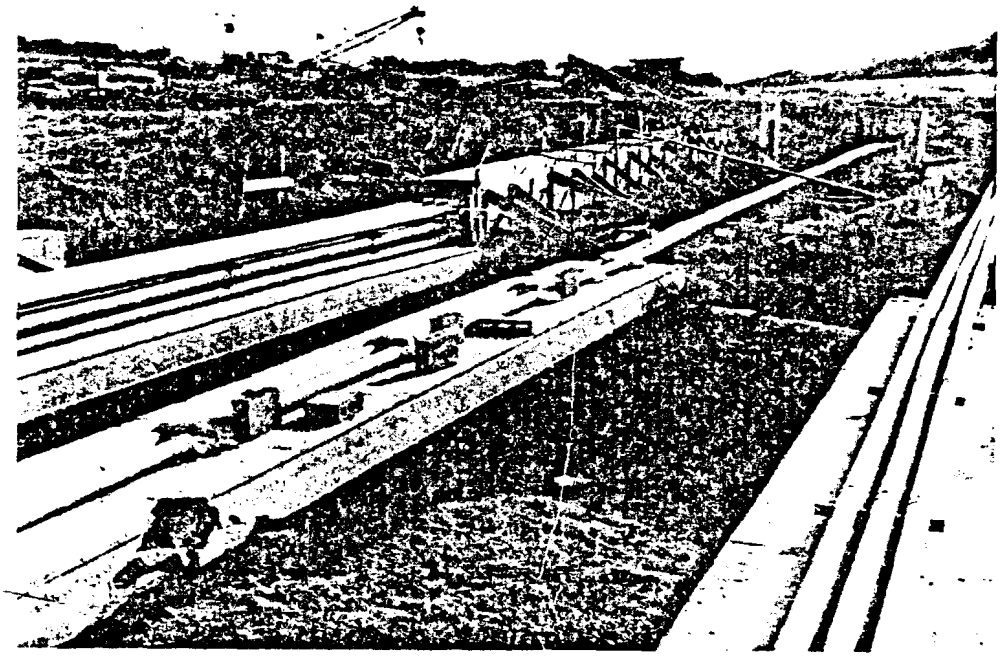
33b - Eroding shoreline at west end of runway

ILLUSTRATION 33 - VIEWS OF RUNWAY AREAS

BEST AVAILABLE COPY



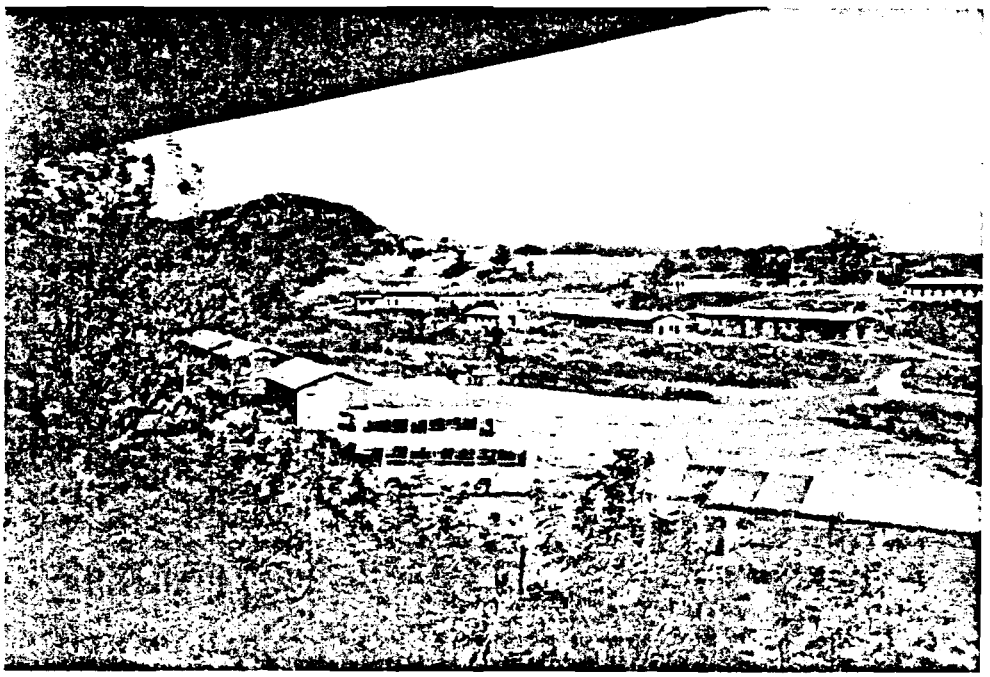
34a - Storm drainage catch basins and water line northwest of Terminal Building



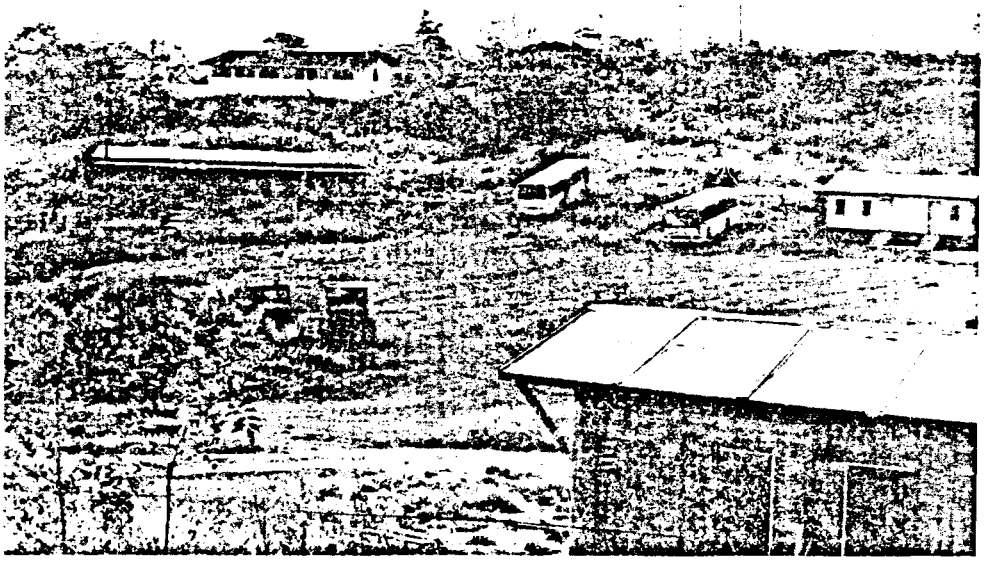
34b - Power and communications systems lines southwest of Crash/Fire/Mail/Cargo Building

ILLUSTRATION 34 - VIEWS OF UNDERGROUND SYSTEMS

BEST AVAILABLE COPY



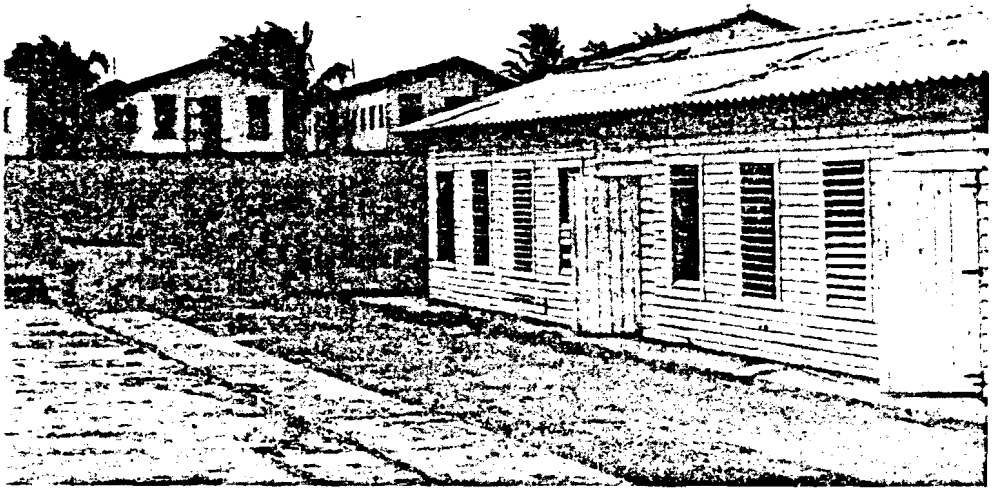
35a - Construction office area from Project Manager's Office, Grenadian construction camp in background



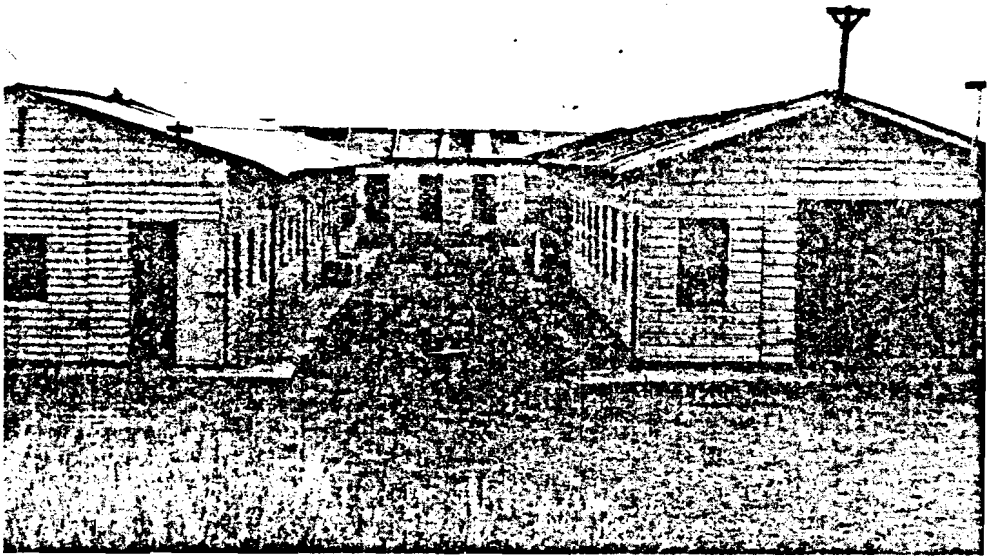
35b - Construction office area, Project Manager's Office in background

