A port infrastructural development plan for the facilitation of bauxite exports from Guyana

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A PORT INFRASTRUCTURAL DEVELOPMENT PLAN FOR THE FACILITATION OF BAUXITE EXPORTS FROM GEORGETOWN, GUYANA

BY

STEPHEN CARLYSLE THOMAS

THE CO-OPERATIVE REPUBLIC OF GUYANA

A dissertation submitted to the World Maritime University in partial fulfillment of the requirements for the award of the Degree of Master of Science in Ports and Shipping Administration.

Year of Graduation
1992
I certify that all material in this dissertation which is not my own work has been identified and that no material is included for which a degree has been previously conferred upon me.

The contents of this dissertation reflect my personal views and are not necessarily endorsed by the University.

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This study examines how an infrastructural development plan for Port Georgetown, Guyana can make a positive contribution to the facilitation of the country’s trade. Guyana’s exports, which are mainly raw materials are increasingly becoming uncompetitive as a result of high freight rates necessitated by the poor state of the port.

Chapter 1 gives a general introduction to the socio-economic situation in the country and sets the scene for the ensuing ones. It describes the location of the major production centers and their dependence upon Port Georgetown.

Port Georgetown is managed and operated in a disorganised and grossly inefficient manner. Chapter 2 critically examines the present organisation and management of the port, and suggests a model of an organisation to replace it.

The problems encountered by users of the port are wide and far-reaching. They range from poor services in general to inappropriate or inefficient facilities. Chapter 3 analyses these problems particularly how they influence the size of ships used for the export of bauxite from Guyana.

For any port to provide the required level of service and facilities for its customers it must plan for the expected volume of traffic, the type and size of ships needed for the particular trades. In this instant, the bauxite trade.
This is done in Chapter 4, but goes further and suggests the optimal size of vessels needed for the export of bauxite from Guyana, given the physical limitations of the port and the potential volume of cargo.

In Chapter 5, plans for improving the port’s marine infrastructure specifically to accommodate the vessel suggested in Chapter 4 are outlined. It mainly involves the deepening and widening of the channel through dredging.

Improving the port’s marine infrastructure is meaningless if it is not accompanied by a corresponding improvement in the port services. Chapter 6 outlines how this can be accomplished.

The port infrastructure development suggested for Georgetown would involve the investment of a substantial amount of capital. Therefore, in order to determine the feasibility and viability of the project an economic and financial evaluation is conducted in chapter 7.

The study concludes in Chapter 8 by arguing for its proposals to be considered with a view to it being implemented. It further stresses that without an improvement in the port, national development would continue to be inhibited.
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Guyana is known as the land of many waters. It is so
called because this South American nation has many rivers
across its length and its four hundred and fifty nine
kilometers coast is bordered by the Atlantic Ocean. As
such it is natural to expect this country to have a well
developed maritime infrastructure to facilitate the use of
these vast resources of communication and transport.
Regrettably, this is not the case.

There are five major rivers in Guyana of which two; the
Demerara and Berbice are the principal ones involved
directly with the import and export trade of the country.
The others are also indirectly involved for goods are
shipped through them, from the outlying areas to a central
location for export and to the major local market. This
central location is Georgetown, the principal port and the
capital city of Guyana, which is the focus of this study.

Guyana is a developing country experiencing many of the
problems faced by these countries. The economy is based
upon the export of primary products and raw materials. The
value of these commodities are generally low, as such they
depend upon a cheap and reliable mode of transportation
for their trade to a profitable venture. It is therefore
imperative that the ports contribute, to the minimising of
cost for the facilitation of this trade. The present
condition of the port, however, suggests that it has been
neglected and falls short of being able to fulfil this
mandate.
This study is not about the very wide discussion of port development in its entirety. Instead, it is limited to one area of this subject which in the researcher's opinion deserves the most urgent attention and where improvements are possible in both the short and long term. It concentrates on the measures, facilities and infrastructure needed to receive the optimal size or most economical ships to serve the needs of the country's bauxite trade.

For the port to contribute positively to national development it must be properly organised and managed. The present administration does not have the mandate nor the appropriate form of organisation to develop the port. In the present situation, the berths are separately owned by individual companies. Whenever there is the need for any particular one of them to expand or modify their respective facilities they do so independent of the port's Administration.

It is apparent that such uncoordinated constructions can have serious negative consequences upon a future port development plan. This study aims in part to examine the present organisation and administration of the port then formulate plans for the establishment of a Port Authority in Guyana and describe its terms of reference. However, since the main subject of this study is about improving and developing the port's infrastructure it would not be examining the port's Administration in general terms but rather as it will relate directly to the subject as delimited.

The worldwide trade of bauxite is mainly handled by bulk carriers of the 55,000 - 70,000 tons deadweight capacity. The local bauxite industry cannot benefit from the economies of the larger ships due to inherent restrictions
imposed by the port.

The wharves are of wooden construction. They cannot accommodate heavy lift cranes and are thus dependent upon the ships’ gears to load and discharge the cargo. Also this form of construction does not permit the depths alongside to be increased so as to accommodate modern vessels.

A ship visiting any port expects to be provided with services to enter safely and to make that stay comfortable. The services provided to ships visiting the ports of Guyana cannot be considered as making a positive contribution to the above.

The Government has embarked upon a program to boost exports in the bauxite and other major sectors of the economy. Should these measures yield the expected results the ports would be hard pressed to contribute positively to this economic program. When an exporter or shipper undertake to use the port of Georgetown, he unconsciously pays a hidden tariff, this is how the extra costs incurred by virtue of a port’s inefficiency can be considered.

In order to accommodate the ships required to serve the country’s trade, development and improvement to the port’s infrastructure is necessary. A project which involves dredging and other maritime constructions can affect the environmental balance. Thus the impact of this would be considered.

Any increase in traffic through the port would necessitate substantial improvement in the quality and range of services offered. Plans for the improvement of these services to all port users would be examined in this study.

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A project of this magnitude would involve the investment of substantial amounts of capital which would have to be secured from either local or international sources. It's feasibility and viability would have to be determined by qualified technicians familiar with this type of project. However, a economic and financial analysis would be initiated for the purpose of this study.

The success of any research is premised on the application of an appropriate research methodology. It is this particular conception that motivated the researcher to adopt the most realistic approach in compiling, presenting and analysing data for this dissertation.

The main approach or method that is applied through this research is that of participant observation. It does not only reflect the information acquired relative to the subject from the researcher's on the job training exercise at the Forth Ports PLC. Scotland, U.K. or from the several field trips to various European ports. Instead it records in some detail his actual experience acquired, having served for over a decade as a mariner and more particular as a pilot in the ports of Guyana.

In addition to observation and informal interviews with experts in the field of port development, officials of the bauxite companies and the terminal operators, a serious attempt is made to chronicle information and material from primary and secondary sources. These are duly acknowledged in the respective chapters. It was considered necessary to draw from these sources to justify a workable port development model for Guyana which it is hoped will alleviate most of the existing problems and make the port efficient and reliable, to the extent that it fulfills its obligation effectively.
Several tables will be used throughout this research to reflect economic and other statistical data. As far as is practicable, given their inherent limitations, these tables will reflect certain trends, highlight comparisons and deviations and outline certain predictions given certain variables. In the present port organisation and at the bauxite companies there is a paucity of up to date statistics and other basic data. This resulted in the use of descriptive rather than quantitative assessments in some instances where the latter would have been more appropriate. Nevertheless, the conclusions would remained the same.

Finally, recommendations for the proposed port development project will be presented in order of priority. However, the assumption is that these will be studied with a view to their acceptance, thereby guaranteeing the improvement of the Port of Georgetown, Guyana.
CHAPTER 1

GENERAL CHARACTERISTICS OF GUYANA

1.1) INTRODUCTION

Guyana is situated on the north-east coast of South America. It is bordered on the north by the Atlantic Ocean; the east by Suriname; the west by Venezuela and Brazil, and to the south by Brazil.

The area of Guyana is approximately 216,000 square kilometers and it is divided into four natural regions. First, the low coastal plain that borders the Atlantic Ocean and is the home of the majority of the country’s population. Most industrial and agricultural production also takes place here. The hilly sand and clay area which is next to the coastal plain is covered by forests and provides a substantial part of the nation’s mineral resources. Beyond this region is the forested mountains which is also rich in precious metals. Finally, is the interior and intermediate savannahs with low pasture land which is a particularly rich area for cattle rearing.

There are five main rivers in Guyana namely: Demerara, Berbice, Essequibo, Pomeroon and Waini. Of these the first three are the principal ones used for the country’s domestic and international trade. At the mouth of the Demerara river is the country’s main seaport; Georgetown. There are two other ports in Guyana; Linden, sixty five miles up the Demerara river, and New Amsterdam, at the mouth of the Berbice river.
Guyana. There are five other towns, namely; New Amsterdam, Rose Hall and Corriverton in the Berbice region; Anna Regina in the Essequibo and Linden up the Demerara river.

The population of Guyana is approximately 751,266 (1990 estimates) inhabitants\(^1\). Approximately 85 percent of this population lives on the coast, even though this region accounts for only 8 percent of the country’s area. Further some 80 percent of this number lives within one hundred and sixty kilometers of Georgetown.

1.2) THE ECONOMY
The main contributors to Guyana’s economy are the production of sugar, bauxite, rice, fish products, light manufacturing, timber and gold.

1.2.1) THE BAUXITE INDUSTRY.
Bauxite is the principal export of Guyana by volume and it is the second largest earner of foreign exchange for the country. It is mined in three areas in the country. First, at Linden; sixty miles up the Demerara river from Georgetown. Secondly, at Kwakwani, approximately one hundred and twenty miles from the port of New Amsterdam in Berbice. The third mining area is also in the Berbice river at Aroima; one hundred and fifteen miles from New Amsterdam.

Formerly, the bauxite industry was owned by two foreign Multinational companies. First, The Aluminum Company of Canada (ALCAN); who owned and operated the facility at Linden, and Reynolds Metal Company of the U.S.A. who owned and operated the facility in Berbice at Everton and Kwakwani. In 1976 the entire industry was nationalized by the Government.

Since nationalization production has systematically declined. In 1980 the total production was 1,874,826 tonnes comprising seven different grades of bauxite. In 1989 the production fell to 1,321,081 tonnes from only five different grades of the product.

Acknowledging that nationalization proved unsuccessful, the Government has embarked upon a program of de-nationalization and divestment of the industry. To date this has been partly successful.

Reynolds has resumed production at a new site; Aroima in the Berbice river. This company is operating a partnership company with the State; Aroima Bauxite Company (ABC). It began operations in 1989 and the total national production has increased by 6 percent to 1,508,442 tonnes in 1991.

Negotiations are being conducted with potential investors, including the former owner of the Linden operations; ALCAN about their possible return to the local industry.

In addition to the above a Venezuelan company; Dayco has established facilities in the Berbice river at Kwakwani for the mining of bauxite also. They began production in 1988 but have not yet began to ship any significant quantities.

1.2.2) THE SUGAR INDUSTRY
The existence of the sugar industry in Guyana is intrinsically linked to its history. It was the success of sugar in Guyana that led the European Colonial powers at that time into confrontation for control of Guyana. Under

---

British rule sugar became more important and was dominated by two British companies; Bookers and Jessels. The former being the most dominant one, while the latter was involved mainly in the production of spirits, which is a by-product of sugar processing.

This industry was the first target of the Government’s nationalization policy and was taken over in 1970. From this time onward the industry experienced similar fortunes as those of the bauxite industry, production progressively declined. In 1980 the industry produced 269,639 tonnes and ten years later; in 1990 it only produced 132,200 tonnes*.

The government in an attempt to reverse the fledging fortunes of the industry is negotiating its return to the former owners and other interests. This has being partially successful, in that Bookers Company is now managing the industry on a contractual basis. Their presence has already made a positive impact upon the industry as production in 1991 increased by 23 percent over the previous year to 162,606 tonnes.

1.2.3) THE RICE INDUSTRY
Rice is also a major contributor to the economy of Guyana. It has a tradition of small and large farmers who organized themselves into production and marketing agencies, such as the Rice Producers Association. In the early 1970’s the State increased its control of the industry and farmers were made to sell their product to a state owned marketing company; the Guyana Rice Marketing Board. This company in turn exercised control over the import and distribution of fertilizers, chemicals, machinery and other inputs needed by the industry.

* Bank of Guyana (March 1991), op. cit.
As with the other sectors of the economy, State involvement and control led to a systematic decline in production. In 1980 rice production was 169,057 tonnes but in 1990 it had declined to 93,444 tonnes\(^*\).

With production this low, the Government has embarked upon the process of divesting and decontrolling the industry. Much of the assets of the former Guyana Rice Marketing Board have been sold to local and overseas interests. The industry has already been decontrolled and it is expected to be operated fully by private interests by the end of 1992. This policy has brought about immediate improvements as production in 1991 increased by 61 percent over the previous year’s total to 152,314 tonnes\(^*\).

1.2.4) OTHER INDUSTRIES
The performance of the other sectors of the economy follows a similar trend as the major ones. They were formerly owned and controlled by private companies, then government’s intervention and control ensued in the 1970’s. Production faltered, hence they are now being systematically privatized and decontrolled.

Among these other products are timber, which includes the famous greenheart that is used for a number of purposes including marine constructions; gold; shrimp and fish products; rum and light manufacturing. The export figures of the major commodities are shown in table 1.1.

\(^*\) Ibid.

\(^*\) Government of Guyana (1992), op. cit.
1.2.5) IMPORTS

Guyana's main import is fuel. This accounts for approximately 20 percent of her total imports. Other major imports are lubricants, fertilizers, vehicles, machinery, industrial goods, processed food and wheat. The total value of imports amounted to US$ 252 million in 1991. Table 1.2 shows imports by end use for the last five years ending 1990.
<table>
<thead>
<tr>
<th>PERIOD</th>
<th>TOTAL IMPORTS</th>
<th>CONSUMER GOODS</th>
<th>FUEL AND LUBRICANTS</th>
<th>OTHER INTERMEDIATE GOODS</th>
<th>CAPITAL GOODS</th>
<th>MISC. IMPORTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985</td>
<td>960</td>
<td>94</td>
<td>432</td>
<td>262</td>
<td>160</td>
<td>12</td>
</tr>
<tr>
<td>1986</td>
<td>1030</td>
<td>110</td>
<td>314</td>
<td>397</td>
<td>203</td>
<td>6</td>
</tr>
<tr>
<td>1987</td>
<td>2590</td>
<td>262</td>
<td>769</td>
<td>1012</td>
<td>521</td>
<td>26</td>
</tr>
<tr>
<td>1988</td>
<td>2156</td>
<td>216</td>
<td>738</td>
<td>749</td>
<td>431</td>
<td>22</td>
</tr>
<tr>
<td>1989</td>
<td>7012</td>
<td>702</td>
<td>2034</td>
<td>1703</td>
<td>2498</td>
<td>75</td>
</tr>
<tr>
<td>1990</td>
<td>12290</td>
<td>1467</td>
<td>2788</td>
<td>2335</td>
<td>5520</td>
<td>180</td>
</tr>
</tbody>
</table>


1.3) THE ORIGIN AND DESTINATION OF MAJOR IMPORTS AND EXPORTS.

Guyana is a member of the Caribbean Common Market (CARICOM). This is an economic and political association of former British colonies in the West Indies. It aims to promote free trade among the countries of the region, as such Guyana has a tradition of trade and commercial contacts with these nations. However, due to the small size of these economies trade between Guyana and the others countries only accounts for 20 percent of Guyana's total trade. Rice, timber, textiles, agricultural products, pharmaceutical and light machinery are Guyana's major exports to the region. In return it imports fertilizers, detergents, lubricants, beverages and light industrial products from the region.

The other major trading partners are Venezuela, the United States of America, Japan, Great Britain and other E.E.C nations.
Guyana imports almost all of its fuel requirements from Venezuela. This is by way of a barter arrangement in exchange for bauxite. The other major markets for Guyana’s bauxite is the United States of America, Northern Europe, Japan and the Far East. Great Britain and the E.E.C are the major importers of the country’s sugar.

1.4) THE IMPORTANCE OF PORT GEORGETOWN TO GUYANA’S ECONOMY.

From the nature of its trade it is evident that Guyana is very much dependent upon maritime trade and the ports to facilitate it. Georgetown, being the Capital City and the most populous center also serves as the nations major seaport. It is the fulcrum of the nations international and domestic trade.

As stated earlier, the bauxite companies’ operations are located great distances up the Demerara and Berbice rivers. At Linden the cargo is transported by rail from the mines to the processing plants which are located in the port area. From here it is then either shipped directly to overseas markets, if the load is a small consignment or as is the most common feature it is shipped from the processing plant at Linden by ocean going ships to a transshipment facility in the port of Georgetown. Vessels for overseas markets then after loading bottom cargo at Linden proceed to this transshipment station to complete their consignments.

The two bauxite operations in Berbice undertake the processing and shipping of their cargo in different ways. First, the State owned company; Guymine mines its bauxite at Kwakwani, one hundred and twenty miles up the Berbice river then transports it by barge in this raw state to the processing plant at Everton; in the port of new Amsterdam. After processing, (except for small shipments)
the cargo is transported to Georgetown by ocean going vessels to the same transshipment facility as used by the Linden operations.

The operations undertaken by the Aroima Bauxite Company is to process and mine its bauxite at the same site. It is then transported by barge to Georgetown for loading into ocean going vessels at a second transshipment facility established by this company.

The transport of sugar follows a similar process as that of bauxite. After cultivation and processing of the cane, the final product; sugar is transported from the estates by road from those accessible by this means and by coastal vessels from the others to a bulk shipment and storage facility in the port of Georgetown; the Demerara Sugar Terminal.

Most of the other major commodities are transported to Georgetown also in coastal vessels and other smaller wooden crafts. Since the population is concentrated in and around Georgetown farmers and other merchants use the port to make their products available for the local market and for export.