ILLUSTRATION 35 - VIEWS OF CONSTRUCTION OFFICE AREAS

BEST AVAILABLE COPY



36a - Living quarters buildings

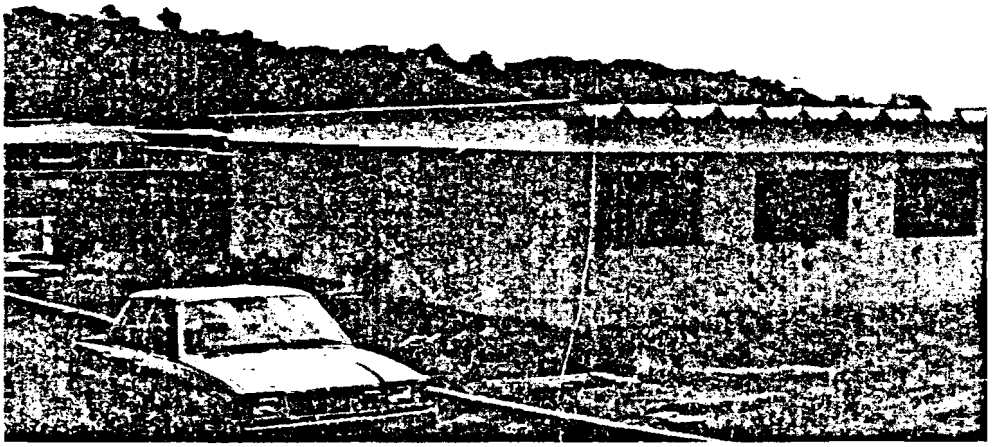


36b - Support buildings

ILLUSTRATION 36 - VIEWS OF GRENADIAN CONSTRUCTION CAMP

BEST AVAILABLE COPY

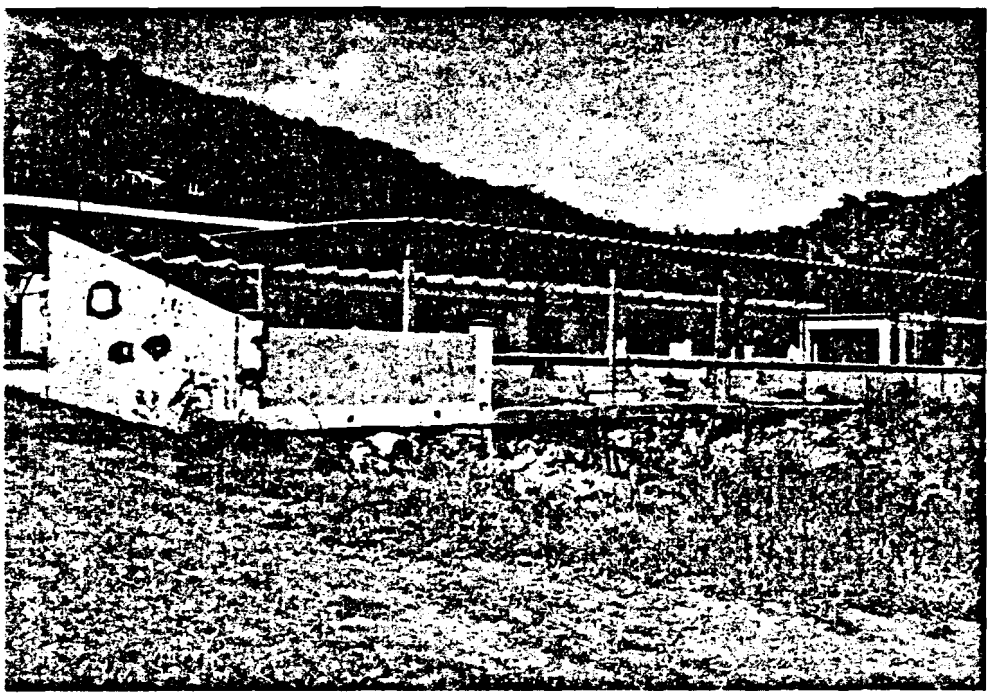
37a - Buildings north of access road



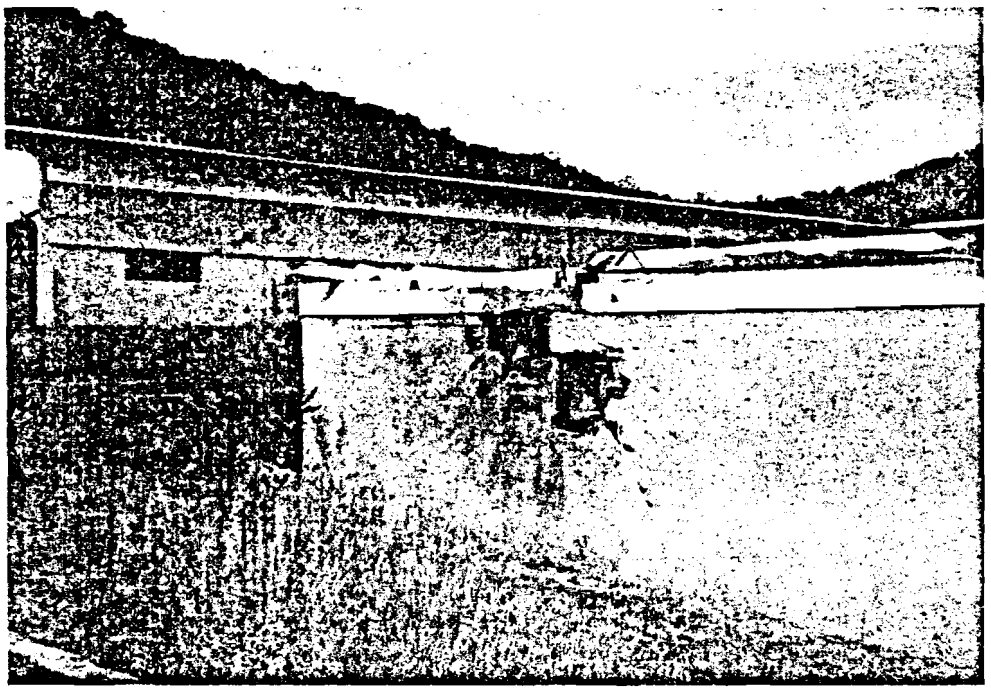
37b - Buildings north of access road, south buildings in background

ILLUSTRATION 37 - VIEWS OF CUBAN CAMP

BEST AVAILABLE COPY



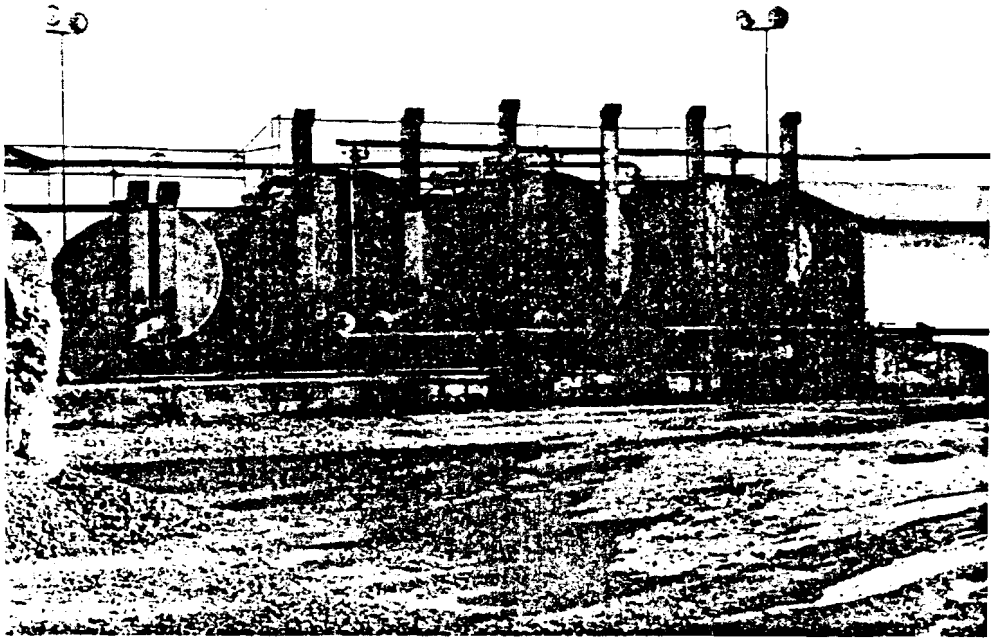
38a - Vehicle shed with shops beyond



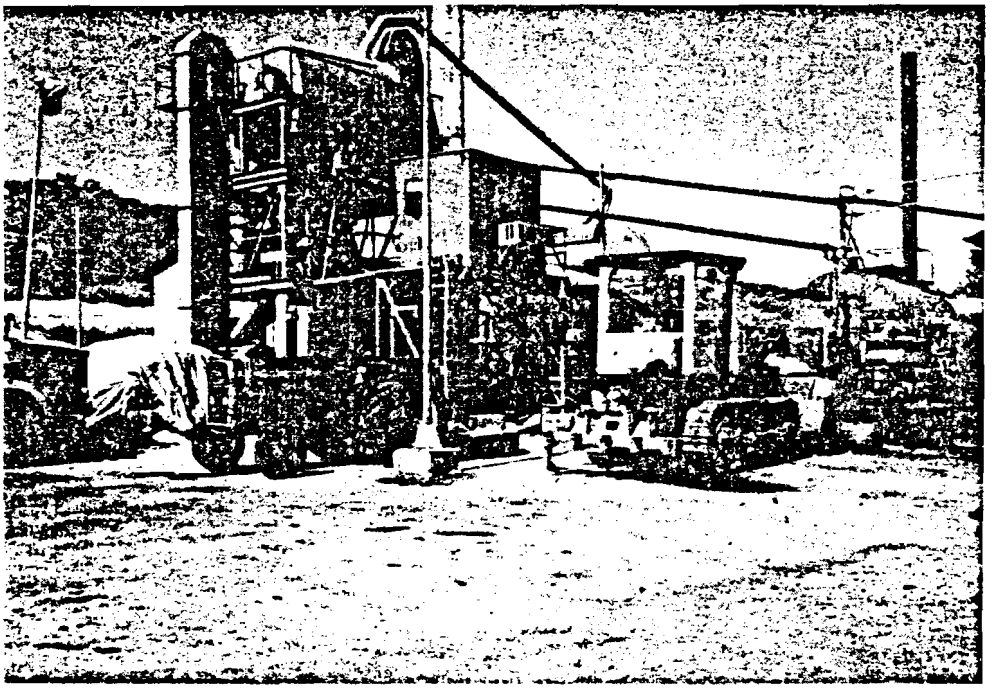
38b - End of vehicle shop, warehouse beyond

ILLUSTRATION 38 - VIEWS OF CUBAN CAMP

BEST AVAILABLE COPY



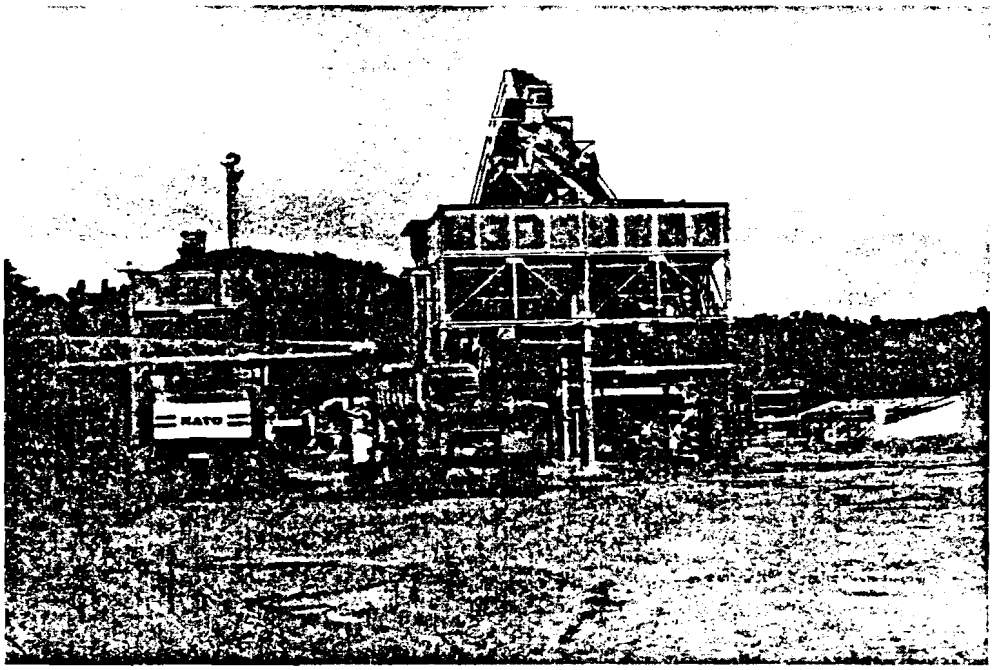
39a - Asphalt plant tanks at quarry site



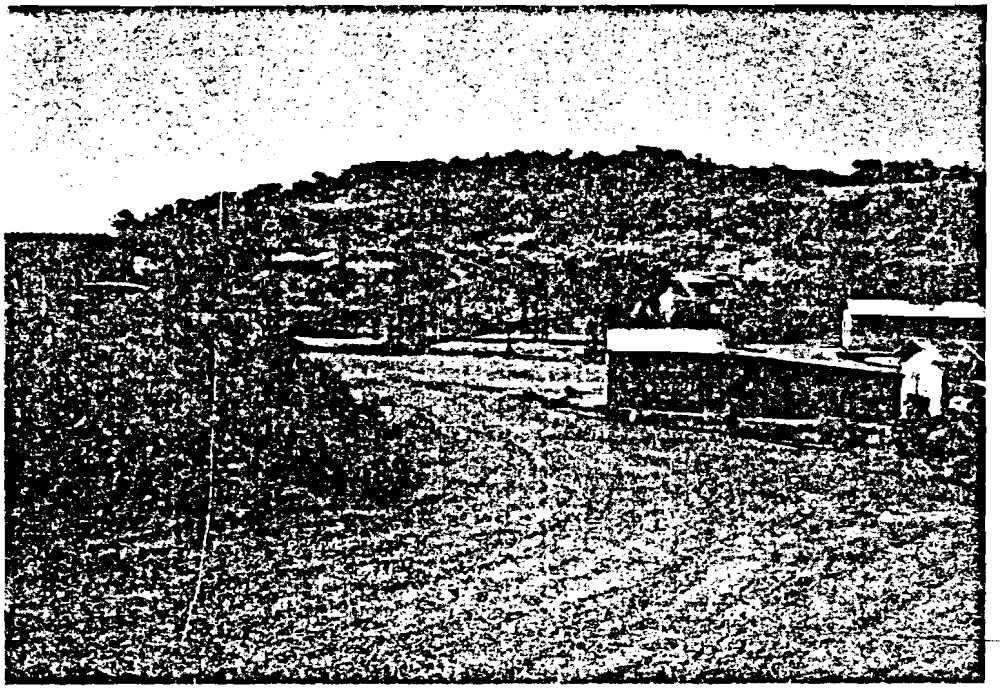
39b - Asphalt plant mixer at quarry site

ILLUSTRATION 39 - VIEWS OF CONSTRUCTION FACILITIES

BEST AVAILABLE COPY



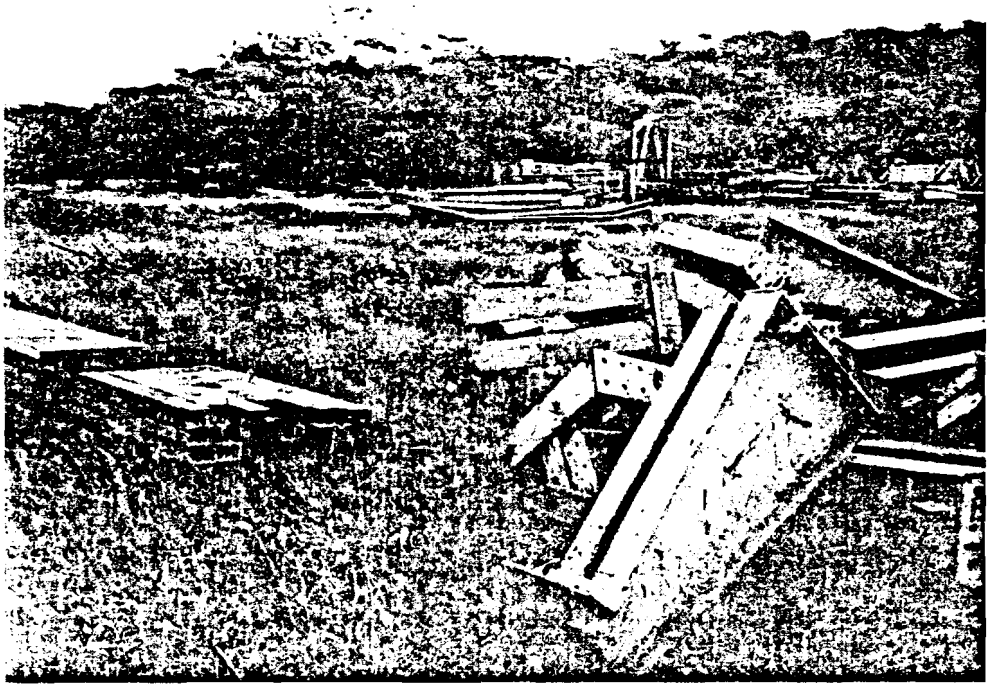
40a - Crushed stone loading hoppers at quarry site



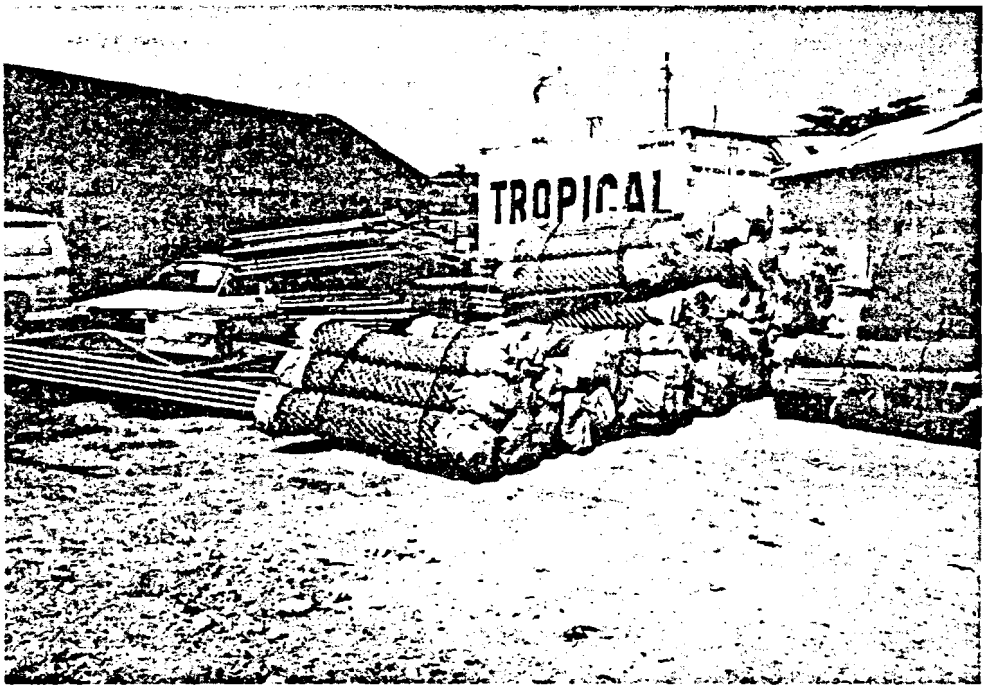
40b - Concrete batching plant at Airport