The majority of imports and exports of Guyana passes through the port of Georgetown. The imports even when destined for another region of the country arrives here in large consignments and then transported as smaller units by road or coastal vessels to these other regions. The exports on the other hand are transshipped from the other regions to Georgetown. Georgetown is the only port in Guyana with general cargo berths and facilities capable of accommodating ocean going ships.
CHAPTER 2

ORGANISATION AND MANAGEMENT OF THE PORT

2.1) ANALYSIS OF THE PRESENT ORGANISATION

The administration of the ports in Guyana cannot be defined within the context of any of the known theories on this subject. According to the Laws of Guyana:

The Transport and Harbors Department shall manage and carry on the railway and government vessels, and shall be charged with the control, improvement, lighting and regulation of the harbor of Georgetown and the other harbors of Guyana and the approaches thereto¹.

It does not mention any specificities of the ports; how it should be owned or administered, instead mention is only made that ports may be nominated for the purpose of the Customs and Excise Department².

This ambiguity leads to many inherent institutional and administrative problems. Georgetown is an estuarial port at the mouth of the Demerara River. The waters are public property but the frontage of the waterside is owned by the Municipalities bordering it, the State, and by Public and Private companies.

¹ Laws of Guyana. Ch. 49:04.
² Ibid.
The former organisation of the port of Brisbane, Australia bears some resemblance to that practiced in Guyana. It was not engaged in any form of port planning techniques nor was there a port authority. Responsibilities were divided between the Department of The Harbour and The Marine; however, neither specified areas of development nor the construction of facilities. This was the work of the private sector which secured leases from the Department or freehold lengths of the river banks, except for the ferry terminal. This led to gross overcapacity, complemented with poor services while port costs doubled that of rival ports\(^3\).

At Port Georgetown the quays are owned and operated independently by both private and public entities whose operations are independent of each other. There are twenty six different berths of varying lengths and sizes, but they are unconnected to each other. Together they extend for a distance of 3760 meters. Nine of these berths are State owned while the remainder are owned by private companies.

Berths are developed in pursuit of commercial and other objectives without consideration of others. No constructional standards are set by the Port's Administration. The Administration only restricts the distance that wharves can be projected into the river, the so called parkline. All other constructions are approved by the Municipality. The port is so disorganised that many incompatible activities intermingle with each other. For example, a sawmill is located next to the power station, others next to commercial wharfs; fishing vessel berths, laybyes and a market are located in the busy commercial or

prime areas of the port. A World Bank report alluded to the fact that there is no overall administration and coordination between the various port activities*.

Only nine of the berths are used directly for international trade. Others are used by vessels engaged in the coastal trade, for fishing vessels or as laybys, where several vessels are berthed at any particular point in time awaiting repairs or cargo. Further, many of the wharves are derelicts or in a perilous state. Generally, many are used for operations which can considered inconsistent with the operations of a commercial seaport.

The administration of the port is headed by the General Manager of the Transport and Harbors Department (T&HD). This department also manages the local riverine and coastal ferry services. The General Manager recommends to the Public Service Commission the appointment of the Harbour Master.

The Harbour Master, under the direction and supervision of the General Manager carries out the functions of administering the port. The result is an inefficient and highly disorganised port, and as Nagorski argues; "a port cannot be efficient if it is managed under rules and regulations established for railways, ferry services, ministries or the civil service"®. This truly reflects the current manner in which the ports in Guyana are administered.

* World Bank (1991), Study into the problems of Port Georgetown, Unpublished.

® Nagorski, B. (1972) Port Problems in Developing Countries, Japan: IAPH, p. 155.
The Harbor Master in addition to the traditional Harbor Master's duties is also responsible for, the safety of navigation, removal of wrecks, casualty investigation, examination of seafarers, licensing of ships, surveys and inspection of ships, the Pilot service and a variety of other duties. Many of these functions have nothing to do with the commercial operation of a port and are now considered to be the responsibility of a Maritime Safety Administration*. Thus he has to compromise his interest and attention between that of Port Administration and Maritime Safety Administration duties. Further, being an employee of the T&H.D he is subordinated to the hierarchy of this department.

The department being also responsible for the ferry services directs most of its interest and resources to this section even though most of its revenue is generated by the Harbors Department. The ferry services are more popular for any inconveniences to the public is highly visible and well publicized with political implications. On the other hand what is not visible is the huge losses suffered to the nation's economy as a result of a disorganised port. Due to the lack of proper statistics and measurable indicators this cost to the economy is difficult to quantify. Most shippers are just contented with passing on these extra costs unto the consumers. This can be done only with imports which are directed to the local population, further aggravating the high cost of living. The price of exports, on the other hand cannot be increased for they have to compete on the international market, in this case the local exporters have to bear the extra costs. It can be argued that this accounts in part for the decline of the local bauxite industry. Bauxite is


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a low valued cargo which depends upon a cheap source of transportation for its trading to be profitable. According to Nagorski:

Under an inefficient port management, the cost of living becomes higher, industrial development more difficult, and the export of products unprofitable, whereby the rate of economic growth and development is drastically curtailed?.

The International Monetary Fund (IMF) reckons that Guyana has excessively high freight rates, considered to be the highest in the Caribbean®. The excessive charges are instituted by shipping lines due to the poor state of the port.

Recently, however, the issue of port administration in Guyana is slowly coming to the fore and the public is becoming increasingly concerned about it°. Such awareness and concern has prompted the Government into action and they are now seeking assistance from international agencies for a study on the improvement of Port Georgetown and other Secondary ports°°.

2.2) THE IMPORTANCE OF A PORT AUTHORITY.
The poor state of the ports in Guyana makes it imperative for a more effective agency to manage and develop them. At Brisbane, Australia, the Port Authority of Brisbane was established in 1970. It co-ordinated and managed the

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°° Stabroek News (March 1991), Port Authority needed for Guyana, Guyana.

activities of the port and initiated large scale construction of modern facilities which led to greatly reduced port costs and was greatly welcomed by the community at large. This confirms the fact that a seaport cannot be properly managed without a Port Authority\textsuperscript{11}.

Initially, a single port authority should be effective enough to administer all the ports in the Guyana. This prevents the unnecessary duplication of efforts and resources. The ports here are not competitors but they supplement each other. However, since Georgetown is the main port and the focus of this study the necessity of a port authority as it relates to this port is considered here but with implications for the entire country.

A Port Authority is the administrative body charged with the responsibility of developing and managing a port. The nature of its structure and mandate determine the extent to which they are involved in the activities of the port.

There are many forms of port authorities depending upon traditions of the country, political factors and more important now, economic considerations. It can be a landlord port; whereby the port authority provides the basic infrastructure and general services and leases them to private enterprises which then develop them to meet their needs. Under this system the port authority takes no part in the operational activities of the port. The ports of Rotterdam, Antwerp and New York are examples of this type of port administration.

A further development of the landlord port is that of the tool port concept. Here the port authority goes further and develop the major superstructures and facilities or

tools required for the handling of cargo; such as sheds, terminals, stacking area, warehouses, cranes and various cargo handling equipment. The French ports belong to this category.\textsuperscript{12}

Also there is the full service ports whereby the port authority provides infrastructure, superstructure, general services and carry out the cargo handling operations. With this system all the facilities, services required by the ships, the cargoes and land carriers are the responsibility of the port authority. Many of the ports in the United Kingdom such as Felixstowe and the Forth Ports PLC are examples of this. Also those in Eastern Europe.

\textbf{2.3) OWNERSHIP OF THE PORT}

Port authorities may be owned by the State, Municipalities, Private companies or a combination of these.

The major ports of Rotterdam, Amsterdam and Antwerp are owned and managed by the municipalities. These are of the landlord concept. In the United Kingdom the ownership of the port is dependent upon the political party in power. The Labour Party advocates State involvement while the Conservatives are opposed. However, within the last decade of Conservative dominance, the British ports are being increasingly privatised. For example, the Forth Ports Authority was administered as a Government Trust since 1962. But in March 1992 it was privatised.

In the United States the ownership of the ports varies greatly. In some ports the terminal facilities are owned and operated by private interests while the local port

\textsuperscript{12} Baudelaire, J.C. (1986). Port Administration and Management, Japan: IAPH, p. 89.
administration is involved in administrative and regulatory functions\textsuperscript{13}. In some others all the facilities are owned and operated publicly by the port authority.

Within the CARICOM region most of the ports are publicly owned autonomous or semi autonomous entities. In Jamaica, the port authority is a public enterprise but the operations of the container terminal is undertaken by a private company. The Barbados Port Authority is a Statutory Corporation with cargo handling operations undertaken by a private company. The Port Authority of Trinidad and Tobago is a State owned corporate body operating as a full service port.

The form of ownership for the Port Authority of Guyana must take into consideration the traditions of the people, commercial dictates and the economic situation of the country. However, regardless of the factors used to determine its ownership it should be an independent body charged exclusively with the management and operation of the port.

2.3.1) THE ROLE OF THE STATE
Initially, the State will have to be involved to a great extent in the ownership of the port as was the case of early port development in the developed countries. There are some functions which the state has to carry out, these fall into the classical description of the public goods concept which private interests will not undertake, for example the provision of lighthouses. Statutory powers will be needed for acquiring the land and property of private companies which will be affected by a port development plan. The state will be reluctant to give this

\textsuperscript{13} Baudelaire, J.C. (1986), op. cit. p. 97.
to private enterprises without the exchange of some autonomy. The government at present has substantial assets in the port through those of the Transport and Harbours Department and other State owned entities.

Since the condition of the port warrants extensive capital investment, the government will be needed to provide or secure these funds for any port development project.

2.3.2) THE ROLE OF THE MUNICIPALITY
The city of Georgetown would be greatly affected by any port development project. Many businesses are located on areas bordering the port with narrow streets breeding traffic congestion. The free movement of traffic in and out of the port is a necessity for it to develop. The terminal operators consider this to be one of the most pressing problems affecting their operations. A modern port also needs large areas of land for its operations, in particular for the reception, delivery, stacking and handling of containerised cargo.

Given the above, any port development plan will have to be incorporated into the development and layout of the city. These and other functions of the municipality as they affect the port may warrant their involvement in the ownership of the port. However, they lack a tradition in this respect and that of involvement in commercial undertakings or managing operations of this magnitude.

2.3.3) THE ROLE OF THE PRIVATE SECTOR
The status and operations of the private berth owners and operators must be carefully considered in the reorganisation and ownership of the port. Their

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involvement and participation must be considered at every stage of the process. They have a tradition of operating their respective terminals and facilities. In a more comprehensive form of port operations and administration their operations would have to be streamlined and organised in such a manner that will demand more than their present resources can sustain. It will of necessity include the construction of modern berths to accommodate modern vessels and satisfy optimum traffic requirements. To undertake this task and others the port authority must be given control over the land where their berths are constructed.

2.3.4) SUGGESTED OWNERSHIP OF THE PORT
The ownership of the port will depend upon the political will of the government as is the case with the British ports. Private interests may not want to relinquish ownership and control of their property so the government will have to initiate legislation compelling them to do so. On the other hand the government may not wish to lose direct control over the port because of its national importance. Therefore, given this diversity of interests the port should be owned by the government as an autonomous corporate entity under the landlord port concept.

Under this system the port authority will provide and develop the infrastructure then lease them to private enterprises who will then develop the superstructure and undertake cargo handling, warehousing and other commercial operations.

2.4) THE TERMS OF REFERENCE OF THE PORT AUTHORITY
A well guided government should not be directly involved in the administration of the port. Instead, it should give the port authority a mission to develop and administer the
port in an efficient and cost effective way to facilitate the nations maritime trade. It should specify the standards and provide the legislative framework, within which the port must achieve its objectives. These measures should ensure, among other things that the port will be well managed and developed along lines consistent with the country’s economic policy; that sound management and accounting procedures are followed and the interest of the public is safeguarded\(^1\). 

The authority should be given controlling power over the entire harbour area including the river, the waterfront, the wharves, sheds, loading and unloading areas, all property bordering the harbour including those traffic areas within defined limits of the port\(^2\).

The powers the Port Authority should assume are\(^3\)\(^4\)
1) The right to sue and be sued as a corporate body;
2) To raise money by public or private borrowing;
3) To acquire, hold and lease lands;
4) To levy charges on ships and goods which use the port’s facilities, and to detain until all dues and charges have been paid or proper security given therefor;
5) To impose regulations with respect to draft and to manoeuvring of vessels in the port and in the port’s approaches;

\(^{1}\) Nagorski, B. (1972), op. cit., p. 156.


\(^{3}\) Taken partly from NEDCO, op. cit., p. 59.

6) To dredge, to execute engineering works, to provide plant for these purposes and to initiate and carry out improvement works, whereby existing facilities of the port or harbour are enhanced;
7) To license persons or companies providing port services, such as cargo handling, labour, lighterage, ship chandlery and bunkering;
8) To control the erection of wharves in the port;
9) To advise on and to propose new legislation regarding the harbour area, including the traffic lanes connecting the port with its hinterland;
10) Make bylaws to regulate the activities of port users and other persons within the port.

The principal functions of the Port Authority should be:
1) To maintain the port in a state of efficiency;
2) To take all reasonable steps to provide for the safety of ships in the port or in the port’s approaches, and for the proper care of passengers and cargo whilst on the port’s premises;
3) Not to discriminate in the matter of charges as between vessels of the same class;
4) To keep proper accounts and to have them audited;
5) To obtain proper port statistics and information;
6) Conservancy and provision of navigational aids;
7) Provision of security for the port and harbour.

This list is not exhaustive but the terms of reference will also be dependent upon the extent of the involvement of the various entities. The government in addition to ensuring that the port’s operations are consistent with the terms of reference must ensure that it is done safely and efficiently in compliance with international standards and regulations.
2.5) IMPLEMENTATION OF RECOMMENDATIONS

Without a port authority the development project for the facilitation of larger vessels for the export of bauxite cannot be successfully undertaken. The poor state of the port warrants immediate reorganisation. This need not be done completely all at once. Initially, the basic mechanisms should be put in place to effect the administrative changes. Further on this said transitionary administration should then be charged with the responsibility of proposing specific measures for the introduction of an autonomous port authority. Expert opinion and advice is needed for this, therefore, the use of consultants should be carefully considered.
ANALYSIS OF THE PROBLEMS AND EXISTING CONDITIONS IN THE PORT

Ports originated as simple landing places on river banks or alongside coastal promontories near to a settlement where the shallow draft vessels of the time could be accommodated and sheltered from the weather.

With the advent of industrialisation and the development of communities came the requirement for more and larger ships. In some cases the original sites did not provide adequate shelter or depths of water for these larger ships. The ports were then relocated to more suitable locations. In some, however, the geography of the entire country presented similar natural conditions which the port had to develop with.

In addition to the natural factors that inhibit the development of a port, there are others which are the result of mal-administration, and lack of organisation and planning. The result is poor services to ships and inappropriate or inefficient facilities.

Even though these two factors are inherently different they are both limitations to a port's operation and development. In Georgetown they both influence the volume and size of ships visiting the port.

The operation and development of some ports are affected by major constraints, others are plagued by problems while others are affected by both. The port of Georgetown falls
in the last category. This chapter analyses these problems and the effect they have on the operation of the port.

3.1) DEPTHS IN THE CHANNEL AND HARBOUR AREA

The continental shelf off the east coast of South America is very wide. It represents a continuation of the flat coastal plain beneath the ocean margins. A comparison between the continental shelves off the east and west coasts of South America reveals the extent that this relatively shallow area projects. A wide continental shelf means that the distance from the shore to the 30 metre depth contour is relatively far1. Depths of 5.4, 11, and 18 metres can only be found at distances of 18.5, 23, and 33 kilometres respectively off the coast of Georgetown.

The natural depth in the channel is 3.05 metres Admiralty Datum (AD) while in the harbour area it is between 7 and 3 metres AD.

3.1.1) IMPACT OF DEPTHS ON PORT OPERATIONS

On the international market bauxite is mainly traded in bulk carriers of 55,000 to 70,000 dwt capacity and the handymax sizes of 35,000 to 50,000 dwt. The latter group accounted for 46 per-cent of this trade in 19892.

Guyana's bauxite is mainly exported in vessels having average size of approximately 27,000 DWT. This prevents the industry from benefiting effectively from the economies of scale gained by using the larger vessels.


Table 3.1 are some examples of economies of scale in bulk Shipping.

### 3.1) Bulk carriers single voyage rates (US$/ton of cargo)

<table>
<thead>
<tr>
<th>Year</th>
<th>25,000 dwt</th>
<th>55,000 dwt</th>
<th>90,000 dwt</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>35.1</td>
<td>22.6</td>
<td>7.4</td>
</tr>
<tr>
<td>1989</td>
<td>36.4</td>
<td>24.0</td>
<td>7.8</td>
</tr>
<tr>
<td>1990</td>
<td>32.8</td>
<td>23.0</td>
<td>6.6</td>
</tr>
<tr>
<td>1991</td>
<td>35.4</td>
<td>26.9</td>
<td>6.8</td>
</tr>
</tbody>
</table>

Even though the smaller vessels were used to transport Guyana’s bauxite, their full capacity was not utilised. They departed with maximum loads of about 10,000 tons cargo and a draft of 6 metres. This under-utilisation of the ships capacity resulted in the payment of enormous sums of deadfreight.

The excessive shipping cost led the Bauxite Industry Development Company Limited (BIDCO) to undertake a project of deepening the Demerara ships’ channel and the establishment of a floating transhipment facility in Georgetown for the export of bauxite. It involved dredging a basin to a depth of 12 metres and deepening the channel from 3.05 metres AD to 7.0 metres AD for a distance of 12 nautical miles. The project commenced in

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* Taken from Lloyds Shipping Economist, November 1991 p. 35, April 1991 p. 35.

* Deadfreight is the freight paid by a shipper or charterer to a shipowner in lieu of freight earnings lost by space which was reserved and not utilised.

* This is the holding company for the State owned bauxite company; GUYMINE and is responsible for marketing and shipping.
1987 and was completed in February 1988. The total cost is estimated at US$ 8.5 million and included the delineation of the channel with buoys.

This project was undertaken and financed by BIDCO. Therefore, only areas directly related to their operations were developed. Other areas of the harbour were unaffected.