ILLUSTRATION 40 - VIEWS OF CONSTRUCTION FACILITIES

BEST AVAILABLE COPY



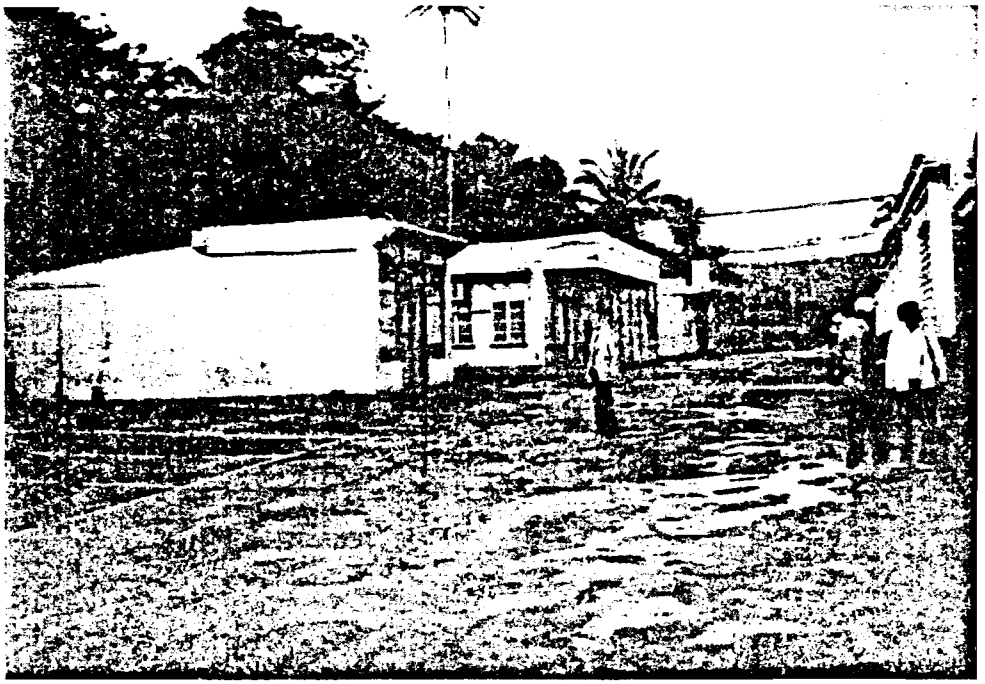
41a - Steel building framing members at Airport



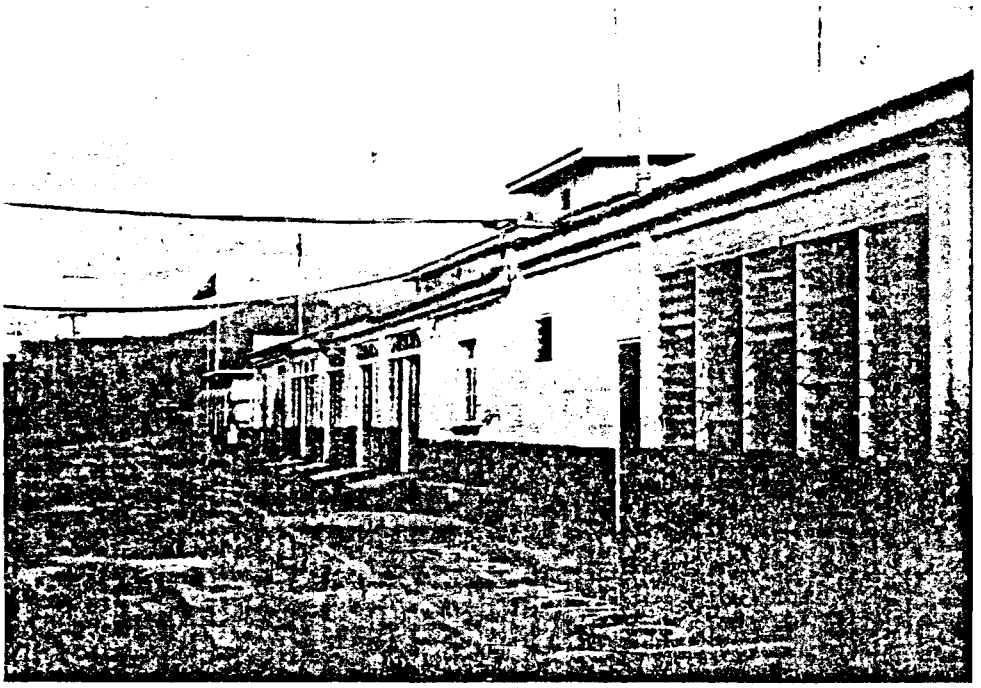
41b - Fencing material at St. Georges dock

ILLUSTRATION 41 - VIEWS OF CONSTRUCTION MATERIALS

BEST AVAILABLE COPY



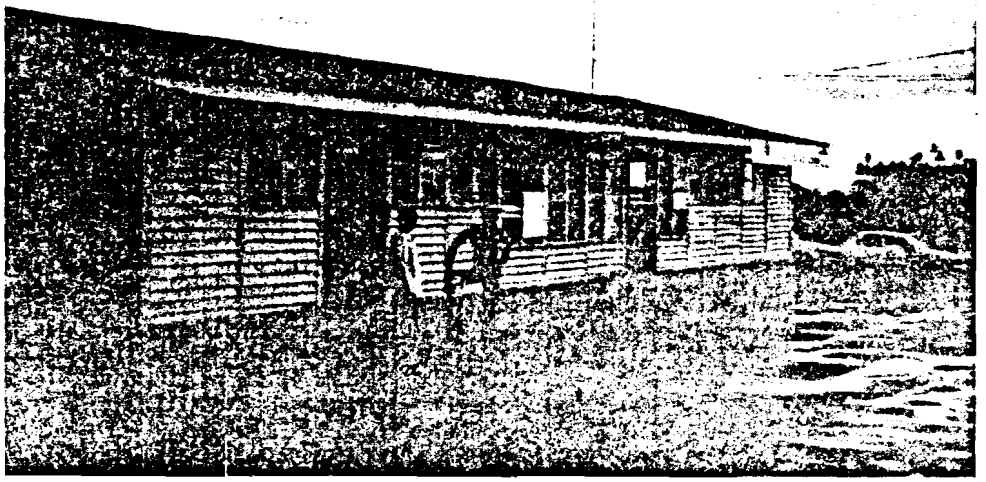
42a - Landside road, concession buildings on left, airport buildings on right



42b - Central airport building land front, control tower shows above roof

ILLUSTRATION 42 - VIEWS OF PEARLS AIRPORT BUILDINGS

BEST AVAILABLE COPY



43a - Airline ticketing building, land front

ILLUSTRATION 43 - VIEW OF PEARLS AIRPORT BUILDING

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APPENDIX B

APPENDIX B

NOTES

The following notes apply to Appendix Tables B.1 through B.12.

Costs

There are two types of costs: construction costs, and the difference in airport operating costs between Case 1 and Case 2. Construction costs are for 1984 and earlier years, while operating costs are for years subsequent to 1984. In 1995, an additional extraordinary cost of $10.6 million is incurred for rehabilitation of the Point Salines Airport.

Tourist Benefits

These benefits are of two types - (1) expenditures in Grenada, and, (2) expenditures made in Barbados by tourists who will no longer have to overnight enroute to Grenada with the availability of direct service and/or night capability with the Point Salines Airport.

Using data in the 1983 OAS Attractions Development Plans for Grenada - 1983, page 24, it was estimated that (based on origin) 45 percent of Grenada-bound stopover visitors presently overnight in Barbados.

Therefore, this benefit was only applied for a single night to 45 percent of the additional air passengers generated by the availability of the Point Salines Airport with jet/night capability. The tourist benefit was estimated at $50 per night.

120

Results for the forecast year were in thousands of dollars: 1985 - 45.0; 1990 - 337.5; 1995 - 900.00; and 2000 - 1,125.0.

Tourist expenditures after arriving in Grenada were based on 8.5 days average stay per tourist, at $50 per day. Using the difference between the Case 1 and Case 2 tourist forecasts, the benefits for the forecast years (in thousands of dollars) were: 1985 - 850; 1990 - 6,375; 1995 - 17,000; and 2000 - 21,250.

Other Benefits

These benefits are of four types; landing fees, rental of space in the airport, savings in vehicle operating costs, and induced employment in agriculture and industry.

- Landing Fees. As shown by Table 6.7, the differences between landing fees for Cases 1 and 2 were estimated for the forecast years as: 1985 - $11,100; 1990 - $34,900; 1995 - $70,400; and 2000 - $145,700.
- Airport Rentals. It was estimated that some 4920 square feet of space would be rented out, in the new Terminal Building. At a rate of $10.61 per square feet per year, and with 75 percent rented by 1985 and 100 percent by 1990, receipts would by $39,200 for 1985 and $52,200 for subsequent years.
- Vehicle Operating Costs. With 19 miles difference in the distance between Pearls Airport and the St. Georges area, compared to Point Salines Airport to the same destination, and assuming estimated savings of 38 cents per mile and three tourist

passengers per vehicle, the savings in vehicle operating costs would be: 1985 - $227,200; 1990 - $145,800; 1995 - $243,200 and 2000 - $278,800. Intransit passengers were subtracted, since by definition, they do not leave the airport. It should be noted that vehicle operating costs are heavily import-oriented.

- Induced Employment in Agriculture. It was estimated that the availability of additional air cargo space would raise the level of agricultural employment as folows: by 1985 - 2 percent, 1990 - 3 percent; 1995 - 4 percent and 2000 - 5 percent. Based on the present employment level (7,700) and at current wages of $400 per year, this would produce additional agricultural wage benefits as follows: 1985 - $61,600; 1990 - $92,400; 1995 - $123,200 and 2000 - $154,000.