3.2) THE EFFECTS OF TIDES AND CURRENT

The ports in Guyana are subjected to the influence of tides and the currents they generate. The tides are semi-diurnal; that is, two high and low waters daily. The heights above admiralty datum (AD) are:

- Mean High Water Spring (MHWS) 2.9 metres
- Mean High Water Neap (MHWN) 2.2 metres
- Mean Low Water Spring (MLWS) 0.3 metres
- Mean Low Water Neap (MLWN) 1.0 metres

For vessels to maximise their loads they must enter or leave port at high water. This varies daily between spring and neap tides. The tidal effect gives periodic increases in depth availability, but the faster turn around of all types of vessels is restricted against the full employment of capital represented by the modern ship*. Should a vessel encounter any delay it would have to wait a further twelve hours; until the next high water to sail. Extremes of this occurs whenever the port is closed to nocturnal navigation necessitating vessels to wait twenty four hours before sailing.

* Bird. (1979), Seaports and Seaports Terminal, Hutchinson, p. 34.
3.3) AIDS TO NAVIGATION

Aids to navigation are used by mariners to guide them safely through channels and waterways. The ability of a ship to remain within these limits depends upon the accuracy and reliability of these aids. In Georgetown the reliability of these aids are very poor.

In the major ports of the world the positioning and maintenance of these aids is a relatively simple and routine task. At the Forth ports in Scotland, for instance, problems with aids to navigation have never been known to affect the operations of the port. They adhere to a strict maintenance and replacement schedule which is aided by a computerised data base. With this the authorities are able to monitor their performance and servicing requirements.

The problems with the aids to navigation in Georgetown have been investigated by the World Bank. Their study revealed that: "vandalism of the lights on the buoys and beacons are prevalent and the lack of a buoy tendering vessel inhibits the servicing and replacing of the aids".  

However, many serving in the port are convinced that these are not the only problems affecting the performance of the aids to navigation. They argue, that it is a more far reaching problem.

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World Bank (1991), Study into the problems of the ports in Guyana (Unpublished).

The author has served several years as a Transport and Harbours Department pilot. These other problems expresses his opinion and observations made from experiences acquired during this time.
There has not been any scientific or technical study to
determine the suitability to local conditions of the aids
being used. In 1988 after the Demerara ship’s channel was
dredged it was delineated with nine buoys. Shortly
thereafter, one by one they consistently became
inoperable, until finally they were all out of commission
within a relatively short period of time. No detailed
analysis was undertaken to determine the cause of this but
it was readily assumed that they were vandalised. There
was some evidence to support this but not to the extent
claimed.

Whenever the lights on the buoys are extinguished, and
vessels; especially trawlers and coastal crafts are
navigating in the vicinity of the harbour entrance at
night or under conditions of restricted visibility they at
times collide with them. Through this they are either
damaged, shifted or displaced completely.

The fixed beacons are more reliable aids to navigation
from a mariner’s point of view as well as that of the port
administration. They are placed in less exposed positions
where they are less susceptible to damage by ships. A pair
of these beacons serves as the leading marks through the
ships’ channel. Pilots rely absolutely upon these to
conduct vessels through the channels. However, they have
their own problems at the Port of Georgetown.

The base of the beacons are constructed of wood with a
metal tower upon its base. Before the channel was dredged
they were fairly reliable. But, since its deepening the
present height and construction has proved less reliable.
Pilots must rely on them for the ten miles transit of the
channel and with much deeper draft vessels where greater
accuracy and precision is required.
The lights on the beacons are also from time to time out of commission. This can be attributed to the lack of maintenance. When they are out of commission the channel is closed to nocturnal navigation.

3.4) PILOTAGE

There are two established pilotage services in Guyana. One is operated by the Transport and Harbours Department (T & H.D) and the other is operated by the Guyana National Engineering Corporation (GNEC). The T & H.D is responsible for pilotage in the main rivers of Guyana, but the Demerara district only includes the port of Georgetown and its approaches. G.N.E.C. on the other hand undertakes pilotage beyond the port as far as the bauxite port of Linden. Pilotage is compulsory in the first instance but not in the latter.

Both services suffer from similar problems which can be attributed to the lack of proper organisation and management of the port. Also, the importance of this service is not fully appreciated.

In many ports the pilot service is operated as a private independent association of pilots and it offers its services to the port. In Guyana, however, the pilots being employed by the T&H.D are regarded as traditional public servants and are remunerated as such. A World Bank study has alluded to the problems of this service. It claims that the pilot service suffers from insufficient salary levels, a necessary condition for retaining qualified staff*. The inadequacy and unreliability of the pilot launches is also a major problem of the pilot service. A total of four

new pilot launches were acquired in 1981 and 1982 from reputable European shipyards, at present only one is in commission. They were relatively reliable for the first three years. From thenceforth they were plagued with problems. This is contrary to the projected their economic life. According to UNCTAD the average economic life of a pilot launch is twenty years\(^{10}\).

The problems with the aids to navigation directly affect the operation of the pilot service. This along with the above are sources of great frustration for the pilots. This translates into low morale and the difficulty in attracting suitable entrants to the service. The end result is the persistent shortage of pilots.

All the port users readily admit that the problems with the pilot service is one of the most serious problems affecting their operations. The combined effect of an inadequate pilot service in Guyana is responsible for BIDCO alone experiencing over 28 days delays in 1991 for vessels they chartered and consequently had to pay demurrage\(^{11}\). As a rough estimate this is equivalent to an approximate loss of US$ 224,000. The other major shipping companies have not compiled similar statistics, but it is certain that they have experienced similar misfortunes.

3.5) HYDROGRAPHIC SURVEYING

Since the Demerara channel was dredged the task of surveying it is now undertaken mainly by the dredging contractor who executed the project. This company surveys


\(^{11}\) The author was given this information by officials of the company.
the channel at their own convenience, for instance, when it is necessary to determine the depths prior to a maintenance dredging program or after specified periods of time. If the Harbours authority is interested in ascertaining such depth for reasons unconnected with the bauxite industry it is at the discretion of the dredging contractors.

The Hydrographic Department of the Transport and Harbours Department is responsible for surveying the channels and waterways of Guyana. They are unable to effectively carry out this mandate for reasons which are amply described by the World Bank\textsuperscript{12}. They contend that:

the important hydrographic surveying function cannot be performed on a regular schedule because of the following:

a) shortage of qualified staff, due to inadequate government salary policies;

b) regular survey work cannot be performed, as the single survey vessel is regularly used as a pilot boat;

c) the surveying equipment is nine years old and in need of repair and upgrading, all of which has to be done by the foreign manufacturer. Due to the foreign exchange limitations this work has been postponed for several years.

3.6) COMMUNICATIONS

Communications are essential for the safe management of vessel traffic in the port; the coordination of port operations and other requirements of ships.

The Georgetown lighthouse at the entrance of the port is its signal station and communication center. Its

operational capability is limited to that of a single VHF and a single telephone connection.

3.7) OTHER SERVICES
Shipowners use their stay in port for working cargo and to service their ships. These services include the provision of fresh water, bunkers and lubrication oils, ship repair, provision and other necessary requirements. Most of these services are at present carried out in an ad hoc manner due to the lack of a proper port organisation.

3.8) PIRACY
There has been increasing incidents of piracy in the port of Georgetown. The situation has become so critical that the International Maritime Organisation (IMO) and BIMCO have on record such incidents\textsuperscript{13,14}.

Piracy, besides giving a negative impression of the port and country as a whole has economic consequences as well. Ships visiting the port will have to pay extra insurance premiums to cover the risk of loss. The additional cost is borne by local shippers through higher freight rates which is further transmitted unto local consumers and exporters.

The problem of piracy has become so acute that a National Task Force has been formed to address the question of piracy in the port. So far their deliberations have not led to a reduction of such incidence.

3.9) THE DEMERARA HARBOUR BRIDGE
A problem of unmeasurable proportions that affect the operation of the port, shippers and the economy as a whole

\textsuperscript{13} International Maritime organisation (February 1991), Piracy And Armed Robbery Against Ships, M.S.C 59/19/3.

\textsuperscript{14} BIMCO (September/October 1991), Bulletin 5/91, p. 65.
is the Demerara Harbour Bridge. It is a floating retractable bridge located one mile beyond the southern limits of the port. Vessels proceeding to the bauxite port of Linden, to the three oil terminals and other installations must transit it in order to get to their destinations.

The bridge retracts one hour before high water for ocean going vessels to transit. Invariably it would do so at this specific time, on other occasions it is completely out of commission for several days leaving many vessels stranded to go in either direction.

In 1991, vessels chartered by BIDCO alone for the export of bauxite experienced 37.2 days delay due to the malfunctioning of the bridge. This resulted in the loss of substantial sums of money for BIDCO.

3.11) BERTHS AND CARGO HANDLING OPERATIONS
3.11.1) GENERAL CARGO BERTHS
The depths alongside the various wharves in the port varies between 3.6 and 6.4 metres AD. The latter draft was sufficient to facilitate vessels loaded to the maximum permissible draft at the time to safely transit the ships’ channel, which had a depth of 3.05 metres AD. When loaded to the maximum permissible draft for the channel of 5.95 metres, the vessels will remain afloat at all states of the tide. As such the major wharves were constructed to accommodate vessels having this draft.

With the deepening of the channel the depths alongside the wharves relative to that of the channel are inadequate, but they cannot be increased significantly. Some wharf owners have attempted to dredge alongside their facilities but with only marginal success for reasons stated below.
First, due to the differences in the ownership of these facilities as explained in chapter Two. When the area alongside one wharf is dredged and the adjacent ones are not, the silt moves from the adjacent ones into the deeper area which had recently been dredged. This is a source of conflict between the wharf owners, for while one owner may wish to develop his facility the other may not.

Secondly, the wharves were constructed many years ago with the depths alongside being directly related to the depth of the channel. As a consequence the piles which support these wharves can only facilitate a maximum depth alongside of 6.5 metres AD. Any attempt to significantly increase this can result in the collapse of the structure.

Further, when many of the wharves were constructed no vertical protective wall to prevent erosion of the natural configuration of the river bank was installed. Beneath them is gently sloping. Therefore, dredging alongside will create a sharp increase in the gradient of the river bank below the wharf, and due to the nature of this material; soft mud, erosion can take place. In addition to refilling the dredged area, the erosion can undermine the foundation of the wharf.
<table>
<thead>
<tr>
<th>WHARF</th>
<th>DEPTH (METRES)</th>
<th>FRONTAGE (METRES)</th>
<th>USAGE</th>
</tr>
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<tbody>
<tr>
<td>MINISTRY OF WORKS</td>
<td>1.8</td>
<td>61</td>
<td>PONTOONS, SLOOPS</td>
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<td>FORESTRY DEPARTMENT</td>
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<td>WRECK ALONGSIDE</td>
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<td>GUY. ELECT. CORP.</td>
<td>4.9</td>
<td>91</td>
<td>FUEL TANKERS</td>
</tr>
<tr>
<td>CARIBBEAN MOLASSES</td>
<td>4.6</td>
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<td>MOLASSES TANKERS</td>
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<td>RICE MARKETING BOARD</td>
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<td>TRANSPORT &amp; HARBOURS</td>
<td>4.6</td>
<td>128</td>
<td>COASTAL CRAFTS</td>
</tr>
<tr>
<td>WETING &amp; RICHTER</td>
<td>5.0</td>
<td>85</td>
<td>TRAWLERS, FISHING VESSELS</td>
</tr>
<tr>
<td>BOOKERS No. 2</td>
<td>3.6</td>
<td>85</td>
<td>DERELICT</td>
</tr>
<tr>
<td>MUNESHWER</td>
<td>5.5</td>
<td>152</td>
<td>COASTERS, LAY BYE GENERAL CARGO</td>
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<tr>
<td>BOOKERS No. 1</td>
<td>5.0</td>
<td>100</td>
<td>DERELICT</td>
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<tr>
<td>JOHN FERNANDES</td>
<td>5.8</td>
<td>90</td>
<td>GENERAL CARGO</td>
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<td>60</td>
<td>FERRY STELLING, HARBOUR STATION</td>
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<td>GUYANA LIQUOR CORP.</td>
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<td>ALCOHOL TANKERS</td>
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<td>GUY. NAT. ENG. CORP.</td>
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<td>GENERAL CARGO, LAY BYE</td>
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<td>DEMERARA SUGAR TERMINAL</td>
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<td>130</td>
<td>BULK SUGAR</td>
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</tbody>
</table>
3.11.1.1) CARGO HANDLING OPERATIONS
In the port all wharves are constructed of wood with the exception of the Demerara Sugar Terminal. The load capacities that can be safely accommodated on them are very limited. This prevents the use of quay-side cranes to load and discharge ships. Therefore, vessels trading here must have self loading and discharging capabilities. The cargo handling performance of the three principal foreign trade general cargo wharves are indicated in table 3.3.

<table>
<thead>
<tr>
<th>WHARF</th>
<th>CARGO HANDLING RATES (PER HOUR).</th>
</tr>
</thead>
<tbody>
<tr>
<td>JOHN FERNANDES LTD.</td>
<td>CONTAINERS: 8</td>
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<tr>
<td></td>
<td>BREAKBULK: 40</td>
</tr>
<tr>
<td>GUY. NAT. ENG.CORP.</td>
<td>CONTAINERS: 6</td>
</tr>
<tr>
<td></td>
<td>BREAKBULK: 24</td>
</tr>
<tr>
<td>GUY NAT SHIPPING CORP.</td>
<td>CONTAINERS: 5</td>
</tr>
<tr>
<td></td>
<td>BREAKBULK: 19</td>
</tr>
</tbody>
</table>

SOURCE: OBSERVATION OF THE AUTHOR AND INTERVIEWING PERSONNEL AT THE VARIOUS TERMINALS.

The cargo handling equipment and methods used at the various terminals are basically similar. Equipment used are forklift trucks, cranes, tractor and trailers, and trucks.

For containerised cargo, import containers are landed on the quay apron, then forklift trucks move them to the stacking area. The heavy containers are landed onto trailers then transported to the stacking area to be further discharged by heavy lift cranes off the quay. Depending upon the availability of equipment, two forklift trucks are normally used to move forty foot containers to the stacking area.

For export containers the reverse process takes place. But in some instances trucks will come directly from the
inland areas to the quay apron and the containers will be loaded directly unto the vessel.

Import breakbulk cargo is handled in the conventional manner, that is by slings and pallets onto the quay then transported to the warehouse by forklift a truck. For export cargo the reciprocal process applies.

There is no dedicated container freight station at any of the facilities even though most of the containers are Less than Container Load (LCL) consignments. The containers are stripped in the container yard or on the quay apron, the cargo is then transported by forklift into the warehouse for delivery. Export cargo is received for shipment in the warehouse then transported to the quay apron or stacking area for consolidation into container loads.

The number of moves per container is reflected in the high handling charges experienced by shippers. For instance in the Port of Grangemouth, Scotland it costs approximately US$ 113. in handling charges for a TEU container, while in Georgetown it costs about US$ 400.

The slow transit of containers and other cargo through the port is a major constraint to terminal operations. Customs Officers insists on checking all containers and other units of cargo for taxation purposes and to verify if they are consistent with the invoices and import license. Due to this it takes three to seven days for a container of cargo to transit the terminal.

At John Fernandes Limited the other major problem is the inadequacy of space. Container traffic requires large areas of land for the handling and storage of containers. Here the quay apron is approximately twenty metres wide. LCL cargo is consolidated here in addition to the ship.

37
shore transfer of cargo. The storage of empty containers created from the imbalance of trade further aggravates this problem. The lines operating here prefer to leave them here for unspecified periods of time because there is no penalty for this.

Both the Guyana National Engineering Corporation (GNEC) and Guyana National Shipping Corporation (GNSC) experience similar problems as above but the quay apron is wider. However, their quay surfaces are uneven; this accounts in part for the disparity in cargo handling rates vis-a-vis John Fernandes Limited, where the quay surface is more even and equipment can move faster.

3.11.2) SPECIALISED FACILITIES
3.11.2.1) DEMERARA TRANSSHIPMENT STATION (DTS) Up to February, 1988 the transportation mode for Guyana's bauxite exported to the United States of America, Europe, and the Far East was to load bottom cargo in Linden and Everton and top up the vessel at Chaguaramas, Trinidad. This transshipment terminal was closed in 1988 after the introduction of a new floating transhipment terminal in Georgetown, Guyana, the Demerara Transhipment Station.

This facility involves a specially modified geared bulk carrier of self loading and discharging capability whose position is maintained by five specialised anchors. It has the following particulars:
Length overall         163 metres
Beam                   26 metres
Capacity               32,000 metric tonnes
Cargo hatches\ holds   5
Loading rate           400 tonnes per hour.
Annual capacity        3.5 million metric tonnes.

This facility caters to accommodate ships up to 183 metres in length and 29 metres beam.
In 1991, from the total volume of 1.5 million tonnes of bauxite exported, 498,000 tonnes were transhipped through this facility.

The initial cost of hiring and positioning the vessel used for this facility was approximately US$ 1.5 million with a time charter hire of US$ 6,500 per day increasing cumulatively at 8 per-cent annually.

With the commissioning of this facility the cost of shuttling cargo from Linden and Everton has been reduced by about 50 per-cent as compared to the use of the Chaguaramas facility. Ocean freight was also reduced by about US$ 1.00 per ton of cargo.

3.11.2.2) AROIMA BAUXITE COMPANY (ABC)
In October, 1990 a second bauxite transhipment facility was commissioned in the port by the Aroima Bauxite Company. This facility is four cables south of the Demerara Transhipment Station.

The operation here is not based upon the fixed storage vessel concept. Instead, export vessels are moored in a basin dredged to 15 metres. Here laden barges come alongside the cargo is loaded unto the export vessel, with her own cranes. Vessels used at this facility have sizes of between 25,000 and 37,000 dwt capacity.

The average loading rate here is 250 tons per hour.
In 1991 approximately 480,000 tonnes of bauxite was exported through this facility.

3.11.2.3) DEMERARA SUGAR TERMINAL
This facility for the storage and export of bulk sugar was commissioned in 1966 by Bookers Sugar Company. Since the nationalisation of the sugar industry it is operated by
the Guyana Sugar Corporation. It has storage capacity of 69,000 tons and a loading rate of 500 tonnes per hour.

Even though this facility was constructed twenty six years ago it remains the most modern in the port having a cemented quay and can accommodate vessels up to 155 metres in length. However, due to the small quantities of sugar available for shipment at any particular instant, the average size of vessels used for the export of sugar is approximately 7,000 dwt capacity.