- Induced Employment in Industry. Only one industry was considered, the readymade clothing industry. Growth rates were estimated at 3, 5, 7 and 9 percent annually (on the 1983 base of 310 employees) for the years 1985, 1990, 1995 and 2000, respectively. With an average wage of $1445, this would produce additional wage benefits as follows: 1985 - $13,100; 1990 - $23,120; 1995 - $32,000 and 2000 - $40,740.

Table B.1
ALT. 1A-NET PRESENT VALUE AND BENEFIT/COST RATIO CALCULATION
(All Construction Costs Included, Discount Rate At 5 Percent)

NUMBER OF YEARS=37 DISCOUNT RATE= 5.0 PERCENT

YEAR	COSTS	PRESENT VALUE	TOURIST BENEFITS	OTHER BENEFITS	TOTAL BENEFITS	PRESENT VALUE
1978	0.0	0.0	0.0	0.0	0.0	0.0
1979	3377.7	3216.9	0.0	0.0	0.0	0.0
1980	2072.2	1879.5	0.0	0.0	0.0	0.0
1981	11534.2	9963.7	0.0	0.0	0.0	0.0
1982	15509.8	12760.0	0.0	0.0	0.0	0.0
1983	14508.4	11367.7	0.0	0.0	0.0	0.0
1984	24000.0	17909.2	0.0	0.0	0.0	0.0
1985	187.8	133.5	340.1	352.2	692.3	492.0
1986	184.5	124.9	508.9	370.4	879.3	595.1
1987	181.4	116.9	761.4	389.5	1150.9	741.9
1988	178.2	109.6	1139.3	409.6	1548.9	950.9
1989	175.1	102.4	1704.7	430.7	2135.4	1248.5
1990	172.1	95.8	2550.7	452.9	3003.6	1672.5
1991	175.9	93.3	3103.6	465.8	3569.3	1892.9
1992	179.7	90.8	3776.2	479.0	4255.2	2149.2
1993	183.7	88.3	4594.6	492.6	5087.2	2447.0
1994	187.7	86.0	5590.4	506.6	6097.0	2793.1
1995	10791.6	4708.3	6802.0	521.0	7323.0	3195.0
1996	202.4	84.1	7112.4	548.1	7660.5	3183.1
1997	212.4	81.1	7437.0	576.6	8013.7	3171.3
1998	222.9	84.0	7776.5	606.6	8383.1	3159.5
1999	233.9	84.0	8131.4	638.2	8769.6	3147.8
2000	245.5	83.9	8502.5	671.4	9173.9	3136.1
2001	245.5	79.9	8502.5	671.4	9173.9	2986.9
2002	245.5	76.1	8502.5	671.4	9173.9	2844.5
2003	245.5	72.5	8502.5	671.4	9173.9	2709.1
2004	245.5	69.0	8502.5	671.4	9173.9	2580.1
2005	245.5	65.8	8502.5	671.4	9173.9	2457.2
2006	245.5	62.6	8502.5	671.4	9173.9	2340.2
2007	245.5	59.6	8502.5	671.4	9173.9	2228.8
2008	245.5	56.8	8502.5	671.4	9173.9	2122.6
2009	245.5	54.1	8502.5	671.4	9173.9	2021.6
2010	245.5	51.5	8502.5	671.4	9173.9	1925.3
2011	245.5	49.1	8502.5	671.4	9173.9	1833.6
2012	245.5	46.7	8502.5	671.4	9173.9	1746.3
2013	245.5	44.5	8502.5	671.4	9173.9	1663.1
2014	245.5	42.4	8502.5	671.4	9173.9	1583.9
TOT	88153.8	64097.2	188866.5	17310.7	206177.3	65019.2

BENEFIT/COST RATIO= 1.01
NET PRESENT VALUE= 921.9
ALL COSTS AND BENEFITS IN THOUSANDS OF 1983 CONSTANT DOLLARS

Table B.2
ALT. 1A-INTERNAL RATE OF RETURN CALCULATION
(All Construction Costs Included, Solve for Tourist Benefits at 5 Percent)

NUMBER OF YEARS=37

YEAR	COSTS	PRESENT VALUE	TOURIST BENEFITS	OTHER BENEFITS	TOTAL BENEFITS	PRESENT VALUE
1978	0.0	0.0	0.0	0.0	0.0	0.0
1979	3377.7	3214.1	0.0	0.0	0.0	0.0
1980	2072.2	1876.3	0.0	0.0	0.0	0.0
1981	11534.2	9937.9	0.0	0.0	0.0	0.0
1982	15509.8	12715.9	0.0	0.0	0.0	0.0
1983	14508.4	11318.7	0.0	0.0	0.0	0.0
1984	24000.0	17816.5	0.0	0.0	0.0	0.0
1985	187.8	132.7	340.1	352.2	692.3	489.0
1986	184.5	124.0	508.9	370.4	879.3	591.0
1987	181.4	116.0	761.4	389.5	1150.9	736.1
1988	178.2	108.5	1139.3	409.6	1548.9	942.7
1989	175.1	101.4	1704.7	430.7	2135.4	1236.7
1990	172.1	94.8	2550.7	452.9	3003.6	1655.3
1991	175.9	92.2	3103.6	465.8	3569.3	1871.7
1992	179.7	89.7	3776.2	479.0	4255.2	2123.3
1993	183.7	87.2	4594.6	492.6	5087.2	2415.5
1994	187.7	84.8	5590.4	506.6	6097.0	2754.7
1995	10791.6	4639.6	6802.0	521.0	7323.0	3148.4
1996	202.4	82.8	7112.4	548.1	7660.5	3134.0
1997	212.4	82.7	7437.0	576.6	8013.7	3119.6
1998	222.9	82.6	7776.5	606.6	8383.1	3105.3
1999	233.9	82.5	8131.4	638.2	8769.6	3091.1
2000	245.5	82.3	8502.5	671.4	9173.9	3077.0
2001	245.5	78.4	8502.5	671.4	9173.9	2927.9
2002	245.5	74.6	8502.5	671.4	9173.9	2786.1
2003	245.5	70.9	8502.5	671.4	9173.9	2651.1
2004	245.5	67.5	8502.5	671.4	9173.9	2522.7
2005	245.5	64.2	8502.5	671.4	9173.9	2400.5
2006	245.5	61.1	8502.5	671.4	9173.9	2284.2
2007	245.5	58.2	8502.5	671.4	9173.9	2173.6
2008	245.5	55.3	8502.5	671.4	9173.9	2068.3
2009	245.5	52.7	8502.5	671.4	9173.9	1968.1
2010	245.5	50.1	8502.5	671.4	9173.9	1872.8
2011	245.5	47.7	8502.5	671.4	9173.9	1782.0
2012	245.5	45.4	8502.5	671.4	9173.9	1695.7
2013	245.5	43.2	8502.5	671.4	9173.9	1613.6
2014	245.5	41.1	8502.5	671.4	9173.9	1535.4
TOT	88153.8	63773.4	188866.5	17310.7	206177.3	63773.6

BENEFIT/COST RATIO= 1.00
NET PRESENT VALUE= 0.1
INTERNAL RATE OF RETURN= 5.1 PERCENT
ALL COSTS AND BENEFITS IN THOUSANDS OF 1983 CONSTANT DOLLARS
6.8 PERCENT
ALL COSTS AND BENEFITS IN THOUSANDS OF 1983 CONSTANT DOLLARS

Table B.3
ALT. 2A-NET PRESENT VALUE AND BENEFIT/COST RATIO CALCULATION
(All Construction Costs Included, Discount Rate At 10 Percent)

NUMBER OF YEARS=37 DISCOUNT RATE=10.0 PERCENT

YEAR	COSTS	PRESENT VALUE	TOURIST BENEFITS	OTHER BENEFITS	TOTAL BENEFITS	PRESENT VALUE
1978	0.0	0.0	0.0	0.0	0.0	0.0
1979	3377.7	3070.6	0.0	0.0	0.0	0.0
1980	2072.2	1712.6	0.0	0.0	0.0	0.0
1981	11534.2	8665.8	0.0	0.0	0.0	0.0
1982	15509.8	10593.4	0.0	0.0	0.0	0.0
1983	14508.4	9008.6	0.0	0.0	0.0	0.0
1984	24000.0	13547.4	0.0	0.0	0.0	0.0
1985	187.8	96.4	751.8	352.2	1104.0	566.5
1986	184.5	86.1	1124.9	370.4	1495.3	697.6
1987	181.4	76.9	1683.2	389.5	2072.6	879.0
1988	178.2	68.7	2518.5	409.6	2928.0	1128.9
1989	175.1	61.4	3768.4	430.7	4199.0	1471.7
1990	172.1	54.8	5638.5	452.9	6091.4	1940.9
1991	175.9	50.9	6860.5	465.8	7326.3	2122.2
1992	179.7	47.3	8347.4	479.0	8826.4	2324.3
1993	183.7	44.0	10156.5	492.6	10649.1	2549.3
1994	187.7	40.8	12357.7	506.6	12864.3	2799.7
1995	10791.6	2135.1	15036.0	521.0	15557.0	3077.9
1996	202.4	36.4	15722.2	548.1	16270.3	2926.4
1997	212.4	34.7	16439.8	576.6	17016.4	2782.3
1998	222.9	33.1	17190.1	606.6	17796.7	2645.4
1999	233.9	31.6	17974.6	638.2	18612.8	2515.2
2000	245.5	30.2	18795.0	671.4	19466.4	2391.4
2001	245.5	27.4	18795.0	671.4	19466.4	2174.0
2002	245.5	24.9	18795.0	671.4	19466.4	1976.3
2003	245.5	22.7	18795.0	671.4	19466.4	1796.7
2004	245.5	20.6	18795.0	671.4	19466.4	1633.3
2005	245.5	18.7	18795.0	671.4	19466.4	1484.9
2006	245.5	17.0	18795.0	671.4	19466.4	1349.9
2007	245.5	15.5	18795.0	671.4	19466.4	1227.2
2008	245.5	14.1	18795.0	671.4	19466.4	1115.6
2009	245.5	12.8	18795.0	671.4	19466.4	1014.2
2010	245.5	11.6	18795.0	671.4	19466.4	922.0
2011	245.5	10.6	18795.0	671.4	19466.4	838.2
2012	245.5	9.6	18795.0	671.4	19466.4	762.0
2013	245.5	8.7	18795.0	671.4	19466.4	692.7
2014	245.5	7.9	18795.0	671.4	19466.4	629.7
TOT	88153.8	49748.9	417494.3	17310.7	434805.4	50435.0

BENEFIT/COST RATIO= 1.01
NET PRESENT VALUE= 686.1
ALL COSTS AND BENEFITS IN THOUSANDS OF 1983 CONSTANT DOLLARS

Table B.4
ALT. 2A-INTERNAL RATE OF RETURN CALCULATION
(All Construction Costs Included, Solve For Tourist Benefits at 10 Percent)

NUMBER OF YEARS=37

YEAR	COSTS	PRESENT VALUE	TOURIST BENEFITS	OTHER BENEFITS	TOTAL BENEFITS	PRESENT VALUE
1978	0.0	0.0	0.0	0.0	0.0	0.0
1979	3377.7	3067.9	0.0	0.0	0.0	0.0
1980	2072.2	1709.5	0.0	0.0	0.0	0.0
1981	11534.2	8642.3	0.0	0.0	0.0	0.0
1982	15509.8	10555.1	0.0	0.0	0.0	0.0
1983	14508.4	8967.9	0.0	0.0	0.0	0.0
1984	24000.0	13474.0	0.0	0.0	0.0	0.0
1985	187.8	95.8	751.8	352.2	1104.0	562.9
1986	184.5	85.5	1124.9	370.4	1495.3	692.5
1987	181.4	76.3	1683.2	389.5	2072.6	871.9
1988	178.2	68.1	2518.5	409.6	2928.0	1118.7
1989	175.1	60.8	3768.4	430.7	4199.0	1457.2
1990	172.1	54.2	5638.5	452.9	6091.4	1919.9
1991	175.9	50.3	6860.5	465.8	7326.3	2097.3
1992	179.7	46.7	8347.4	479.0	8826.4	2295.0
1993	183.7	43.4	10156.5	492.6	10649.1	2514.9
1994	187.7	40.3	12357.7	506.6	12864.3	2759.4
1995	10791.6	2102.5	15036.0	521.0	15557.0	3030.9
1996	202.4	35.8	15722.2	548.1	16270.3	2879.1
1997	212.4	34.1	16439.8	576.6	17016.4	2734.9
1998	222.9	32.5	17190.1	606.6	17796.7	2597.9
1999	233.9	31.0	17974.6	638.2	18612.8	2467.8
2000	245.5	29.6	18795.0	671.4	19466.4	2344.2
2001	245.5	26.9	18795.0	671.4	19466.4	2129.2
2002	245.5	24.4	18795.0	671.4	19466.4	1933.9
2003	245.5	22.2	18795.0	671.4	19466.4	1756.5
2004	245.5	20.1	18795.0	671.4	19466.4	1595.3
2005	245.5	18.3	18795.0	671.4	19466.4	1449.0
2006	245.5	16.6	18795.0	671.4	19466.4	1316.1
2007	245.5	15.1	18795.0	671.4	19466.4	1195.4
2008	245.5	13.7	18795.0	671.4	19466.4	1085.7
2009	245.5	12.4	18795.0	671.4	19466.4	986.1
2010	245.5	11.3	18795.0	671.4	19466.4	895.7
2011	245.5	10.3	18795.0	671.4	19466.4	813.5
2012	245.5	9.3	18795.0	671.4	19466.4	738.9
2013	245.5	8.5	18795.0	671.4	19466.4	671.1
2014	245.5	7.7	18795.0	671.4	19466.4	609.5
TOT	88153.8	49520.0	417494.3	17310.7	434805.4	49520.3

BENEFIT/COST RATIO= 1.00
NET PRESENT VALUE= 0.2
INTERNAL RATE OF RETURN= 10.1 PERCENT
ALL COSTS AND BENEFITS IN THOUSANDS OF 1983 CONSTANT DOLLARS

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Table B.5

ALT. 3A-NET PRESENT VALUE AND BENEFIT/COST RATIO CALCULATION
(All Construction Costs Included, Discount Rate At 12 Percent

NUMBER OF YEARS=37 DISCOUNT RATE=12.0 PERCENT

YEAR	COSTS	PRESENT VALUE	TOURIST BENEFITS	OTHER BENEFITS	TOTAL BENEFITS	PRESENT VALUE
1978	0.0	0.0	0.0	0.0	0.0	0.0
1979	3377.7	3015.8	0.0	0.0	0.0	0.0
1980	2072.2	1651.9	0.0	0.0	0.0	0.0
1981	11534.2	8209.8	0.0	0.0	0.0	0.0
1982	15509.8	9856.8	0.0	0.0	0.0	0.0
1983	14508.4	8232.5	0.0	0.0	0.0	0.0
1984	24000.0	12159.2	0.0	0.0	0.0	0.0
1985	187.8	85.0	984.5	352.2	1336.7	604.7
1986	184.5	74.5	1473.1	370.4	1843.5	744.5
1987	181.4	65.4	2204.1	389.5	2593.6	935.3
1988	178.2	57.4	3298.0	409.6	3707.6	1193.7
1989	175.1	50.3	4934.7	430.7	5365.4	1342.4
1990	172.1	44.2	7383.7	452.9	7836.6	2011.5
1991	175.9	40.3	8984.0	465.8	9449.8	2165.7
1992	179.7	36.8	10931.1	479.0	11410.1	2334.7
1993	183.7	33.6	13300.2	492.6	13792.8	2519.9
1994	187.7	30.6	16182.7	506.6	16689.3	2722.4
1995	10791.6	1571.7	19690.0	521.0	20211.0	2943.6
1996	202.4	26.3	20588.6	548.1	21136.7	2748.6
1997	212.4	24.7	21528.3	576.6	22104.9	2566.5
1998	222.9	23.1	22510.8	606.6	23117.5	2396.5
1999	233.9	21.7	23538.2	638.2	24176.4	2237.8
2000	245.5	20.3	24612.5	671.4	25283.9	2089.5
2001	245.5	18.1	24612.5	671.4	25283.9	1865.7
2002	245.5	16.2	24612.5	671.4	25283.9	1665.8
2003	245.5	14.4	24612.5	671.4	25283.9	1487.3
2004	245.5	12.9	24612.5	671.4	25283.9	1327.9
2005	245.5	11.5	24612.5	671.4	25283.9	1185.7
2006	245.5	10.3	24612.5	671.4	25283.9	1058.6
2007	245.5	9.2	24612.5	671.4	25283.9	945.2
2008	245.5	8.2	24612.5	671.4	25283.9	843.9
2009	245.5	7.3	24612.5	671.4	25283.9	753.5
2010	245.5	6.5	24612.5	671.4	25283.9	672.8
2011	245.5	5.8	24612.5	671.4	25283.9	600.7
2012	245.5	5.2	24612.5	671.4	25283.9	536.3
2013	245.5	4.6	24612.5	671.4	25283.9	478.9
2014	245.5	4.2	24612.5	671.4	25283.9	427.6
TOT	88153.8	45466.1	546718.9	17310.7	564030.0	45607.2

BENEFIT/COST RATIO= 1.00
NET PRESENT VALUE= 141.0
ALL COSTS AND BENEFITS IN THOUSANDS OF 1983 CONSTANT DOLLARS

Table B.6
ALT. 3A-INTERNAL RATE OF RETURN CALCULATION
(All Construction Costs Included, Solve for Tourist Benefits of 12 Percent)

NUMBER OF YEARS=37

YEAR	COSTS	PRESENT VALUE	TOURIST BENEFITS	OTHER BENEFITS	TOTAL BENEFITS	PRESENT VALUE
1978	0.0	0.0	0.0	0.0	0.0	0.0
1979	3377.7	3015.2	0.0	0.0	0.0	0.0
1980	2072.2	1651.2	0.0	0.0	0.0	0.0
1981	11534.2	8204.6	0.0	0.0	0.0	0.0
1982	15509.8	9848.4	0.0	0.0	0.0	0.0
1983	14508.4	8223.7	0.0	0.0	0.0	0.0
1984	24000.0	12143.7	0.0	0.0	0.0	0.0
1985	187.8	84.8	984.5	352.2	1336.7	603.8
1986	184.5	74.4	1473.1	370.4	1843.5	743.3
1987	181.4	65.3	2204.1	389.5	2593.6	933.5
1988	178.2	57.3	3298.0	409.6	3707.6	1191.2
1989	175.1	50.2	4934.7	430.7	5365.4	1538.8
1990	172.1	44.1	7383.7	452.9	7836.6	2006.4
1991	175.9	40.2	8984.0	465.8	9449.8	2159.7
1992	179.7	36.7	10931.1	479.0	11410.1	2327.8
1993	183.7	33.4	13300.2	492.6	13792.8	2511.9
1994	187.7	30.5	16182.7	506.6	16689.3	2713.2
1995	10791.6	1566.1	19690.0	521.0	20211.0	2933.0
1996	202.4	26.2	20588.6	548.1	21136.7	2738.1
1997	212.4	24.6	21528.3	576.6	22104.9	2556.2
1998	222.9	23.0	22510.8	606.6	23117.5	2386.4
1999	233.9	21.6	23538.2	638.2	24176.4	2227.8
2000	245.5	20.2	24612.5	671.4	25283.9	2079.8
2001	245.5	18.0	24612.5	671.4	25283.9	1856.6
2002	245.5	16.1	24612.5	671.4	25283.9	1657.3
2003	245.5	14.4	24612.5	671.4	25283.9	1479.4
2004	245.5	12.8	24612.5	671.4	25283.9	1320.6
2005	245.5	11.4	24612.5	671.4	25283.9	1178.9
2006	245.5	10.2	24612.5	671.4	25283.9	1052.3
2007	245.5	9.1	24612.5	671.4	25283.9	939.4
2008	245.5	8.1	24612.5	671.4	25283.9	838.6
2009	245.5	7.3	24612.5	671.4	25283.9	748.6
2010	245.5	6.5	24612.5	671.4	25283.9	668.2
2011	245.5	5.8	24612.5	671.4	25283.9	596.5
2012	245.5	5.2	24612.5	671.4	25283.9	532.5
2013	245.5	4.6	24612.5	671.4	25283.9	475.3
2014	245.5	4.1	24612.5	671.4	25283.9	424.3
TOT	88153.8	45418.8	546718.9	17310.7	564030.0	45419.0