3.11.3) OTHERS
Molasses is exported from a bulk storage and shipment facility in the port operated by the Caribbean Molasses company. This trade is served by specialised tankers of about 1,000 dwt capacity.

Bulk fuel is imported by four oil companies operating in Guyana. Their facilities are outside the limits of the port. They are wooden jetties projecting into the river to accommodate tankers of approximately 120 metres in length with depths alongside between 5 and 5.5 metres.

Alcohol is exported from Guyana in bulk and in the bottled form. Bulk shipments are further divided into minor shipments, that is, by bulk containers on the general cargo vessels and major bulk in specialised tankers. The bulk terminal is operated by the Guyana Liquor Corporation and the vessels used here are have capacities of about 2,000 dwt and maximum length of 100 metres.

3.12) TARIFFS AND FINANCIAL ANALYSIS
Like any other economic enterprise, a port must be financially strong to be efficient. Only sound finances will enable the port administration to keep all facilities to high technical and operational levels which are
necessary to render efficient and economical services to its customers.\textsuperscript{18}

The level of tariffs is dependent upon the objectives of the port, whether it is to minimise payment by users, minimise users port-related ship costs or to minimise users total through transport cost. On the other hand it can be applied to maximise benefits to the owners of the port or to maximise benefits to the region or country as a whole.

There is no formal policy with regard to tariffs in the port. However, observation of the charging system reveal that they are based upon fiscal considerations rather than the level of services provided.

The level of port costs in Georgetown is relatively low vis a vis the other CARICOM countries. However, this port can still be considered as being expensive, for as Faurant explains; an expensive port is not necessarily one with high charges, but a port with poor quality of service.\textsuperscript{19}

Since this port is not organised along conventional principles there is no consistent policy with regards to port tariffs such as for cargo handling, wharfage, mooring etc. General charges instituted by the Transport and Harbours Department are based upon the vessel itself. These are light dues, tonnage dues and pilotage fees. Appendix 1 is a schedule of these rates while table 3.4 indicates the level of revenue received by the department in 1991 from these charges.


Table 3.4) Receipts of Port Dues: Georgetown (1991).

<table>
<thead>
<tr>
<th>Charge</th>
<th>Receipts (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilotage</td>
<td>285,664</td>
</tr>
<tr>
<td>Light dues</td>
<td>198,574</td>
</tr>
<tr>
<td>Tonnage dues</td>
<td>451,945</td>
</tr>
<tr>
<td>Total</td>
<td>936,183</td>
</tr>
</tbody>
</table>

Source: Harbour Master's Department, Georgetown.

In addition to these amounts almost US$ 400,000 remains outstanding to the authorities from various companies.

The specific tariffs instituted upon ships by the terminal operators are for wharfage, cargo handling and warehousing. However, these terminal operators are usually the port agents and freight forwarders of the lines using their respective facilities. For reasons claimed to be based upon confidentiality the rates and level of these charges are not forthcoming.

The analysis of the problems and existing conditions of the port gives a general idea of the magnitude of resources necessary to bring it up to the standards of a modern seaport. The services can be improved in a relatively short time if these activities are managed and coordinated effectively. The development of the infrastructure, on the other hand, call for a massive long term development master plan to be formulated first. However, smaller projects which can be integrated in the overall development plan should proceed on a timely basis. It is against this background that a project for the facilitation of larger vessels into the port for the export of bauxite has been conceived.
CHAPTER 4

PLANNING AND FORECASTING

The development of a port must be comprehensively planned throughout all its stages if it to be a worthwhile or feasible investment. It should cater for the specific needs of the trade or trades it seeks to facilitate and at the same time allow for sufficient flexibility so that it can respond to the changing trends in technology and ship types. In general a successful plan cannot be static but dynamic.

The facilities which the port provide should be designed jointly with the specific industry whose ships will be using the facilities. It would have to go even further and consider the transport of the cargo from the hinterland and the port facilities at the other end of the route. The development of Port Georgetown has already been initiated by the local bauxite company, BIDCO in the absence of an effective port administration. It established the Demerara Transshipment Station as part of its effort to control the total physical distribution system of bauxite from the mines to overseas customers. When a port authority is established in Guyana then the task of any future port development programme would be assumed by this organisation. It would however, in conjunction with planners in the bauxite industry study the overall economic optimisation level between, for example ship size, rate of loading, size of buffer stock and the hinterland transport facilities.
The plan has to be based upon the assumption that facilities would be actively utilised. Consequently, the extent of this has to be predicted through the use of forecasting techniques. This is the evaluation of future prospects based on past experiences and expectations for future occurrences. The goal of the forecast is to make the best possible use of data and information that is available\(^1\).

Planning and forecasting the requirements for the export of bauxite from Guyana cannot be reliable if it is based totally upon historical trends. Major structural changes have occurred in the industry such as the participation of new companies with modern mining equipment. Therefore, the levels of production in the coming years are expected to improve substantially above the historical trend.

As a result of the present condition of port the infrastructural development plan will realise improvements at some point between the short and medium terms. Since no conscious effort was made to improve the port for a number of years, any well thought out plan, even on a small scale is bound to have an almost immediate positive impact upon the port. Nevertheless, it must be implemented with due consideration for a subsequent long term master plan for the development of the port and the industries it seeks to facilitate.

4.1 POTENTIAL VOLUMES
For a port development plan to be successful the potential volumes of cargo must be ascertained to set the optimal design capacity of the facilities.

The government of Guyana believes that in the short term the country's economic prospects are closely associated with improved performance in the bauxite and sugar industries².

Total national exports are expected to grow at an annual average rate of fifteen percent a year in real terms between 1991-93, mainly reflecting the recovery of rice, sugar and bauxite exports³.

The International Monetary Fund (IMF) predicts 1993 production of bauxite will be 3.7 million tonnes⁴. This is supported by officials of the local bauxite industry who estimate annual exports of 4.3 million metric tons per year in the medium term. This suggests that by about 1996 this level will be achieved. It represents an average growth rate of approximately 5 percent per annum.

The reason why the above optimistic predictions were made is with the imminent divestment of the State owned bauxite company. Judging from the recent record of private sector involvement in the industry these estimates can be considered reasonable, if not conservative.

This growth rate is projected to hold until the turn of the century when levels may taper off as the optimum utilisation of productive capacity is achieved and the consequent softening of demand. The estimated volume of bauxite production for export from Guyana is plotted below in figure 4.1.

³ IMF (1991), op. cit.,
⁴ Ibid.
4.2) WORLD BAUXITE TRADE
The demand for bauxite is a derived demand. It is dependent upon the demand for the secondary product; aluminum. This latter demand is closely linked to the level of economic activity in the industrial countries. The depression of the OECD countries during the early 1980's led to a twenty five percent decline in the bauxite trade during the period 1980 to 1983. However, as the economies recovered the trade increased to 47 million metric tons in 1989 up from a low of 40.6 million metric tons in 1986⁵. Table 4.1 shows the world seaborne trade in bauxite and alumina.

Table 4.1) By Exporting Areas

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mediterranean</td>
<td>2342</td>
<td>2525</td>
<td>1470</td>
<td>2242</td>
</tr>
<tr>
<td>Africa</td>
<td>6554</td>
<td>11374</td>
<td>12675</td>
<td>13531</td>
</tr>
<tr>
<td>Jamaica</td>
<td>8506</td>
<td>9479</td>
<td>3954</td>
<td>5736</td>
</tr>
<tr>
<td>Other Americas</td>
<td>7496</td>
<td>8568</td>
<td>7000</td>
<td>8794</td>
</tr>
<tr>
<td>Asia</td>
<td>2059</td>
<td>2948</td>
<td>2283</td>
<td>2079</td>
</tr>
<tr>
<td>Australia</td>
<td>11776</td>
<td>13179</td>
<td>11592</td>
<td>12114</td>
</tr>
<tr>
<td>Others</td>
<td>354</td>
<td>197</td>
<td>862</td>
<td>1225</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>41187</td>
<td>48270</td>
<td>40036</td>
<td>47721</td>
</tr>
</tbody>
</table>


Table 4.2) By Importing Areas

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>UK/Continent</td>
<td>6004</td>
<td>6359</td>
<td>6118</td>
<td>5261</td>
</tr>
<tr>
<td>Other Europe</td>
<td>9113</td>
<td>9957</td>
<td>11418</td>
<td>14181</td>
</tr>
<tr>
<td>North America</td>
<td>18514</td>
<td>23186</td>
<td>15022</td>
<td>19653</td>
</tr>
<tr>
<td>Japan</td>
<td>5160</td>
<td>6440</td>
<td>3563</td>
<td>2291</td>
</tr>
<tr>
<td>Others</td>
<td>2396</td>
<td>2328</td>
<td>3915</td>
<td>6335</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>41187</td>
<td>48270</td>
<td>40036</td>
<td>47721</td>
</tr>
</tbody>
</table>


The production of aluminum is expected to continue its strong growth during the 1990's and this is evidenced by the re-opening of a major refinery in the United States at Burnside, Louisiana in 1988. This is now the principal market for Guyana's bauxite. Venezuela, which is also a major market is boosting its aluminum production capacity,
thus further increasing the potential for exports from Guyana.

The bauxite trade is highly regionalised with Africa being the main supplier to the EEC market, although low freight rates in the mid 1980’s resulted in increased shipments from long haul sources as Australia. The world’s largest exporters of bauxite; Guinea and Australia are able to penetrate the huge North American market in part because they trade in larger vessels than Guyana. Guinea’s trade is mainly with vessels of over 60,000 dwt while Australia’s trade is with vessels up to 120,000 dwt. These sizes nullify the advantages Guyana has by virtue of its close proximity to the North American market especially when freight is low. With higher freight rates the trade can be expected to revert to regional supplies. Guyana, therefore, is well positioned to increase its share of the market to this region.

4.3) THE DEMAND FOR THE PORT’S SERVICES

When countries with large raw material resources do not possess a comparative advantage in processing, then the expansion and improvement of infrastructure for bulk export may be the best way to increase revenue. There is no likelihood, at least in the short term for Guyana to reduce the volume of its bauxite exports by refining into aluminum locally. If this were to be done then the demand for the port’s services with respect to this cargo would evaporate. It takes some 5.4 tonnes of bauxite to produce 1 tonne of aluminum. During the period 1974 to 1984 the world seaborne trade in bauxite remained constant even though the demand for aluminum increased. This was as a result of the fact that some bauxite producing nations

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* Ibid.

result of the fact that some bauxite producing nations began refining bauxite locally. This was initiated by the high cost of electricity for aluminum smelting after the 1973 oil crisis

It must be appreciated that forecasting the demand for port services is a task with great uncertainty attached. A confident assessment would require accurate and reliable information on the overall size and growth of the world economy and production levels according to estimates. Economists are unable to predict the former accurately and the latter is dependent on a number of variables.

According to the American National Research Council:

Decisions with regard to developing additional port capacity, must be made with the recognition that the fundamental reality is an uncertain future. An uncertain future implies risks:

a) If the decision is to do nothing, trade may be lost;
b) or trade may be sustained with existing port capacity
but at a higher cost;
c) if additional port capacity is created, the additional trade or traffic may fail to develop;
d) or the additional capacity may be insufficient;
e) changes in technology may supersede improvements, and make them obsolete.

All of Guyana’s major exports to its traditional and potential markets would in the foreseeable future be shipped through the nation’s ports. The country does not possess the resources nor infrastructure to ship through neighboring countries. Bauxite was transshipped through

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Chaguramas, Trinidad. However, this was discontinued in 1988 due to the excessive transportation costs. The use of ports in bordering countries is also unfeasible or unsuitable for this trade for differing reasons.

First, the ports in Suriname have similar draft restrictions as those experienced in Guyana due to the depths in the ships channel. The maximum depths in the main channel here is 4 metres AD. Then there would have to be the development of other cross border transport links which at present do not exist. Further the ports in this country are plagued by similar problems as those in Guyana. Therefore, they do not have the capacity to accommodate this additional trade.

Secondly, Venezuelan ports are further away from the bauxite mining and production centers in Guyana. These ports have well developed port infrastructure to handle this cargo but this would also entail the construction of substantial surface transport links.

Finally, the other possibility of shipping through Brazilian ports is uneconomical and unfeasible. The use of these would mean moving the cargo further away from the traditional markets. The distance overland is much longer than for Suriname and Venezuela. As a matter of fact the Brazilians are looking forward to the development of Port Georgetown so that the trade of its north eastern State of Roraima can be facilitated through it.

When countries are heavily involved in bulk exports and the demand is steady then the development of dedicated facilities and ships can be justified due to the likelihood of optimum utilisation. Therefore, since the development of Guyana’s bauxite industry is consistent
with this then the need to develop the port for this trade is justifiable.

4.4) TRENDS IN DRY BULK CARRIER SIZES
Bauxite is one of the five commodities traded at sea that are considered to be major bulk cargoes. The others are iron ore, coal, grain and phosphate. The average size of vessels engaged in this trade has been increasing steadily over the years. Panamax size vessels dominate the trade and have significantly increased market share in recent years.¹⁰

The future characteristics of the length, breadth and draft of a ship will have implications for the facilities of a port in terms of channel development and maintenance, berth provision, loading equipment and the services. Hence, a knowledge of future trends in ship sizes is critical to a port development plan, in particular the design of physical infrastructure. The limiting characteristics of a sample of modern dry bulk carriers is in table 4.3.

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Table 4.3 Sample of dry bulk carriers in the bauxite trade

<table>
<thead>
<tr>
<th>Size</th>
<th>Length (M)</th>
<th>Beam (M)</th>
<th>Draft (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25,853</td>
<td>150.0</td>
<td>24.6</td>
<td>9.8</td>
</tr>
<tr>
<td>26,925</td>
<td>160.0</td>
<td>25.5</td>
<td>11.0</td>
</tr>
<tr>
<td>29,791</td>
<td>176.0</td>
<td>25.5</td>
<td>11.0</td>
</tr>
<tr>
<td>37,188</td>
<td>178.0</td>
<td>26.4</td>
<td>9.0</td>
</tr>
<tr>
<td>39,188</td>
<td>176.0</td>
<td>26.0</td>
<td>11.4</td>
</tr>
<tr>
<td>41,139</td>
<td>184.5</td>
<td>30.5</td>
<td>11.0</td>
</tr>
<tr>
<td>47,503</td>
<td>200.0</td>
<td>32.2</td>
<td>11.0</td>
</tr>
<tr>
<td>50,482</td>
<td>184.0</td>
<td>32.2</td>
<td>12.4</td>
</tr>
<tr>
<td>68,278</td>
<td>214.0</td>
<td>32.2</td>
<td>13.6</td>
</tr>
<tr>
<td>85,414</td>
<td>243.8</td>
<td>32.2</td>
<td>14.8</td>
</tr>
<tr>
<td>123,180</td>
<td>247.0</td>
<td>40.6</td>
<td>17.1</td>
</tr>
</tbody>
</table>


The worldwide development in the size of ships has an influence on the characteristics of ships visiting a port. Guyana’s bauxite export constitutes only a very small proportion of the global trade, therefore it is not a trend setting factor in the shipping market. The transport of Guyana’s bauxite is therefore influenced by shipping trends outside its control.

The development of the dry bulk fleet is influenced by changing conditions in the steel industry, energy sector, grain and other commodity markets. During the period 1970 to 1991 there was a tremendous growth in the dry bulk sub-sector of the world’s bulk fleet. It grew from 1,964 vessels with tonnage capacity of 55.1 million dwt in 1970, then reached a peak in terms of number of vessels in 1985 with 4,968 ships but with total tonnage capacity of 197.5 million dwt. However, in terms of total tonnage capacity, 1991 produced the largest increase with 4,836 ships but with 214.3 million dwt. Table 4.4 shows the total number and total tonnage of ships falling under the

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various sizes and categories as at July, 1991. This clearly indicate that vessels of between 25,000 and 40,000 dwt are dominating the market.

<table>
<thead>
<tr>
<th>Size in '000 dwt.</th>
<th>No. of Ships</th>
<th>'000 dwt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 - 18</td>
<td>494</td>
<td>7,220</td>
</tr>
<tr>
<td>18 - 25</td>
<td>790</td>
<td>17,056</td>
</tr>
<tr>
<td>25 - 40</td>
<td>1837</td>
<td>58,048</td>
</tr>
<tr>
<td>40 - 50</td>
<td>507</td>
<td>22,011</td>
</tr>
<tr>
<td>50 - 60</td>
<td>191</td>
<td>10,350</td>
</tr>
<tr>
<td>60 - 80</td>
<td>613</td>
<td>40,972</td>
</tr>
<tr>
<td>80 - 100</td>
<td>38</td>
<td>3,281</td>
</tr>
<tr>
<td>100 - 250</td>
<td>356</td>
<td>52,589</td>
</tr>
<tr>
<td>250 - 400</td>
<td>10</td>
<td>2,769</td>
</tr>
</tbody>
</table>


Table 4.5 chronicles the development of the dry bulk fleet. After a peak of 4,856 ships in 1985, the numbers began to decline, but inversely to the ship sizes, which increased. This is further evidenced by the fact that after a high of 1,603 ships in 1980 of ships between 10,000 and 25,000 dwt, this number declined to 1,284 in 1991. During this period, however, ships within the 25,000 - 50,000 dwt sizes increased sharply\[12\].

\[12\] Ibid.
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td>1964</td>
<td>2992</td>
<td>4020</td>
<td>4856</td>
<td>4656</td>
<td>4651</td>
<td>4730</td>
<td>4817</td>
</tr>
<tr>
<td>10 - 25</td>
<td>1125</td>
<td>1357</td>
<td>1603</td>
<td>1580</td>
<td>1328</td>
<td>1314</td>
<td>1302</td>
<td>1302</td>
</tr>
<tr>
<td>25 - 50</td>
<td>633</td>
<td>1182</td>
<td>1724</td>
<td>2237</td>
<td>2276</td>
<td>2264</td>
<td>2301</td>
<td>2326</td>
</tr>
<tr>
<td>50 - 100</td>
<td>200</td>
<td>369</td>
<td>555</td>
<td>798</td>
<td>761</td>
<td>773</td>
<td>807</td>
<td>835</td>
</tr>
<tr>
<td>100 - 200</td>
<td>6</td>
<td>84</td>
<td>137</td>
<td>229</td>
<td>272</td>
<td>275</td>
<td>289</td>
<td>318</td>
</tr>
<tr>
<td>200+</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>12</td>
<td>19</td>
<td>25</td>
<td>31</td>
<td>36</td>
</tr>
</tbody>
</table>

Source: Fearnley's, op. cit p. 5.

The existing fleet of dry bulk carriers at July, 1991\(^{13}\) shows that the average age is 12.04 years. However, those of the 10 - 25,000 dwt sizes are above this average at 13.9 years, while those of 25 - 50,000 dwt are below the average at 11.6 years. Older vessels have a higher operating and maintenance cost vis a vis newer ones. This would of necessity result in higher freight rates for the use of the former. If the local bauxite industry continues to rely on these and pay the high freight rates, then the final cost per ton of cargo to the customer will be higher than those of its competitors.

The number of new dry bulk carriers on order indicates that only fourteen of the smaller 10,000 - 25,000 dwt sizes are ordered as against thirty eight of those between 25,000 - 50,000 dwt sizes\(^{14}\). All these point towards a future trend of larger bulk carriers.

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\(^{14}\) Ibid.
4.5) THE SIZE OF SHIPS NEEDED FOR THE BAUXITE TRADE

Considering the trends and developments in the dry bulk carrier market it is apparent that the smaller size 10,000 -25,000 dwt vessels are being increasingly replaced by the handymax, Panamax and Capesize vessels. Most of Guyana’s bauxite is, however, still being traded in this size that is increasingly being replaced by the larger ones. Even these vessels cannot always leave at their loaded draft, this limits their cargo carrying capacity. Additional draft is achieved by piloting the vessels in the channels at slower speeds, by taking fully laden vessels in or out at high water and allowing minimum keel clearance. Nevertheless, the additional draft that is achieved this way is limited.

In order for this cargo to be competitive on the world market it would have to be transported in a more cost effective way. This can be achieved by using larger ships. The primary factor influencing the movement towards larger ships is that they offer lower transportation costs. In the absence of adequate port capacity, large ships must enter and leave port partly loaded or the industry must continue trading with smaller ships. In either case the cost will be higher. To enable the larger ships to maximise their loads the channel and harbour area must be developed.

The plan to improve the ability of the port to accommodate larger bulk carriers is not for the largest of these vessels that are available even though they would mean a lower cost per ton of cargo shipped. The physical characteristics of the port does not make this possible. In fact it is generally considered that to optimising of shipping is based on the use of Panamax size vessels and above. The optimal size for this port favors those between 25,000 - 50,000 dwt capacity. Ideally, the latter size is
preferable to take advantage of economies of scale, but the port development plan envisaged cannot be accommodative of this. At present the port accommodates vessels of 37,000 dwt capacity having a length of 185 metres, 29.5 metres beam and 10 metres draft.

After an analysis of the existing and future dry bulk fleet that are potentially able to use the port, an optimum size of 40,000 dwt was derived. The physical dimensions are length 190 metres, beam 30.0 metres and draft 11.5 metres. This model is therefore used as the optimum size vessel that the port is aiming to accommodate for the export of bauxite by developing its infrastructure. The so called design vessel is in Diagram 4.1.


The ports which import bauxite from Guyana all have the facilities to receive 40,000 dwt bulk carriers, also those of competing exporters. Table 4.6 shows ship size limitations of ports which receive bauxite from Guyana and other connected with the trade.
Table 4.6: Major bauxite trading ports

<table>
<thead>
<tr>
<th>PORT</th>
<th>LOA (m)</th>
<th>DRAFT (m)</th>
<th>BEAM (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burnside, U.S.A.</td>
<td>305</td>
<td>12.19</td>
<td>41</td>
</tr>
<tr>
<td>St. Croix, U.S Virgin Is.</td>
<td>274</td>
<td>13</td>
<td>-</td>
</tr>
<tr>
<td>Matanzas, Venezuela</td>
<td>225</td>
<td>12.5</td>
<td>-</td>
</tr>
<tr>
<td>Rotterdam, N.W.Europe</td>
<td>-</td>
<td>22</td>
<td>-</td>
</tr>
<tr>
<td>Savannah, Georgia, U.S.A.</td>
<td>183</td>
<td>12.2</td>
<td>-</td>
</tr>
<tr>
<td>St. Lawrence, Canada</td>
<td>-</td>
<td>11</td>
<td>-</td>
</tr>
<tr>
<td>Nagoya, Japan</td>
<td>-</td>
<td>12</td>
<td>-</td>
</tr>
<tr>
<td>Busan, South Korea</td>
<td>330</td>
<td>12.5</td>
<td>-</td>
</tr>
<tr>
<td>Port Esquivel, Jamaica</td>
<td>192</td>
<td>11</td>
<td>-</td>
</tr>
<tr>
<td>Moengo, Suriname</td>
<td>160</td>
<td>6.8</td>
<td>-</td>
</tr>
<tr>
<td>Paramar, Suriname</td>
<td>213</td>
<td>6.8</td>
<td>-</td>
</tr>
<tr>
<td>Conarkey, Guinea</td>
<td>200</td>
<td>10.05</td>
<td>-</td>
</tr>
<tr>
<td>Bridgetown, Barbados</td>
<td>244</td>
<td>9.6</td>
<td>-</td>
</tr>
<tr>
<td>Manaus, Brazil</td>
<td>210</td>
<td>8.8</td>
<td>-</td>
</tr>
<tr>
<td>Gove, Australia</td>
<td>-</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Gladstone, Australia</td>
<td>270</td>
<td>12.5</td>
<td></td>
</tr>
<tr>
<td>Kamsar, Guinea</td>
<td>229</td>
<td>13.0</td>
<td></td>
</tr>
<tr>
<td>Chaguaramas, Trinidad</td>
<td>292</td>
<td>10.05</td>
<td>-</td>
</tr>
</tbody>
</table>

Chapter 5

Improving The Port's Marine Infrastructure

For the port to accommodate the vessel expected to be engaged in the bauxite trade the infrastructure must be improved considerably. The present facilities are only marginal and are incapable of handling any such increases. This chapter will examine the areas where such infrastructure development is necessary for this specific port development project.

There are several options for the accommodation of large vessels in the port. They include:

1) Construction dredging, that is the underwater excavation of materials to create a wider deeper channel for larger vessels;
2) Offshore terminals designed to accommodate deep draft vessels;
3) The design and construction of new deep-water ports, or offshore industrial islands;
4) The use of wide-beam ships, with substantial cargo carrying capacity and drafts compatible with the limitations of the port;
5) The lightering of incremental cargo to lighten incoming ships to drafts compatible with channel depths and to top off out bound ships.

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With this specific project, when considering factors such as economic, navigational safety, environmental consequences and the project’s contribution to the future port master plan, then most of the options can be eliminated. Some of them, however, were addressed by the local bauxite company; BIDCO before deciding upon the establishment of the Demerara Transshipment Station in Georgetown. After studies were conducted by Delft University, Netherlands, and the dredging contractor the decision was made to reject the others in favor of the DTS. This was found to be the most feasible and beneficial option because of its relatively low cost and its potential benefits to other sectors of the economy.

The establishment of the DTS can be described as the beginning of a port improvement initiative, even though it was undertaken by the bauxite company. The port development project being considered in this study is a consolidation and enhancement of this original plan now being executed by the port administration for the benefit of the bauxite industry and the national economy as a whole.

5.1) CHANNEL AND HARBOUR AREA

The present characteristics of the channel and harbour area are:
- Depth in channel 6.9 metres.
- Depth in harbour area 4 - 7 metres.
- Length of channel 12 nautical miles.
- Width of channel 70 metres.

The characteristics of the design vessel are:
- Length Overall 190 metres
- Beam 30 metres
- Draft 11.5 metres
5.1.1) CHANNEL DEPTH REQUIREMENTS

The channel is for one way traffic but it still falls short of the recommended minimum as suggested by the Permanent International Association of Navigation Congress (PIANC), the International Association of Ports and Harbours and various maritime administrations. These organisations have set design standards for channels, which are based upon the overall manoeuvreing requirements of a vessel. The parameters they publish are based on the selection of a design vessel and calculating the needed widths and depths of the channel after making allowance for sinkage, passing in one way channels, wind and current effects and other predictable local effects.

A one way channel is usually developed when there are grave financial constraints imposed upon the authorities and the volume of traffic is limited. Since the improvement of the channel is mainly for the export of bauxite, then it is only outbound vessels that would have the deep drafts. Thus the further development of a one way channel is pursued.

The depth in the channel would have to be increased from its present level of 6.9 metres AD. According to PIANC the design depth in this instant should have a minimum of 15 percent of the design draft as clearance between the ship’s bottom and the sea bed\(^2\). The minimum required depths of the channel based upon the design vessel is determined below:

\(^2\) Permanent International Association of Navigational Congress
<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design draft</td>
<td>12.00 m</td>
</tr>
<tr>
<td>15 percent clearance +</td>
<td>1.80 m</td>
</tr>
<tr>
<td>Required depth</td>
<td>13.80 m</td>
</tr>
<tr>
<td>Present depth at MHW -</td>
<td>9.34 m</td>
</tr>
<tr>
<td>Required deepening</td>
<td>4.46 m</td>
</tr>
</tbody>
</table>

These design standards are not followed by many port administrations. In the United States, for instance, a Federal Commission found that the dimensions of many American ports are at or below the minimum recommended geometrical limits for the average size vessels using the channels\(^3\). Other port organisations define sufficient water depth differently. At the German Port of Bremen it is defined as 1 foot (0.33 m) keel clearance for vessels in excess of Panamax sizes\(^4\).

In the Port of Georgetown loaded vessels leave with one foot (0.33 m) keel clearance, similar to that practiced at Bremen. This has proved adequate even though no scientific techniques were applied in the derivation of this factor, rather the decision was based upon the intuition and experience of the Harbour Master and Pilots. Using this allowance for determining the depth of the channel then the amount of dredging required is calculated as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design draft</td>
<td>12.00 m</td>
</tr>
<tr>
<td>Keel clearance +</td>
<td>0.33 m</td>
</tr>
<tr>
<td>Required depth</td>
<td>12.33 m</td>
</tr>
<tr>
<td>Present depth at MHW -</td>
<td>9.34 m</td>
</tr>
<tr>
<td>Required deepening</td>
<td>2.99 m</td>
</tr>
</tbody>
</table>

\(^3\) Marine Board (1986), op cit. p 99.

5.1.2) CHANNEL WIDTH REQUIREMENTS
PIANC recommends that for one way traffic, the width of the channel to be 5 times the beam of the design vessel. According to this criterion, the minimum required width is:

\[30 \times 5 = 150 \text{ m}\]

The pilots in Georgetown are accustomed to piloting vessels in the channel with a width of less than that specified above. For instance, they pilot vessels of 29.5 metres beam in the present channel of 70 metres width. This gives a ratio of 2.4 times the ships beam.

The length of the channel would have to be extended further seaward. At present it is 10 miles from the entrance of the port but the desired depth necessitates an extension of an additional 3 nautical miles, where the depths at the fairway buoy will be sufficient.

5.1.3) HARBOUR AREA REQUIREMENTS
The inner channel ends in the harbour area where vessels manoeuvre and turn to approach their respective berths. According to UNCTAD\(^\text{b}\) the diameter of the turning basin should be 4 times the length of the design vessel if no tugs are available. If tugs are available, then this diameter can be reduced to 2 ship lengths, that is for the design vessel 380 metres. These are only averages but when local conditions such as wind and currents are considered then the dimensions would have to be adjusted accordingly.

In the harbour the current attains a rate of 4 knots on the ebb and a rate of 2.5 on the flood, at spring tides. But even under these conditions the local pilots manage

\(^b\) UNCTAD,(1985), Port Development: A handbook for planners in developing countries, p. 97.
quite comfortably to turn and manoeuvre vessels in the harbour. The turning area here varies between 3.5 and 5 cables, that is, between 3 and five times the design vessel's length. Even vessels of greater length have been safely manoeuvred in this area.

The depth in the manoeuvring area varies from 4 to 7 metres. This is adequate for the design vessel in the ballasted condition close to the time of high water. The vessels are expected to arrive in such condition since they are for the export of bauxite.

5.1.4) OPTIMAL CHANNEL DESIGN
After an assessment was made of the cost of dredging, the safety of navigation, the capabilities of the pilots and the current and potential problems of shiphandling, it is suggested that "the dimensions of the channel can be for all practical purposes be as follows:

Depth 12.50 metres (12.0 + 0.50)
Width 90.00 metres (30 * 3)

This is not the technically optimal design. But this decision is consistent with the harsh realities of the local economic situation. Under such circumstances, the fiscal and economic considerations, rather than by what is technically desirable prevails. However, it does not compromise the safety of ships.

Even though the dimensions are below those recommended by the various organisations, piloting vessels through the channel would be safer than hitherto. This has to be viewed from the perspective of the total development

* The author has several years experience as a first class pilot in the ports of Guyana.
project, that goes along with increasing the dimensions of the channel. First, the dimensions vis-à-vis the ship size is no less proportionally than it is at present. Therefore, when considered together with improved aids to navigation, improved communications and other services, the safety of ships is enhanced as a result of the project.

A diagrammatic representation of the channel is given below in diagram 5.1. The inner configuration represents the present channel dimensions while the outer configuration represents the proposed channel design.

Diagram 5.1. Channel design (Not drawn to scale).

5.1.5) DREDGING
To develop the channel to the requirements necessary to accommodate the designed vessel it would have to be dredged. This is the process in which materials from below the water surface are excavated and transported to a designated site for placement. The navigational channels, manoeuvring areas in ports and alongside berths in the major ports of the world have been developed and maintained by dredging. They include the super-ports such as Rotterdam, Hamburg, Le Havre, Yokahoma and others such as the Forth Ports in Scotland and most of those in America.
A thorough investigation of tidal hydraulics and circulation is a pre-requisite to dredging in order for the engineers to determine the optimum design of a dredged navigational channel. Site specific hydrographic surveys, measurement of currents, and an understanding of existing patterns of sedimentation, in addition, physical models are helpful tools in assessing the relationship of these variables.

Approximate preliminary estimates of the quantity of material to be removed in the initial capital dredging puts it at about 14,000,000 cubic metres. The derivation of this is given in appendix 5.

5.1.5.1) THE DREDGING PROCESS
The dredging of sedimentary deposits in a port or waterway is accomplished by either hydraulic or mechanical dredging. The selection of the correct equipment is vital in achieving economies of scale in the operations. But such is dependent upon the sediment type, water depth and prevailing sea conditions. According to the US Marine Board7 hydraulic dredging techniques are well suited for use in areas characterised by a high degree of sedimentation. Mechanical dredging on the other hand is frequently employed in areas of slower sedimentation.

Economies and efficiency in dredging can further be achieved by the use of modern dredges, application of modern technology and the integration of project planning.

The greatest benefits of dredging can be realised through the use of modern dredges. Available technology in this respect increases productivity at reduced operating costs, and design features can be incorporated that extend

capabilities and enhance safety. An illustration of this is in Rotterdam's Euro-port where dredging operations were significantly improved by the introduction of modern, partly automated dredges with high technology instrumentation. At the same time annual maintenance dredging costs were reduced by 40 percent.

Integration of project planning reduces mobilisation costs; that is transporting people, equipment and materials. It also includes the cost of setting up or outfitting the dredges for operation, establishing supply lines and completing the lengthy administrative procedures associated with each contract. This means that when a dredging company is contracted to undertake a project then it should not be on a piecemeal basis with some assurance that the company would be engaged to the extent of the project. It is only through this approach that the benefits in this regard can be appreciated. It has been found that with most dredging projects the productivity in the first half is only forty percent vis a vis the second.

5.2) MOORING FACILITIES
The mooring facilities in the port for the export of bauxite comprise are two transshipment stations. These have already been described in chapter 3.10. The sizes of the basins in which they are located are adequate to accommodate the design vessel.

The first facility operated by BIDCO is dredged to 11.4 metres and has a length of 280 metres and a width of 180 metres. The transshipment operation is performed by shuttle vessels bringing the bauxite from Everton in the

* Ibid.
† Ibid.
Berbice river and from Linden up the Demerara river. The export vessel should have an overall length of 183 metres and 29 metres beam. The design vessel exceeds these dimensions by 7 metres in length and 1 metre in beam.

When the terms for the establishment of the D.T.S were negotiated a certain degree of flexibility was incorporated in it. The owners of the silo vessel undertook to make available another vessel of greater dimensions and capacity if the situation warrants.

The depth in this basin is in excess of 11 metres A.D. and is capable of accommodating the design vessel in its loaded condition. Even though the export vessel would not be experiencing the dynamic motions of a vessel underway, it must always remain afloat while loading.

The other facility operated by Aroima Bauxite Company in its present condition is also capable of accommodating the design vessel. The dimensions of this basin are 290 metres length, 180 metres width and the depth is 13.5 metres. The mooring buoys to which the vessel must be made fast are capable of withstanding forces in excess of those created by 45,000 dwt vessels. However, the ultimate objective of this project is to integrate these two operations into one where greater utilisation of resources would be achieved.

5.3) AIDS TO NAVIGATION

Regulation 14 of the Safety of Navigation Section of the International Convention for the Safety of Life at Sea (SOLAS) mandates governments to establish and maintain aids to navigation\(^\text{10}\). Some governments then further mandate the port authority under whose jurisdiction the

particular area falls to provide such aids. Others provide and maintain them directly but in any event they do so with the co-operation of the port authority.

The deepening and widening of the channel is meaningless if it is not properly marked to guide mariners safely. As intimated earlier most of the problems experienced by the pilots in conducting vessels through the channel can be traced to the lack of, or unreliability of the aids to navigation. The Pilots in the United States argue that improved aids to navigation cannot substitute for channel improvements\textsuperscript{11}. Those in Guyana, while not totally un-supportive of this argument, however, would be prepared to piloting vessels with improved aids as a limited compensation for a reduction in the channel design parameters, but not below those suggested earlier. Further, this latter criteria is taken into consideration in the design parameters suggested in the previous section.

It is in the interest of safety that the channel be as wide as possible. At the same time it is of economic importance that a dredged channel be as narrow as possible in order to reduce both capital and maintenance dredging costs. Without proper and reliable aids the channel will have to be wider than otherwise necessary. With proper aids on the other hand, the latter can be considered. The aids to navigation employed is therefore, a major factor, influencing the design of a narrow channel.