BENEFIT/COST RATIO= 1.00
NET PRESENT VALUE= 0.2
INTERNAL RATE OF RETURN= 12.0 PERCENT
ALL COSTS AND BENEFITS IN THOUSANDS OF 1983 CONSTANT DOLLARS

Table B.7
ALT. 1B-NET PRESENT VALUE AND BENEFIT/COST RATIO CALCULATION
(1984 Construction Costs Only, Discount Rate at 5 Percent)

NUMBER OF YEARS=32 DISCOUNT RATE= 5.0 PERCENT

YEAR	COSTS	PRESENT VALUE	TOURIST BENEFITS	OTHER BENEFITS	TOTAL BENEFITS	PRESENT VALUE
1983	0.0	0.0	0.0	0.0	0.0	0.0
1984	24000.0	22857.1	0.0	0.0	0.0	0.0
1985	187.8	170.3	107.4	352.2	459.6	416.9
1986	184.5	159.4	160.7	370.4	531.1	458.8
1987	181.4	149.2	240.5	389.5	629.9	518.2
1988	178.2	139.6	359.8	409.6	769.3	602.8
1989	175.1	130.7	538.3	430.7	969.0	723.1
1990	172.1	122.3	805.5	452.9	1258.4	894.3
1991	175.9	119.0	980.1	465.8	1445.8	978.6
1992	179.7	115.9	1192.5	479.0	1671.5	1077.5
1993	183.7	112.8	1450.9	492.6	1943.5	1193.2
1994	187.7	109.7	1765.4	506.6	2272.0	1328.4
1995	10791.6	6009.2	2148.0	521.0	2669.0	1486.2
1996	202.4	107.3	2246.0	548.1	2794.1	1481.8
1997	212.4	107.3	2348.5	576.6	2925.2	1477.4
1998	222.9	107.2	2455.7	606.6	3062.4	1473.0
1999	233.9	107.2	2567.8	638.2	3206.0	1468.7
2000	245.5	107.1	2685.0	671.4	3356.4	1464.4
2001	245.5	102.0	2685.0	671.4	3356.4	1394.7
2002	245.5	97.2	2685.0	671.4	3356.4	1328.2
2003	245.5	92.5	2685.0	671.4	3356.4	1265.0
2004	245.5	88.1	2685.0	671.4	3356.4	1204.8
2005	245.5	83.9	2685.0	671.4	3356.4	1147.4
2006	245.5	79.9	2685.0	671.4	3356.4	1092.8
2007	245.5	76.1	2685.0	671.4	3356.4	1040.7
2008	245.5	72.5	2685.0	671.4	3356.4	991.2
2009	245.5	69.0	2685.0	671.4	3356.4	944.0
2010	245.5	65.8	2685.0	671.4	3356.4	899.0
2011	245.5	62.6	2685.0	671.4	3356.4	856.2
2012	245.5	59.6	2685.0	671.4	3356.4	815.4
2013	245.5	56.8	2685.0	671.4	3356.4	776.6
2014	245.5	54.1	2685.0	671.4	3356.4	739.6
TOT	41151.7	31791.6	59642.1	17310.7	76952.8	31538.7

BENEFIT/COST RATIO= 0.99
NET PRESENT VALUE= -252.9
ALL COSTS AND BENEFITS IN THOUSANDS OF 1983 CONSTANT DOLLARS

Table B.8
ALT. 1B-INTERNAL RATE OF RETURN CALCULATION
(1984 Construction Costs Only, Solve for Tourist Benefits at 5 Percent)

NUMBER OF YEARS=32

YEAR	COSTS	PRESENT VALUE	TOURIST BENEFITS	OTHER BENEFITS	TOTAL BENEFITS	PRESENT VALUE
1983	0.0	0.0	0.0	0.0	0.0	0.0
1984	24000.0	22871.6	0.0	0.0	0.0	0.0
1985	187.8	170.6	107.4	352.2	459.6	417.4
1986	184.5	159.7	160.7	370.4	531.1	459.6
1987	181.4	149.6	240.5	389.5	629.9	519.6
1988	178.2	140.1	359.8	409.6	769.3	604.7
1989	175.1	131.2	538.3	430.7	969.0	725.8
1990	172.1	122.9	805.5	452.9	1258.4	898.3
1991	175.9	119.6	980.1	465.8	1445.8	983.6
1992	179.7	116.5	1192.5	479.0	1671.5	1083.6
1993	183.7	113.5	1450.9	492.6	1943.5	1200.7
1994	187.7	110.5	1765.4	506.6	2272.0	1337.7
1995	10791.6	6054.9	2148.0	521.0	2669.0	1497.5
1996	202.4	108.2	2246.0	548.1	2794.1	1494.0
1997	212.4	108.2	2348.5	576.6	2925.2	1490.5
1998	222.9	108.2	2455.7	606.6	3062.4	1487.1
1999	233.9	108.3	2567.8	638.2	3206.0	1483.6
2000	245.5	108.3	2685.0	671.4	3356.4	1480.2
2001	245.5	103.2	2685.0	671.4	3356.4	1410.6
2002	245.5	98.3	2685.0	671.4	3356.4	1344.3
2003	245.5	93.7	2685.0	671.4	3356.4	1281.1
2004	245.5	89.3	2685.0	671.4	3356.4	1220.8
2005	245.5	85.1	2685.0	671.4	3356.4	1163.4
2006	245.5	81.1	2685.0	671.4	3356.4	1108.7
2007	245.5	77.3	2685.0	671.4	3356.4	1056.6
2008	245.5	73.7	2685.0	671.4	3356.4	1006.9
2009	245.5	70.2	2685.0	671.4	3356.4	959.6
2010	245.5	66.9	2685.0	671.4	3356.4	914.5
2011	245.5	63.7	2685.0	671.4	3356.4	871.5
2012	245.5	60.7	2685.0	671.4	3356.4	830.5
2013	245.5	57.9	2685.0	671.4	3356.4	791.5
2014	245.5	55.2	2685.0	671.4	3356.4	754.2
TOT	41151.7	31878.0	59642.1	17310.7	76952.8	31878.1

BENEFIT/COST RATIO= 1.00
NET PRESENT VALUE= 0.1
INTERNAL RATE OF RETURN= 4.9 PERCENT
ALL COSTS AND BENEFITS IN THOUSANDS OF 1983 CONSTANT DOLLARS

Table B.9
ALT. 2B-NET PRESENT VALUE AND BENEFIT COST RATIO CALCULATION
(1984 Construction Costs Only, Discount Rate at 10 Percent)

NUMBER OF YEARS=32 DISCOUNT RATE=10.0 PERCENT

YEAR	COSTS	PRESENT VALUE	TOURIST BENEFITS	OTHER BENEFITS	TOTAL BENEFITS	PRESENT VALUE
1983	0.0	0.0	0.0	0.0	0.0	0.0
1984	24000.0	21818.2	0.0	0.0	0.0	0.0
1985	187.8	155.2	214.8	352.2	567.0	468.6
1986	184.5	138.7	321.4	370.4	691.8	519.7
1987	181.4	123.9	480.9	389.5	870.4	594.5
1988	178.2	110.7	719.6	409.6	1129.1	701.1
1989	175.1	98.9	1076.7	430.7	1507.4	850.9
1990	172.1	88.3	1611.0	452.9	2063.9	1059.1
1991	175.9	82.0	1960.1	465.8	2425.9	1131.7
1992	179.7	76.2	2385.0	479.0	2864.0	1214.6
1993	183.7	70.8	2901.9	492.6	3394.5	1308.7
1994	187.7	65.8	3530.8	506.6	4037.4	1415.1
1995	10791.6	3438.5	4296.0	521.0	4817.0	1534.8
1996	202.4	58.6	4492.1	548.1	5040.2	1460.0
1997	212.4	55.9	4697.1	576.6	5273.7	1388.7
1998	222.9	53.4	4911.5	606.6	5518.1	1321.0
1999	233.9	50.9	5135.6	638.2	5773.8	1256.6
2000	245.5	48.6	5370.0	671.4	6041.4	1195.3
2001	245.5	44.2	5370.0	671.4	6041.4	1086.6
2002	245.5	40.1	5370.0	671.4	6041.4	987.8
2003	245.5	36.5	5370.0	671.4	6041.4	898.0
2004	245.5	33.2	5370.0	671.4	6041.4	816.4
2005	245.5	30.2	5370.0	671.4	6041.4	742.2
2006	245.5	27.4	5370.0	671.4	6041.4	674.7
2007	245.5	24.9	5370.0	671.4	6041.4	613.4
2008	245.5	22.7	5370.0	671.4	6041.4	557.6
2009	245.5	20.6	5370.0	671.4	6041.4	506.9
2010	245.5	18.7	5370.0	671.4	6041.4	460.8
2011	245.5	17.0	5370.0	671.4	6041.4	418.9
2012	245.5	15.5	5370.0	671.4	6041.4	380.8
2013	245.5	14.1	5370.0	671.4	6041.4	346.2
2014	245.5	12.8	5370.0	671.4	6041.4	314.8
TOT	41151.7	26892.3	119284.1	17310.7	136594.9	26225.4