The traffic density, variety and types of ships using the channel also influence the aids to navigation which are needed. In a single lane channel as presented in this study, the loaded vessel can keep to the centerline, but

\textsuperscript{11} Marine Board (1986), op cit. p 101.
guidance is needed for smaller vessels which might be in the channel at the same time. Consequently, the navigator should know how much room is available for manoeuvring in the channel. Considerations such as this, along with the prevailing state of visibility and climatological conditions determine the extent of the aids to navigation required.

There is no shortage of aids to navigation in Georgetown. However, their operational efficiency is unreliable as highlighted in Chapter 3. The buoys used in this port are similar to those used by the Forth Ports PLC. in Scotland, United Kingdom. Here the marine environment is very hostile, a situation which is not dissimilar to the conditions experienced off the coast of Guyana. The reliability of the aids here are excellent. The reason being that they have a deliberate policy with regard to the acquisition, placement and servicing of these aids, which must be carefully studied before the decision on acquisition is made.

The World Bank suggested that the absence of a buoy tender is responsible for the problems of the aids to navigation in Georgetown\footnote{World Bank (1991), Study into the problems of Port Georgetown, Guyana: Unpublished.}. It can be argued that this is not necessarily the case. For instance at the Forth Ports the buoy tender is the said vessel engaged in hydrographic surveying activities. Therefore, to have an efficient buoyage system a policy in this respect would have to be formulated and pursued by the port authority. This should be preceded by a comprehensive study of the requirements with their suitability to local conditions being a prime consideration.
The most important aids to navigation needed for the channel are the leading marks or leading lights by night. These can be placed either ashore or in the water. For the improvement of these a careful study is also needed to determine the best location and height of the light and structure. Such study will have to take into consideration the state of visibility, local weather conditions and the configuration of the coastline.

5.4) REMOVAL OF WRECKS
In the port of Georgetown several wrecks; some visible while others are submerged punctuate the borders of the channel and harbour area. They all do not directly or seemingly endanger the safety of navigation, but nevertheless they are unsightly and the potential risk is always present. This sends a negative signal to shipowners, mariners and other port users in general.

The responsibility for the removal of wrecks lies with the Maritime Safety Administration\(^{13}\). But in Guyana there is no such organisation, therefore, the Central Government must assume responsibility for their removal. Further, it is important that a maritime safety administration be created in tandem with the Port Authority. Joseph argued that such an agency is necessary to cope with the many international and local regulations concerning maritime safety and protection of the environment\(^{14}\). This port development project will generate a greater volume of traffic than hitherto existed, thus this reinforces Joseph's argument.


5.5) ENVIRONMENTAL IMPACT ANALYSIS

In addition to the economic, financial and technical considerations for the development of a port, the impact the developmental activities create upon the environment must also be considered. Consideration of the environmental impact assessment has to be part of the decision making process of a port development project, before the formulation of the plan is finalised. Formerly, this was considered as just another subsequent procedure of no real consequence, after the decision to adopt the plan has been taken.

The World Bank argues that\(^{15}\):

- environmental damage can be prevented or greatly reduced at a cost which is financially acceptable to its borrowers;

- environmental protection measures can often be shown to have economic benefits that exceed their economic costs. In other cases qualitative benefits, particularly from the avoidance of irreversible effects, may readily justify the cost of protection. In most cases, preventive measures give more effective protection and at less cost than later remedial measures.

The development of a port, particularly with the dredging proposed in this study would disrupt the chemical and biological characteristics of the marine environment. In addition to this the operational activities may also generate environmental consequences such as dust and noise pollution.

The effects of port development activities are felt greatest by the ecology of the environment. An environmental impact assessment made in the initial stages of the developmental plan can analyse these influences and the extent of their effect. Ecological considerations in port design and operation include:

1) Disturbance in water motion (surface and subsurface) and resultant effects on sediment flow, siltation underwater and shore erosion.
2) Changes in submarine bottom structure and effects of structural invasion, permanent or temporary.
3) Resulting ecological changes and disturbances of fish, shellfish, and other marine life.
4) Oil spills through surface floating, flexible riser, mechanically supported, or submarine pipelines.
5) Vessel collision, grounding, leakage or waste disposal spills.
6) Tank vessel leakage, rupture overflow or similar spills.
7) Air pollution caused by effluent such as combustion, venting cargo spaces and bulk loading operations.
8) Interference with recreational, fishing, and other industrial use of the sea as well as nearby shore.
9) Aesthetic interference.
10) Regularly occurring operational spills during disconnect operations.
11) Above subsurface noise and vibrations during construction and operation of facility.
12) Effects on land use of terminal interface, particularly the pipe, conveyor, or hose and/or shore connection.

* * *

* * Taken partly from Bruun, P. (1989), Port Engineering, Volume 1, Harbour Planning, Breakwaters and Marine Terminals, Gulf Publishers, p. 325.
13) Effects of vessel movements, manoeuvring and anchoring pattern on marine biology; conflicting use of sea and coastal zone.
14) Effects of filling operations on benthic organisms that are located at the site
15) Disruptive effects at source location of foundation and ditch excavations as well as bottom sand and gravel removal.
16) Environmental disturbances caused by construction or separate port facilities and structures.
17) Relocation of fish and other marine life distribution causing undue concentrations often near the structure while depleting marine life in nearby locations.

The availability of precision navigation and high resolution acoustic profiling systems permit the management of ocean disposal sites to a very high degree of accuracy. These systems allow the placement of dredged materials at designated dumping sites which are mandated by the London Dumping Convention\textsuperscript{17} where their negative impacts can be minimised.

In the United States Of America investigations undertaken into the environmental effects of dredging noted that it is possible, using the above equipment to design and carry out a dredging project in which the short term effects are both minimal and acceptable\textsuperscript{18}. The long term considerations are more difficult to ascertain and quantify.

\textsuperscript{17} International Convention on the Disposal of Dredged Materials at Sea.

\textsuperscript{18} Marine Board (1986), op. cit. p. 124.
A port should strive to achieve a balance of environmental costs and economic benefits. The level of the negative changes must, however, not be such as to destroy the natural ecological balance locally, regionally or globally but at the same time achieve the requirements for successful port operations. International financial institutions such as the World Bank would not finance such projects if the negative consequences are excessive or irreversible. Further, many governments would not permit such projects for similar reasons.
CHAPTER 6

IMPROVING THE PORT SERVICES

The success of a port development project is not only dependent on the completion of the initial engineering and technical works. Instead, it is the ongoing maintenance and optimum utilisation of the facility that ensures its success. In order for the project to be effective, the services the port offers to ships must be improved simultaneously. In some cases the level of service required goes beyond improving the existing ones. Such cases require the introduction of new concepts in the provision of port services.

The model of port administration suggested for Georgetown is that of the landlord port concept; however, it must be specifically tailored to suit local conditions and peculiarities. Under such a system, the administration will be directly responsible for infrastructural development and the provision of statutory services. However, this does not exonerate it from ensuring that the terminal operators and others so contracted do not provide adequate services as mandated by the port’s statutes.

In this study those services that the port administration are directly responsible for would be examined; as well as those that are required for the facilitation of the project’s specific vessel into the port, its stay in the port and its departure from the port.
6.1) VESSEL TRAFFIC MANAGEMENT.

Vessel traffic service (VTS) is the systematic set of activities involving the monitoring, informing and advising of ships in a particular area. The information varies from statutory notifications to navigational requirements and includes berthing orders, planned passages, navigational warnings and progress reporting. Generally speaking it may include any service to vessel traffic designed to improve safety and efficiency of traffic and the protection of the marine environment\(^1\).

The International Maritime Organisation (IMO) has adopted a recommendation on VTS in 1985 which aims to harmonise the services of VTS worldwide\(^2\).

The services provided a VTS range from the provision of a simple information system to a sophisticated one which manages the traffic in the port. It involves the establishment of a radar station to monitor vessels in the port and its approaches. The level of sophistication required is dependent upon the volume and density of traffic, prevailing conditions of visibility, local conditions and cost considerations.

6.1.1) PLANNING SHIPS' MOVEMENTS

The planning of ship movement in a port is an essential part of the VTS operations. It is essential that vessels enter the channel in the correct order particularly those restricted to one way traffic. A VTS will be needed more than ever in the Port of Georgetown particularly for this purpose, and in view of the predicted increase in volume

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\(^2\) International Maritime Organisation, Recommendation On The establishment of Vessel Traffic Services.
and size of ships as a result of the development project. It is absolutely essential that in planning vessel movements that a vessel whose draft is restricted by the prevailing tidal limitations is not delayed to the extent of missing the tide. Any such delay would necessitate the vessel waiting for about twelve hours.

6.1.2) MONITORING
A VTS enables the port authorities to monitor the vessel’s traffic. Usually, as evidenced at the Forth Ports in Scotland and at the French Port of Le Havre all vessels are required to follow particular communication procedures and report their positions when approaching the VTS coverage area and their movement when navigating within this area³. In view of how the aids to navigation are damaged in the port; in many instances by vessels colliding with them (as stated in chapter 3), this system has the capability of constantly monitoring their positions simultaneously with that of ships. Should a vessel collide with one of the buoys, it would be possible to ascertain with a reasonable degree of accuracy when such damage occurred and apportion responsibility to the negligent vessel. Further, it can prevent such accidents in the first place, by warning the unsuspecting vessel of the eminence of such occurrence.

6.1.3) EQUIPMENT
In a VTS the most important factor is communication. Towards this end reliable VHF radios and telephones are necessary. Other essential equipment needed for running the system include wind anemometer, tide height recorder, VHF audio tape recorder, direction finding apparatus, radar and radar display video recorder.

³ The operation of these facilities were witnessed by the author while visiting them.
Wind recorders showing both direction and velocity are usually considered a necessity in most ports since wind speed restriction is imposed upon the movement of vessels.

Tide height recorders are common in most ports. They are used for comparing the actual heights as against the predicted one. Hydrographers are most interested in these to update their predictions.

The VHF audio tape recorder is valuable at a VTS. It records conversations between parties communicating, therefore, if an accident or incident occur such recording can be used as evidence.

Direction finders are also useful in a situation where difficulty is experienced in pinpointing the position of a particular vessel which might be needing assistance. Also they can be used similarly for the purpose of locating illegal transmissions.

Generally speaking, the port of Georgetown does not need a sophisticated VTS system at this stage. A simple system capable of facilitating the traffic presently using the port and those expected with the port development project under consideration in this study. Further, the level of sophistication is a function of the volume of traffic and the nature of the cargoes vessel transport through the port. For instance, in European ports which are frequented by vessels with dangerous cargo, a VTS of a certain capability is becoming mandatory.

6.1.4) TRAINING
According to Commander Belle:

VTS operators are the linchpin of any VTS system. They can make a poor system function properly or conversely ruin a good one. They represent the
flexibility of the system. They are the most important component of the system and it is vital to select the right person for the task, which means taking into account the person, the overall system requirements and the operating procedures*.

The above gives an indication of the necessity of acquiring the right person for the task of operator. In Guyana, the introduction of this system is a new innovation. Experience is available in operating the much simple version of port communication but not one of this magnitude. When a decision is made to acquire such a system the location and training of the needed personnel must be undertaken simultaneously.

There are no universal standards for the training of these operators, but generally most ports employ the services of ex-seagoing officers who are familiar with bridge and maritime communications procedures.

When considering the introduction of a VTS, the advice and involvement of personnel from the Maritime Safety Administration, Coast Guard and the use of a Consultant is needed to decide upon the specifications of the system and the level of sophistication aimed at.

6.2) PILOTAGE
Compulsory pilotage is instituted in many ports by governments to ensure the safety of navigation. The pilots are employed for their navigational and ship-handling skills in confined waters and their familiarity with local vessel traffic. Further, they are needed to protect national assets and ensure that a delinquent shipmaster

does not in any way compromise or threaten them through his unfamiliarity with local conditions. According to the Laws of Guyana, pilotage in the Port of Georgetown is compulsory\(^\text{a}\). This service is maintained by the Transport and Harbours Department (T & H.D.), at present with a complement of ten pilots. The problems associated with the operation of the service were highlighted in chapter 3.

With the port development plan, such problems cannot be allowed to continue. The plan is to attract larger ships to the port; consequently, any delay would result in the payment of large sums in demurrage. Such a situation would definitely defeat the intent of the plan and negate the savings the bauxite industry is attempting to make in order to be competitive on the world market.

In order to ensure the optimum utilisation of the port facilities, ports usually seek a commitment from the shippers of their intent to use the port. Further, they should be part of the planning of the port development plan. In return for such commitment they usually seek guarantees, which includes the undertaking by the port authority to provide adequate services for their ships in a timely manner. Accordingly, corrective measures must be instituted to improve the pilot service. The Government of Guyana is already seeking assistance to improve the pilot service. Towards this end the World Bank has suggested that the service be privatised.

In the major ports of the world pilotage is undertaken by a private company or association of the pilots who themselves form a company and make their services available to the port. At the French Port of Le Havre, such an Association exists, and the pilots own and

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\(^{\text{a}}\) Laws Of Guyana, Chapter 49:04.
maintain their equipment such as pilot launches and helicopter.

At the British ports the situation is somewhat different. Formerly, the pilots were employed by the State but in 1980 this was abolished and the responsibility for the provision of pilotage is with the local port authority*. The port authority would decide how it wants the pilotage in the port to be organised. The options most readily practiced are either for the port to directly employ the pilots or to let them form their own independent company. At the Fort Ports for instance, pilotage is performed by the Pilots Association, which is a company formed by the pilots themselves. However, the Port administration provides and maintains the pilots launches.

In the Caribbean the service is operated as an association in some ports while at others the pilots are directly employed by the Port Authority. They are known to provide a high level of service and do not encounter the multiplicity of problems experienced in Guyana.

The main problem with the pilot service is low morale as a result of low wages. This situation is accentuated because the port is being subjected to the same restrictive wages policy as the traditional Public Service. Over the years the revenue generated by this service within the T&H.D is several times in excess of the cost of maintaining the pilot boats and the payment of pilots salaries. These problems can be addressed by initially incorporating the pilot service into the port authority, which being autonomous can dictate its own wages policy. Subsequently, as the port is more properly organised then the pilot service should be privatised only if this serves the best

interest of the port. This will relieve the port authority of the administration of it, but in any event it is responsible to its customers for the provision of this service.

The Pilot’s Association or private company, would have to enter into agreement with the port’s authority to provide adequate service at a reasonable cost. They cannot be allowed to unilaterally increase their fees without the approval of the port administration who would only consider such after consultation with the port users; consistent with the prevailing general economic conditions in the country.

Presently, there are no international standards related to the provision of pilotage. But this may soon change. The shipowners’ insurance organisations (P & I Clubs) for instance, are pressing the International Maritime Organisation (IMO) to set international standards on pilotage. Further, there has been calls and suggestions for the reform of international maritime law, making the pilots’ and Port Authority more liable for the acts of pilots*. Considering these and other aforementioned factors it is imperative that the pilot service in Guyana be transformed.

6.3) TUG SERVICE
When steamships evolved they rarely used tugs to assist them in mooring and un-mooring. As they increased in size, the larger cargo and passenger ships found it helpful to have such assistance*. In Georgetown, tugs are not used

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* Bruun (1989), op. cit. 1139.
at present. Traditionally, the pilots used other techniques to moor and un-moor vessels then proceed in and out of port without such assistance. This technique involves using the current and wind to advantage to achieve similar results. However, manoeuvring vessels this way incurs delays whilst the pilots wait for such conditions.

Because of the expected increase in size of vessels calling at the port, the channel, berths and manoeuvring areas are scaled down relatively than hitherto. The port development project would of necessity result in an increase in non bauxite traffic also. When the above factors are considered, it is apparent that the environment for manoeuvring would not be the same as before the project. This coupled with the fact that the cost of ships time in port would increase, necessitates the use of tug assistance in the manoeuvring of vessels.

Most large ships need tugs for berthing, un-berthing and other tight manoeuvre in a port and even when proceeding along a channel. In the latter instant, tugs assist in preventing vessels from running aground. In the event of grounding, the same tug assistance can be used to re-float the ship. Even without the port development project it can be argued that tugs are needed in the port. For instance, if a vessel is grounded or stranded for some reason or another it has to re-float by manoeuvring under its own power. This can take days, even weeks until the height of the tide is equivalent or higher than when the incident occurred. Had there been a tug to respond promptly in such a situation, then it is likely that the vessel would have been re-floated much earlier.

Due to their fire-fighting capability, tugs are even more valuable to a port. At the French port of Le Havre the tug
crews are trained by the fire brigade in the art of fire-fighting. At the same time the fire service personnel utilise these tugs for fire-fighting exercises carried out as part of the port’s emergency plan. At the same port tankers are required to engage tugs with this capability to escort them into port and remain on stand by when cargo handling operations are in progress. These tugs have the capability to fight fires aboard ships and more-so their powerful pumps are capable of delivering water at great distances to fight fires ashore. In cities where domestic water is scarce this can be a key factor in influencing the decision to acquire tugs.

Tugs can also be utilised in other port related activities such as moving barges and floating equipment, towing ships that may escape from their moorings and engage in salvage operations both within the port and out at sea. Finally, tugs generally assist in ensuring that the port operations are not interrupted.

Most Port Authorities avoid owning the tugs themselves. They are costly in both capital and operating cost and must be managed efficiently and used economically. Private contractors are therefore dominant as it relates to the ownership and use of tugs in this regard.

The relationship between the Port Authority and the tug owner will vary from port to port depending upon the constitution and bye laws which influence the operation of the port. In some ports there is no direct commercial relationship between the two parties. The Port Authority will be mainly interested in the type of tugs, level and cost of service and the maintenance of certain standards such as fire-fighting capability. They cannot increase their charges unilaterally. This is done only after approval from the port authority. They (tug owners) then
would enter into agreement with shipowners or charterers undertaking to provide towage assistance when their vessels call at the port.

In order to ensure that the tugs are utilised and in the interest of port safety, the port authority will set safety and navigational standards for the port and this will specify the use of tugs for certain classes of ships enshrined in the bye laws. This can be done after consultation with the pilots, tug owners and port users.

6.4) HYDROGRAPHIC SURVEYING
Georgetown being a tidal port experiences frequent movement of sediments in the channel and harbour area. The port administration being aware of these conditions needs to have constant information on water depths, tidal regime and the presence of dangers to navigation. These important tasks and others are the function of the hydrographic department.

The information they provide must be accurate and up to date. Inaccurate and outdated hydrographic information is a serious threat to the safety of navigation. Should a vessel be given such information and as a result runs aground, then serious litigation can be pursued against the administration. Therefore, it is important to both the State and the port authority that the channel and harbour are constantly and properly surveyed.

6.4.1) THE IMPORTANCE OF THE HYDROGRAPHIC SURVEY DEPARTMENT
Prior to carrying out a capital or maintenance dredging program surveys are required to ascertain the rate and location of areas subjected to siltation in order to assess the dredging requirements. Once dredging begins,
then surveys will be needed to monitor progress and determine the quantity of material removed.

Hydrographic surveyors are further needed when an accident occurs and a survey is required to determine the possible cause of such. They are involved in assessing the state of the seabed as a result of grounding and searching for a sunken craft or ensuring that the area is clear of debris.

They also conduct navigational surveys to provide information which detects changes in the bathmetry and trends towards siltation and corrosion. For navigational usage, the essential requirement is to identify the shoal areas and to ensure that the significant depths are identified and plotted in their correct positions.

The positions of navigational buoys have to be constantly monitored. This can be done in part by the VTS. But frequent visits by surveyors can be a form of double check on the accuracy of the above using modern high accuracy electronic positioning equipment.

Many harbours may be littered with wrecks or other obstructions. All may not interfere with navigation if their positions and depth over them are accurately known. Here again the services of the hydrographic surveyors are needed for this task.

In Georgetown, the hydrographic surveyors also constantly monitor the height and the frequencies of very high or extraordinary tides. These assist in the future development of the port and update data in this respect and increase the accuracy of tidal prediction such as in the tide tables.
6.4.2) ORGANISATION OF THE HYDROGRAPHIC SURVEYING DEPARTMENT

Large ports which have regular and continuous hydrographic activity have their own independent hydrographic sections. Smaller ones which do not need such continuous and regular surveys contract such services when needed. Georgetown falls in the latter category with respect to size but have the need for constant hydrographic surveying activity as indicated above. The problem with the use of outside contractors is that it limits the port’s ability to respond to an unexpected situation.

The problems alluded to earlier in chapter three inhibit the operation of the hydrographic department and severely hamper their ability to undertake the above functions. The generic reason for the problems here and in other sections of the Harbours Department of the T&H.D can be traced back to the lack of a proper port organisation.

The World Bank has suggested that this section be privatised and be separated from the port administration. This may prove very expensive and unnecessary for the port since there is almost a constant need for this service. With a streamlined port administration and the introduction of modern equipment this section can be made more effective and be organised to carry out its mandate. It need not be a large burgeoning section, for instance at the Forth Ports the hydrographic surveying section which monitors dredging and surveying in the Forth estuary consists of only two

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surveyors along with the crew of the surveying vessel. They also perform buoy servicing duties.

6.5) PORT SECURITY
The port of Georgetown is plagued by security problems as described in chapter 3.5. These are mostly associated with acts against the ships themselves rather than cargo. For the port to reverse this tendency there is first, the need for a port policing and security policy. A constituted port authority would have to make a decision whether to create such a section or to use the national police force. The latter is presently directly responsible for port security but as the records indicate, they have not proved effective in combating robberies aboard ships in the port.

The problems with the national police is the lack of equipment and specialist personnel who are totally committed to the suppression of crimes in the port. Further, they have their other civic responsibilities which do not necessarily have the combating of crime in the port as a priority. Therefore, the port authority should be allowed to establish its own security service, although it is an established fact that the national police is always in overall charge of internal security in any country.

The port police must know the industry, have sufficient legal powers and knowledge to do the job. They should liaise with the national police and the international port police community. They must also be knowledgeable in port operations and procedures and understand the attitude of those who work in the industry11.

Port management has a duty to implement security measures within their areas of jurisdiction. If crime is allowed a free reign in the port it would definitely scare away customers who once gone are difficult to re-attract. Therefore, it is also in the commercial interest of the port to ensure adequate security.

In addition to the above the port through the government has international obligations to provide adequate security in the port. The IMO has issued several recommendations and conventions requiring contracting governments to adopt measures for the suppression of unlawful acts on passengers and crew aboard ships\textsuperscript{12}.

To ensure effective security in the port, Ellen suggests that a chief when appointed is not subjected to the direct orders of the port’s management on police operational matters\textsuperscript{13}. He further suggests that the chief should not be an extension of the port’s line management whose independence should be carefully preserved.

6.6) OTHER SERVICES
There are other services which the port authority would have to develop and improve in order to make a ships stay in port as comfortable as possible. Also, there are statutory requirements in this regard which must be satisfied.

The Authority should not be directly involved in these but allow private contractors to undertake them. However, they must be licensed by the port authority as suggested in chapter 2.4.

\textsuperscript{12} International Convention for the Supression of Unlawful Acts against Passengers and Crew in Port and at Sea.

Guyana is not a Signatory State to the International Convention for the Prevention of Pollution from Ships 1973, as modified by the Protocol of 1978 relating thereto (known as Marpol 73/78). This convention aims at preventing and combating pollution from aboard ships.

Regulation 12 of Annex 1 requires States to provide reception facilities for residues of oil and mixture containing such substances. Regulation 7 of Annex 5 further requires States to provide reception facilities for the collection of garbage. The port can undertake these responsibilities through private contractors who would charge the ships a fee for this service rendered.

Other services which the port would have to provide, through private contractors include fresh water, bunkers, stores and lubricants, repair facilities, mooring boats service, launch service for crew and recreational facilities.

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*International Maritime Organisation (IMO), op. cit.*
CHAPTER 7

ECONOMIC AND FINANCIAL EVALUATION OF THE PROJECT

7.1) COST ESTIMATES
The main cost component of the port development project is the dredging of the channel. This is a capital intensive project, which would require foreign expertise and resources to execute. Since this is the only cost element that is directly and specifically related to the facilitation of larger vessels for the export of bauxite, it is only this element that would be considered here. The improvement of the other facilities and services would be mainly undertaken by private contractors while others will be done by the port authority. Apart from this, the capital cost of dredging is the only significant foreign exchange component of the project. The others are for the provision of spares and equipment for the local dredger which will be carrying out the maintenance dredging of the channel.

The improvement of those facilities and services mentioned earlier that are the responsibility of the port authority are all necessary whether or not this project is implemented. They are the basic necessities that any progressive port should have. In other words the cost of these is not a consequence of the port’s undertaking to develop the channel to accommodate larger ships. They would have to be undertaken regardless of whatever policy is pursued.
It is the preliminary cost estimates that are considered here. A more detailed one is only possible after the engineering and design studies and tests have been carried out. However, the cost estimates should be as accurate as the nature of the project and the state of the art reasonably permits. According to ESCAP\(^1\) it is almost an impossibility to accurately calculate the quantity of material to be dredged and dumped. Another great uncertainty with dredging is to accurately forecast the rate of siltation which is necessary so as to estimate the maintenance dredging cost. Large variations in the siltation rate could destroy the reliability of the cost estimates and subsequently the feasibility studies. In any event it is better to err on the side of the greater estimates. Underestimation can lead to the acceptance of the project that would not otherwise be justified. The financial requirements will be understated, which can lead to a shortage of funds which may impede the project’s completion.

A separate cost estimate has to be prepared for each component of the project. Estimates of recently completed similar projects executed in the country can be the principal guide to costs analyses in this regard. The potential dredging contractor or experienced surveyors should be contracted to prepare these estimates. It was they who conducted such studies for the previous dredging of the channel.

To arrive at the preliminary cost estimate for this project it is necessary for a comparison to be made with the previous one. The cost of the initial capital dredging

project was US$ 8.5 million, with the annual maintenance dredging cost of US$1.7 million. An estimated quantity of about nine million cubic metres of silt was removed in the process. This approximates to two thirds of the quantity to be removed in this instance. Even though the cost of dredging increases with depth, it is reasonable to assume a similar proportionate cost for this project, that is, approximately US$ 1.00 per cubic metre. The question may be asked, why are the costs now similar to those in 1988; when the first project was undertaken?

The reason for the above is that cost saving measures made possible by the advances in dredging technology and hydrographic engineering have reduced the cost of dredging considerably. In some instances it is claimed that the cost of dredging has been reduced by over fifty percent in the last five years. Along with this is the fact that the entire US$ 8.5 million was not for dredging but it also included the cost of providing and placing aids to navigation to delineate the channel. Comparisons of this sort are generally accepted as a reliable method of approximating dredging costs for preliminary estimates in the absence of more reliable methods and physical tests.

Most ports have their own dredge for capital as well as maintenance dredging. Most, however, are used for the latter, while the former is undertaken by private contractors. For the maintenance dredging of the Demerara channel, the dredge already possessed by the harbour authorities is capable of performing this task. It is a modern Hopper suction dredge constructed specifically for dredging and maintaining the channels and waterways of Guyana. In Pakistan after the initial capital dredging was completed by foreign contractors for a dredging project in 1980, the authorities acquired a dredge. It was successfully used for the maintenance dredging program,
effecting savings in foreign currency in excess of US$ 10 million annually².

Under similar conditions as above the port authority’s dredge would be operated with minimal foreign exchange outflow. Besides the foreign exchange savings effected by using the local dredge and personnel for the maintenance dredging, other benefits are derived². These include the following:

1) A continuous dredging operation is guaranteed;
2) Experience in local soil conditions is available;
3) Since the maintenance dredging operation is less complicated than the capital one, local personnel can more easily cope with it;
4) Experience in the art of dredging is acquired; which is of great value on occasions when capital dredging projects are executed.

The only foreign expenditure envisaged is that for the acquisition of additional equipment and the provision of spares. It is also important to mention that the majority of local costs would not be created by this project. Without it they would still be there; such as wages and salaries even though it is now under-employed or non-employed for most of the time. Additional costs created from running it for the project such as for fuel and lubricants have to be considered. Bringing it all together, the total foreign exchange cost for operating the dredge specifically for this project can be estimated at US$ 0.5 million annually while the local component is estimated at 6$ 37.5 million (US$0.3 million) annually.


7.2) FINANCING OF THE PROJECT

The present port administration does not have the capital to finance this project. Its operations are more of a passive nature and the need to commit itself to a project of this nature is not amongst its plans. To undertake this project, the port authority would have to seek assistance for its funding.

There is a difference in perception between governments and organisations as to who should finance the dredging of channels and waterways. In the United States of America, for instance, the dredging of channels and waterways is undertaken by the Army Corp of Engineers. It is a Federal, State and Local Government responsibility to make the channels accessible for the various port authorities, be it public or private. The authorities there argue that it is too important to the national security and economic interest of the country to be entrusted to the port authorities*. Further, they consider dredging as a public service; similar to the provision and maintenance of roads.

Most of the other industrialised countries share the same view as the United States. In France, Germany and the Netherlands; which are noted for super ports such as Le Havre, Bremen and Rotterdam, it is the respective Governments and Local Authorities that fund the dredging of channels and waterways. In the United Kingdom, however, State financing of dredging is considered as a subsidy to the port. Therefore, it is the responsibility of the port to finance its own dredging requirements.

In Guyana, the present economic situation may not permit the government to directly fund the dredging of the channel. But it can seek such assistance on the port’s behalf from other sources such as the World Bank, the Caribbean Development Bank and the Inter-America Development Bank. On the other hand if the port authority’s statute permits, then it can privately raise the capital for the project, from the financial institutions or development contractors as was done with the initial dredging project.

The World Bank is a major financier of port development projects in developing countries. This institution should be viewed carefully as the possible source of financing for this project. Even if it is not, its lending criteria can be used as a the basis for procuring funds from other sources. Further, the requirements of the Bank are considered as the minimum standard for other financing agencies; it is a sort of litmus test as to the project’s justification. With this in mind, the financing requirements of the Bank will be considered here as far as its extent and relevance to this project is concerned.

The World Bank provides loans on soft terms repayable for periods ranging from five to twenty years. They usually finance sixty percent of the project, or for countries with serious foreign exchange difficulties; the foreign exchange component. An interest rate of seven percent (7%) is not unusual for projects of this nature, therefore, it is this amount that would be used as the basis for this project, being repayable in ten years beginning in the first year after the project’s completion. The estimated time of the initial capital project is eight months; similar to the approximate time for the first. The economic and financial appraisals which follow are based upon the Banks criteria.
7.3) ECONOMIC AND FINANCIAL ANALYSIS
The stated objective of this project is to develop and improve the port for the facilitation and reception of the optimum size vessel for the export of bauxite from Guyana. If this objective is fulfilled then bauxite shipped from this country can be more competitive on the world market; the revenue from which should go a long way towards contributing to the economic well-being of the nation as a whole. The investment process and techniques of the appraisal must be reflective of such.

Ports being public agencies cannot be evaluated solely on the basis of the financial criteria which determine profitability. Instead the prime objective should be to effect savings in transport cost thus further ensuring savings in the cost of goods and services to the country. This savings must be greater than the cost of the project.

The national or economic appraisal of a port development plan does not exonerate the port authority from implementing its own private accounting regime to verify the project’s profitability at the micro level. It must still maintain its independent goals, facilities, revenue, financial-management and profitability. With public projects of this nature the private appraisal can be considered secondary to the overall macro-economic objectives. The project evaluation methodology has to involve both the economic analysis for the public dimension and the financial analysis for the private dimension.

The economic and financial evaluation are in principle similar. Both methods are used in project evaluation and both are based on comparing costs with benefits. The difference between them is how they define these costs and benefits.
7.3.1) ECONOMIC ANALYSIS
The port is viewed as a public service in France; as an activity/business with a public responsibility in the United States of America and in Germany it is viewed as a public necessity. In all these cases it has an obligation to provide a continuous and permanent service to the users, and to adopt itself to its clients needs. Here, the emphasis is placed on the service component of the port’s function with financial returns on the port’s specific investment less of a priority. With the model administration suggested for this port the emphasis should be similar to the above as far as the port authority is concerned, with the various port operators undertaking the commercial functions.

7.3.1.1) ECONOMIC COST
The conduct of the economic analysis is very complex. The economic cost of a project is based on the cost to society for committing scarce and competing resources. The economic cost of a resource is the opportunity cost of that resource, that is, the highest valued benefits given by using the resource for its present value rather than another. The calculation of this cost is based on social alternatives and sometimes on the hypothetical use of resources. The market price in societies where such prevails can serve as a basis for the economic cost in calculating the operating cost factors.

In most developing countries the official exchange rate of the currency does not truly reflect its value. It is the

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parallel exchange rates that are more representative of the value of the currency. By using the official rate in such situations for the evaluation of a project would misrepresent the value of resources to the society. When foreign currency is used in a project it is the value of the currency if it were to be freely floated that should be quoted; this is what economist term a form of shadow pricing.

Shadow prices are used in project appraisal to accurately reflect the value of the country’s resources and the true opportunity cost of capital. For example, if Guyana had a two tier exchange system and the potential savings to be realised by this project are in foreign currency, with the rate of return based on the fixed rate, then she may underestimate the benefits that are derived. However, in Guyana, it is only a single tier exchange mechanism that is being used. The currency floats freely on the market, similar to what prevails in the developed market economies. It depends upon supply and demand and fluctuates daily as market forces dictate. This rate is used for all foreign exchange transactions in the country. At present US$ 1.00 = G$ 125.7.

For socio-economic costs it is necessary to consider the impact of the project on its surroundings (whether negative or positive). Accordingly, in evaluating the project’s cost, environmental impacts as well as the cost of auxiliary infrastructure requirements must to be considered.

Much of the cost elements associated with this project are social in character. The establishment of a port authority

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7 This information is public knowledge and is published in the local press. The rate quoted her is at the 30th July, 1992.
to provide the basic services expected of such an organisation readily fits into such a category. The cost of this is difficult to quantify but the alternative is for the status quo; that is, a disorganised port with a negative contribution to the facilitation of the country's trade. The alternative was highlighted in chapter 3; during the investigation into the problems and existing conditions of the port.

7.3.1.2) ECONOMIC BENEFITS
The quantification of project benefits is a two stage process, firstly, determining the various project beneficiaries and then measuring the economic value of such benefits. The beneficiaries are further divided according to their relation to the project, that is direct or indirect. The former includes the direct port users such as terminal operators, local, regional, and foreign shippers, while the latter includes industries and the community as a whole.

The calculation of direct benefits to the port is conducted on a relative basis, that is, comparing direct cost to project users with and without the project. The calculation of indirect benefits; the reduction in cost to the consumer of goods and services created by the project requires a complex set of assumptions and calculations, the data for which is not available for this study.

The benefits to be derived from dredging the channel are:
1) As the port will now be able to accommodate vessels of deeper draft, it will probably also be able to attract more and heavier industries that depend on transport by such vessels;
2) Increased utilisation of ships' capacity. Since the present size vessels being used will now be able to load
to their maximum draft. There will be a reduction in the payment of deadfreight:

3) A reduction in demurrage due to shorter waiting times for vessels entering and leaving port due to the increased tidal window:

4) The principal benefit is the use of larger vessels. This leads to a reduction in the cost of shipping bauxite from Guyana through the benefits which accrue from the economies of scale. The reduction in the cost per ton of cargo shipped is computed below.

Comparison of the cost of shipping bauxite using a 27,000 dwt and 40,000 dwt bulk carriers from Georgetown, Guyana to St. Croix, U.S. Virgin Islands (1994)**. (Costs are in US$).

A) SHIP SIZE AND CARGO VOLUME

1) Amount to be shipped\(^{10}\) 3,900,000 3,900,000
2) Size of ship (dwt) 27,000 40,000
3) Average load of ship 22,000 38,000
4) No. of ship trips required 177 103

B) SHIP COST IN PORT

5) Days in port (at both ends) 4 5
6) Total number of ship days in port 709 513
7) Cost per ship day in port\(^{11}\) 10,369 11,473
8) Total ship cost at port 7,352,564 5,887,461

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* Model taken from UNCTAD, op. cit. p. 65.