BENEFIT/COST RATIO= 0.98
NET PRESENT VALUE= -666.9
ALL COSTS AND BENEFITS IN THOUSANDS OF 1983 CONSTANT DOLLARS

Table B.10
ALT. 2B-INTERNAL RATE OF RETURN CALCULATION
(1984 Construction Costs Only, Solve for Tourist Benefits at 10 Percent)

NUMBER OF YEARS=32

YEAR	COSTS	PRESENT VALUE	TOURIST BENEFITS	OTHER BENEFITS	TOTAL BENEFITS	PRESENT VALUE
1983	0.0	0.0	0.0	0.0	0.0	0.0
1984	24000.0	21864.5	0.0	0.0	0.0	0.0
1985	187.8	155.9	214.8	352.2	567.0	470.6
1986	184.5	139.5	321.4	370.4	691.8	523.0
1987	181.4	124.9	480.9	389.5	870.4	599.5
1988	178.2	111.8	719.6	409.6	1129.1	708.6
1989	175.1	100.1	1076.7	430.7	1507.4	861.7
1990	172.1	89.6	1611.0	452.9	2063.9	1074.9
1991	175.9	83.4	1960.1	465.8	2425.9	1151.1
1992	179.7	77.7	2385.0	479.0	2864.0	1238.0
1993	183.7	72.3	2901.9	492.6	3394.5	1336.7
1994	187.7	67.3	3530.8	506.6	4037.4	1448.4
1995	10791.6	3527.1	4296.0	521.0	4817.0	1574.4
1996	202.4	60.3	4492.1	548.1	5040.2	1500.7
1997	212.4	57.6	4697.1	576.6	5273.7	1430.5
1998	227.9	55.1	4911.5	606.6	5518.1	1363.6
1999	233.9	52.7	5135.6	638.2	5773.8	1299.9
2000	245.5	50.4	5370.0	671.4	6041.4	1239.1
2001	245.5	45.9	5370.0	671.4	6041.4	1128.8
2002	245.5	41.8	5370.0	671.4	6041.4	1028.4
2003	245.5	38.1	5370.0	671.4	6041.4	936.9
2004	245.5	34.7	5370.0	671.4	6041.4	853.5
2005	245.5	31.6	5370.0	671.4	6041.4	777.6
2006	245.5	28.8	5370.0	671.4	6041.4	708.4
2007	245.5	26.2	5370.0	671.4	6041.4	645.4
2008	245.5	23.9	5370.0	671.4	6041.4	587.9
2009	245.5	21.8	5370.0	671.4	6041.4	535.6
2010	245.5	19.8	5370.0	671.4	6041.4	488.0
2011	245.5	18.1	5370.0	671.4	6041.4	444.5
2012	245.5	16.5	5370.0	671.4	6041.4	405.0
2013	245.5	15.0	5370.0	671.4	6041.4	368.9
2014	245.5	13.7	5370.0	671.4	6041.4	336.1
TOT	41151.7	27065.9	119284.1	17310.7	136594.9	27065.9

BENEFIT/COST RATIO= 1.00
NET PRESENT VALUE= 0.1
INTERNAL RATE OF RETURN= 9.8 PERCENT
ALL COSTS AND BENEFITS IN THOUSANDS OF 1983 CONSTANT DOLLARS
1983 CONSTANT DOLLARS

Table B.11

ALT. 3B-NET PRESENT VALUE AND BENEFIT COST RATIO CALCULATION
(1984 Construction Costs Only, Discount Rate at 12 Percent)

NUMBER OF YEARS=32 DISCOUNT RATE=12.0 PERCENT

YEAR	COSTS	PRESENT VALUE	TOURIST BENEFITS	OTHER BENEFITS	TOTAL BENEFITS	PRESENT VALUE
1983	0.0	0.0	0.0	0.0	0.0	0.0
1984	24000.0	21428.6	0.0	0.0	0.0	0.0
1985	187.8	149.7	286.4	352.2	638.6	509.1
1986	184.5	131.4	428.5	370.4	798.9	568.6
1987	181.4	115.3	641.2	389.5	1030.7	655.0
1988	178.2	101.1	959.4	409.6	1369.0	776.8
1989	175.1	88.7	1435.6	430.7	1866.2	945.5
1990	172.1	77.8	2148.0	452.9	2600.9	1176.5
1991	175.9	71.0	2613.5	465.8	3079.3	1243.7
1992	179.7	64.8	3180.0	479.0	3659.0	1319.5
1993	183.7	59.1	3869.1	492.6	4361.8	1404.4
1994	187.7	54.0	4707.7	506.6	5214.3	1499.0
1995	10791.6	2769.9	5728.0	521.0	6249.0	1604.0
1996	202.4	46.4	5989.4	548.1	6537.5	1498.2
1997	212.4	43.5	6262.8	576.6	6839.4	1399.5
1998	222.9	40.7	6548.6	606.6	7155.2	1307.2
1999	233.9	38.2	6847.5	638.2	7485.7	1221.1
2000	245.5	35.8	7160.0	671.4	7831.4	1140.6
2001	245.5	31.9	7160.0	671.4	7831.4	1018.4
2002	245.5	28.5	7160.0	671.4	7831.4	909.3
2003	245.5	25.5	7160.0	671.4	7831.4	811.9
2004	245.5	22.7	7160.0	671.4	7831.4	724.9
2005	245.5	20.3	7160.0	671.4	7831.4	647.2
2006	245.5	18.1	7160.0	671.4	7831.4	577.9
2007	245.5	16.2	7160.0	671.4	7831.4	516.0
2008	245.5	14.4	7160.0	671.4	7831.4	460.7
2009	245.5	12.9	7160.0	671.4	7831.4	411.3
2010	245.5	11.5	7160.0	671.4	7831.4	367.2
2011	245.5	10.3	7160.0	671.4	7831.4	327.9
2012	245.5	9.2	7160.0	671.4	7831.4	292.8
2013	245.5	8.2	7160.0	671.4	7831.4	261.4
2014	245.5	7.3	7160.0	671.4	7831.4	233.4
TOT	41151.7	25552.9	159045.5	17310.7	176356.3	25828.7

BENEFIT/COST RATIO= 1.01

NET PRESENT VALUE= 275.8

ALL COSTS AND BENEFITS IN THOUSANDS OF 1983 CONSTANT DOLLARS

Table B.12
ALT. 3B-INTERNAL RATE OF RETURN CALCULATION
(1984 Construction Costs Only, Solve for Tourist Benefits at 12 Percent)

NUMBER OF YEARS=32

YEAR	COSTS	PRESENT VALUE	TOURIST BENEFITS	OTHER BENEFITS	TOTAL BENEFITS	PRESENT VALUE
1983	0.0	0.0	0.0	0.0	0.0	0.0
1984	24000.0	21408.4	0.0	0.0	0.0	0.0
1985	187.8	149.4	286.4	352.2	638.6	508.1
1986	184.5	131.0	428.5	370.4	798.9	567.0
1987	181.4	114.8	641.2	389.5	1030.7	652.6
1988	178.2	100.7	959.4	409.6	1369.0	773.2
1989	175.1	88.2	1435.6	430.7	1866.2	940.2
1990	172.1	77.3	2148.0	452.9	2600.9	1168.8
1991	175.9	70.5	2613.5	465.8	3079.3	1234.4
1992	179.7	64.3	3180.0	479.0	3659.0	1308.3
1993	183.7	58.6	3869.1	492.6	4361.8	1391.2
1994	187.7	53.4	4707.7	506.6	5214.3	1483.6
1995	10791.6	2738.9	5728.0	521.0	6249.0	1586.0
1996	202.4	45.8	5989.4	548.1	6537.5	1480.0
1997	212.4	42.9	6262.8	576.6	6839.4	1381.2
1998	222.9	40.2	6548.6	606.6	7155.2	1288.9
1999	233.9	37.6	6847.5	638.2	7485.7	1202.9
2000	245.5	35.2	7160.0	671.4	7831.4	1122.5
2001	245.5	31.4	7160.0	671.4	7831.4	1001.3
2002	245.5	28.0	7160.0	671.4	7831.4	893.2
2003	245.5	25.0	7160.0	671.4	7831.4	796.7
2004	245.5	22.3	7160.0	671.4	7831.4	710.7
2005	245.5	19.9	7160.0	671.4	7831.4	634.0
2006	245.5	17.7	7160.0	671.4	7831.4	565.5
2007	245.5	15.8	7160.0	671.4	7831.4	504.4
2008	245.5	14.1	7160.0	671.4	7831.4	450.0
2009	245.5	12.6	7160.0	671.4	7831.4	401.4
2010	245.5	11.2	7160.0	671.4	7831.4	358.0
2011	245.5	10.0	7160.0	671.4	7831.4	319.4
2012	245.5	8.9	7160.0	671.4	7831.4	284.9
2013	245.5	8.0	7160.0	671.4	7831.4	254.1
2014	245.5	7.1	7160.0	671.4	7831.4	226.7
TOT	41151.7	25489.1	159045.5	17310.7	176356.3	25489.2

BENEFIT/COST RATIO= 1.00
NET PRESENT VALUE= 0.1
INTERNAL RATE OF RETURN= 12.1 PERCENT
ALL COSTS AND BENEFITS IN THOUSANDS OF 1983 CONSTANT DOLLARS
OLLARS

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Table B.13
DERIVATION OF ANNUAL TOURIST DAYS AND EXPENDITURES
1985 - 2000

YEAR	TOTAL GENERATED TOURISTS	8.5 DAY TOURISTS(1)	9.5 DAY TOURISTS(1)	TOTAL TOURIST DAYS	TOTAL TOURIST EXPENDITURES(2)
1985	2,000	1,100	900	17,900	$ 895.0
1990	15,000	8,250	6,750	134,250	$ 6,712.5
1995	40,000	22,000	18,000	358,000	$17,900.0
2000	50,000	27,500	22,500	447,500	$22,375.0

(1) 55 percent of tourists were assumed to stay 8.5 days in Grenada. 45 percent were assumed to stay an additional day (9.5 days) representing the overnight stay previously required in Barbados because of airline connections.

(2) At $50 per day.