** One of the local bauxite companies also uses St Croix as a basis for predicting future shipping requirements. This is an intermediary point between Guyana and its principal market; the USA. They base their future upon a single transshipment facility in Georgetown for all domestic bauxite shipments.

\(^{10}\) Amount as estimated in Chapter 4.

\(^{11}\) Ocean Shipping Consultants (1991), Freight Rates and Shipping Costs to 1996- bulk carrier and tanker profitability analysis, p. 104.
C) SHIP COST AT SEA

9) Avg. sailing time per round trip 5 5
10) Total sailing days 886 513
11) Cost per ship sailing day\(^{12}\) 12,325 14,067
12) Total sailing costs 10,924,432 7,218,592

D) TOTAL SHIP COST

13) Total ship cost 18,276,995 13,106,053
14) Shipping cost per ton 4.69 3.36

E) SAVINGS IN SHIPPING COST FOR YEAR 5,170,943. 80 646,367,880

Savings for the various years until the year 2003 are also similarly calculated and are stated below.

GROSS SAVINGS IN SHIPPING COST (MILLION US$)

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The above model, being based upon the distance between Guyana and St. Croix is a rather conservative estimate of savings. On the longer routes the savings would be greater. In the United States of America, for instance, a study indicated that a reduction in shipping cost of US$ 3.38 per ton would be effected if large bulk carriers are used to ship coal from Hampton Roads, U.S. to Rotterdam\(^{13}\).

The savings in shipping cost pertain to the shipowner. But the bulk shipping market closely resembles a perfect market, where competition dictates charter rates. Most vessels in this market accept freight rates that are just about break even, with marginal profits or operating at a loss. Those with higher rates would not find employment. Therefore, these savings are likely to be passed on to the

\(^{12}\) Ibid

\(^{13}\) Grosdidier de Matons, J.C. op cit. p. 263.
shippers. This being the principal objective of the project.

Other direct benefits to port users are would also be realised. With the port authority co-ordinating activities such as dredging within the port, it is possible for the areas alongside the general cargo and other specialised berths to be dredged in a systematic manner, in the short term. In the long term a greater port development project, should include the construction of new, modern berths to accommodate safely vessels of sizes and drafts similar to those used for shipping bauxite. Similar cost saving benefits would be realised as a result of such initiative.

In general it is readily apparent that all shippers would benefit directly from this project, mainly in the form of reduced shipping costs.

The indirect benefits are more difficult to quantify. The most prominent being the creation of employment opportunities as a consequence of the project. Other benefits can be credited to the project if the savings in freight is reinvested in the industry to increase production capacity and generate more employment. The difference between the production and employment levels with and without the project can be considered as net benefits to the port project.

Once the project has been defined; and the cost elements and potential benefits are identified then its viability needs testing. Tests of economic viability can be conducted on the basis of Internal Rate of Return (IRR), the Net Present Value (NPV) criteria and the Benefit/Cost Ratio; based on a discounted cash flow of costs and benefit to the community as a whole.
ECONOMIC APPRAISAL WITH INCREASING BAUXITE EXPORTS

<table>
<thead>
<tr>
<th>YEAR</th>
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<tr>
<td>COSTS</td>
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<td>7.1</td>
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<td>8.6</td>
<td>8.6</td>
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</tbody>
</table>

NET BENEFITS -15 4.9 5.5 5.7 6.2 6.9 7.7 8.4 8.4 8.4 8.4
PV BENEFITS 19.6
PV COSTS 15.6
NPV 4.0
BENEFIT/COST RATIO 1.3
IRR 38.33
DISCOUNT RATE 30%
YEAR 1 = 1994

In the unlikely event of bauxite exports remaining at their 1991 level, that is, 1,500,000 tonnes, then the economic appraisal will be:

ECONOMIC APPRAISAL WITH EXPORTS AT 1,500,000 TONNES.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>0</th>
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<tbody>
<tr>
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<td>-15</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
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<td>2.1</td>
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<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
</tr>
</tbody>
</table>

| NET BENEFITS| -15| 1.7| 1.9| 1.9| 2.0| 2.2| 2.3| 2.3| 2.3| 2.3| 2.3 |
| PV BENEFITS| 6.7 |
| PV COSTS| 15.6 |
| NPV| -8.9 |
| BENEFIT/COST RATIO| 0.4 |
| IRR| 6.4 |

A positive NPV indicates that the benefits are greater than the cost. A benefit/cost ratio greater than one indicates that the project is viable, and when the IRR is higher than the required rate of return, this is an
indication that the project is economically acceptable. The World Bank views any project with an IRR less than 15 percent with caution.

The value of any analysis relies heavily upon the sensitivity of the variables relative to change. At best, any economic projection, any economic calculation of rates of return of a project is an honest approximation. Traffic projections are likely to change, the discount rate is likely to change, the demand for the cargo fluctuates, and production shortfalls; these would all affect the outcome of the appraisal. Towards this end a sensitivity analysis is conducted to test the project's viability under differing levels of the input and output variables.

### SENSITIVITY ANALYSIS OF ECONOMIC INVESTMENT APPRAISAL

<table>
<thead>
<tr>
<th>Discount Rate</th>
<th>10%</th>
<th>15%</th>
<th>20%</th>
<th>25%</th>
<th>30%</th>
<th>35%</th>
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</thead>
<tbody>
<tr>
<td>NPV</td>
<td>26.2</td>
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<td>11.8</td>
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</tr>
<tr>
<td>B/C Ratio</td>
<td>2.6</td>
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<td>1.7</td>
<td>1.5</td>
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<td>1.1</td>
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</table>

### SENSITIVITY ANALYSIS WITH 30% DISCOUNT RATE

<table>
<thead>
<tr>
<th>Capital Cost (Million US$)</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
<th>18</th>
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</thead>
<tbody>
<tr>
<td>NPV</td>
<td>11</td>
<td>9</td>
<td>7</td>
<td>5</td>
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<td>1</td>
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<tr>
<td>IRR</td>
<td>69%</td>
<td>57%</td>
<td>48%</td>
<td>41%</td>
<td>36%</td>
<td>32%</td>
</tr>
<tr>
<td>B/C Ratio</td>
<td>2.3</td>
<td>1.8</td>
<td>1.6</td>
<td>1.3</td>
<td>1.2</td>
<td>1.1</td>
</tr>
</tbody>
</table>

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15 Ibid.
Based on the economic investment appraisal the project is feasible under certain predicted conditions. These are providing that the cargo volume in 1994 is approximately 3.9 million tonnes; the discount rate is less than 38 percent; and the capital cost is US$ 15 million. The above indicates the extent to which changes in the variables affect the appraisal of the project. However, it can readily be seen that if the cargo volumes increase beyond the predicted quantity, then the project becomes more favorable and vice versa. Also, as the discount rate increases the value of the project decreases. Based upon this criterion, the project should be accepted. Most developmental agencies give credence to this (economic) appraisal as against the financial as the basis for deciding whether to finance a project or not.

7.4) FINANCIAL ANALYSIS
The financial analysis is concerned with private costs and benefits as actually incurred by a private owner. This is usually determined by the prevailing market conditions. It involves the calculation of the actual cash streams of the project to the port authority. These are the conventional accounting methods of expenditure and revenue. The World Bank insists that the port’s balance sheet should reflect all resources applied to the project, which in turn should
generate adequate returns to maintain its service effectively\(^{14}\).

Once the receipts and expenditure are defined they are discounted at an appropriate discount rate to arrive at the common financial indicators similar to those used in the economic appraisal, namely; Net Present Value (NPV), Internal Rate of Return (IRR) or alternatively private Benefit /Cost ratio. The financial analysis is concerned with outright cash-flows; there are no adjustments for external considerations such as environmental impact or public subsidies as long as they do not affect the owners’ cash flow. The port’s commercial profitability is measured by the amount at which its revenues exceed costs in direct monetary value.

The purpose of the financial analysis is to evaluate the financial feasibility of the project after its economic viability has been established. It needs to be conducted after the economic appraisal because tariffs, an essential element in port finances, can in principle, be determined only after the port’s economic objectives are known\(^{17}\).

The port’s receipts and payments need to be set out against each other on a year by year basis. The receipts will consist primarily of additional harbour dues and the institution of a conservancy charge.

Conservancy charges are instituted by ports to compensate for the cost of dredging and maintaining channels and waterways. Since this project is about deepening the channel to accommodate larger ships, then this area should be the revenue center for the recoupment of the

\(^{14}\) Ibid.

\(^{17}\) Ibid.
expenditure. The extent of additional charges is dependent upon the objectives of the port and its given mandate.

The financial appraisal is based upon market prices and take into account only the receipts and payments paid directly to or by the port. The revenue received from local shippers and other internal sources are recorded as receipts and are not considered as transfer payments as with the economic appraisal.

Financial appraisal of project
Loan amount (US $ M) 15.0
Repayment period 10 YEARS
Interest rate 7%
Discount rate 30%

COST ESTIMATES

<table>
<thead>
<tr>
<th>YEAR</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<tr>
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<td>0.5</td>
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<tr>
<td>MISCELLANEOUS</td>
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<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
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<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
</tr>
</tbody>
</table>

| TOTAL COST | 2.94 | 2.94 | 2.94 | 2.94 | 2.94 | 2.94 | 2.94 | 2.94 | 2.94 | 2.94 |
| DISCOUNTED COST | 2.26 | 1.74 | 1.34 | 1.03 | 0.79 | 0.61 | 0.47 | 0.36 | 0.28 | 0.21 |
| PV COST | 9.08 |

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FORECAST OF GROSS REGISTERED TONNAGE OF SHIPS USING PORT (MILLION TONNES)\textsuperscript{10}

<table>
<thead>
<tr>
<th>YEAR</th>
<th>OTHER CARGO</th>
<th>BULKITE</th>
<th>TOTAL</th>
<th>DISC'TD VOLUME</th>
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<tr>
<td>1994</td>
<td>1.72</td>
<td>2.46</td>
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<td>3.22</td>
</tr>
<tr>
<td>1995</td>
<td>1.81</td>
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<td>1996</td>
<td>1.90</td>
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</tr>
<tr>
<td>1997</td>
<td>2.00</td>
<td>2.84</td>
<td>4.84</td>
<td>1.69</td>
</tr>
<tr>
<td>1998</td>
<td>2.10</td>
<td>2.97</td>
<td>5.07</td>
<td>1.36</td>
</tr>
<tr>
<td>1999</td>
<td>2.20</td>
<td>3.16</td>
<td>5.36</td>
<td>1.11</td>
</tr>
<tr>
<td>2000</td>
<td>2.31</td>
<td>3.29</td>
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</tr>
<tr>
<td>2001</td>
<td>2.43</td>
<td>3.29</td>
<td>5.72</td>
<td>0.70</td>
</tr>
<tr>
<td>2002</td>
<td>2.55</td>
<td>3.29</td>
<td>5.84</td>
<td>0.55</td>
</tr>
<tr>
<td>2003</td>
<td>2.68</td>
<td>3.29</td>
<td>5.97</td>
<td>0.43</td>
</tr>
</tbody>
</table>

Total 8.57 14.67

7.5) TARIFF LEVELS

Even though the channel deepening project is to facilitate the larger vessels, they alone should not be made to pay for it. Other vessels will benefit also, so they too must be made to pay. If the charges are levied only on the larger vessels then this would be contrary to the objectives of the project, that is to attract and facilitate larger vessels for the country's trade.

Since costs are proportional to the size of a vessel, a widely accepted charging system is the gross registered tonnage (GRT). It is a reliable index of the vessel in terms of the space, which is to be provided by the port in view of all three dimensions; length, beam and draft\textsuperscript{19}. According to the above computations, all

\textsuperscript{10} This model was taken from UN/ESCAP (1983), op. cit. p. 104.

\textsuperscript{19} UN/ESCAP, (1983), Model Port Tariff Structure, Final Report, p. 78.
commercial vessel would pay conservancy dues as per their gross registered tonnage.

To recover the total cost of the project, that is, capital cost, maintenance dredging cost and the other expenses, the conservancy charges should not be less than: Discounted cost/Discounted grt (9.08/14.67) = 0.6190 US$ per grt. This would make the present value income and expenditure equal, that is the break even point. The rate would however have to be in excess of this because of the inherent errors in forecasts. The profit margin would have to be decided by the government, port authority or lending agency.

This study suggests that the government should finance the capital dredging of the channel as is the case in most countries; an issue which cannot be over-emphasised. The port authority would then have to acquire a loan to purchase additional equipment for the local dredge that would be undertaking the maintenance program. It is assumed that a loan of US $ 1 million is secured for this purpose under similar conditions as that for the loan the government would have to secure for the initial capital dredging.

<table>
<thead>
<tr>
<th>YEAR</th>
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<tr>
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<tr>
<td>MAINT. DREDGING</td>
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</tr>
<tr>
<td>MISCELLANEOUS</td>
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<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>TOTAL COST</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
</tr>
<tr>
<td>PRESENT VALUE (US$ MILLION)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

With this the minimum conservancy charge should be: 2.91/14.67, = US$ 0.198 per grt.

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Since the discount rate used is thirty (30%) percent, then assuming that the port authority institute the conservancy charge to yield a rate of return of forty percent (40%), then the charge per grt will be US$ 0.277.

The financial evaluation from the point of view of the port Authority will be:

Present value costs 2.91
Present value receipts 4.06 (14.67 + 0.277)
Net present value (US$ Million) 1.15
Benefit/cost ratio 1.4

Financial evaluation from the point of view of the Bauxite Industry:
1) WITHOUT THE PROJECT THE SHIPPING COST WILL BE AS FOLLOWS.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>1</th>
<th>2</th>
<th>3</th>
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<th>7</th>
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<td>1.77</td>
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<td>1.96</td>
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<tr>
<td>SEA FREIGHT</td>
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<td>22.07</td>
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<td>32.44</td>
<td>32.44</td>
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</tr>
<tr>
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<td>23.75</td>
<td>26.02</td>
<td>28.44</td>
<td>31.67</td>
<td>34.48</td>
<td>34.48</td>
<td>34.48</td>
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</tr>
</tbody>
</table>

Present value costs (US$ Million) 77.72

2) WITH THE PROJECT THE SHIPPING COST WILL BE AS FOLLOWS.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>1</th>
<th>2</th>
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<td>23.74</td>
<td>23.74</td>
<td>23.74</td>
<td>23.74</td>
</tr>
</tbody>
</table>

Present value costs (US$ Million) 57.18
Present value conservancy dues 2.40
Present value total costs 59.58

The total savings to the bauxite industry as a result of the project is, therefore:

Present value costs without project 77.72
Less present value cost with project 59.58
Net Present Value savings (US$ Million) 18.14

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7.6) SUMMARY

In summary, the economic and financial evaluation of the project is favorable from the point of view of the port, the economy and more specifically, the bauxite industry. Therefore, based upon these projected benefits the project should be considered with a view to it being accepted and implemented.
CHAPTER 8

RECOMMENDATIONS AND CONCLUSION

Recognition needs to be given to the driving force behind this research, that is, to argue for the adoption of a port development model that is consistent with Guyana’s developmental needs. This has been occasioned by a pre-determined focus on the bauxite industry which is one of the leading foreign exchange earners for Guyana. This position is poised to be consolidated even further through the involvement of new companies in the industry.

This model is not entirely unique in its configurations because the State owned bauxite company has initiated a port development project which was basically oriented towards the satisfaction of its own transshipment needs. This project was geared to improve the physical dimensions of the ships’ channel. However, it was undertaken outside of the total framework of the port environment thus lacks the co-ordination that is necessary to achieve the desired benefits. It is not only limited in scope and self-directed but could be considered meaningless when an analysis is made relative to what is required as nationally expedient.

Bauxite is not the only commodity exported in bulk from Guyana. In fact of the three major bulk exports; sugar, rice and bauxite accounts for approximately seventy percent of the country’s foreign exchange earnings. Along with alcohol and molasses this figure is well over seventy
percent. Therefore, it is readily apparent that any improvement in the port for the facilitation of larger bauxite exporting vessels would benefit these industries as well.

The alcohol exporting company has undertaken to expand its bulk exporting facilities in order to accommodate larger vessels. Here again this is a single and somewhat narrow approach which could be classified in a similar scenario as the local bauxite company to which earlier mention was made. Clearly, what is needed is a co-ordinated approach to all port operations and development. This ensures the development of a port with the scope and breadth of servicing the needs of shippers, port operators and all port users in general. In this regard co-ordination is vital, given the national and economic importance of the port. Therefore, without attempting an oversimplification, the strategy or model of administering the port suggested in this research makes manifest its applicability.

It cannot be over-emphasised that Guyana is in urgent need of a port authority to co-ordinate all port related activities and undertake port infrastructural development. Given the market oriented policies the country is pursuing, the potential for expansion of commerce and industry is immense. Therefore, against this backdrop to retard such development can be considered inimical to economic progress and development of the country as a whole.

A restatement of the emphasis of this research at this point allows for a clearer conception of the central issues which were established in the various chapters. The project suggested exemplifies a facility aimed at facilitating larger ships for the export of bauxite from Guyana. Of course this has to be preceded by the
formulation of the port authority which must be given a fair degree of independence and relative autonomy. It is being argued here that where concessions are granted to some companies through the waiving of pilotage fees and harbour dues these should cease. These concessions were apparently given to compensate for the negative contribution of the port to the facilitation of these companies operations. The government should quantify these amounts over a given period of time and compare them with the cost of dredging the channel and improving the port in general. Even though the cost of the latter might exceed the former, the difference would surely be overwhelmed by the combined benefits accruing to all entities through the improved operational capacity and efficiency of the port. Even so, since the Government of Guyana is optimistic that bauxite will continue to lay the foundation for the country’s economic development, maximum attention should be given to any infrastructural development plan to facilitate its trade.

While the port authority is not a panacea for the problems of the port, it can, if properly organised and managed reduce the problems experienced by shippers and all port users. Having undertaken port development it will free industries of this undertaking which in turn can direct their resources to their particular sphere of activity. Most ports in the world and certainly those in the Caribbean have long passed this stage of port development. They are now able to satisfy their respective nations’ trade and are now fiercely competing to capture the trade of other nations by becoming hub ports; where the larger vessels will call and smaller; feeder vessels will distribute cargo to other ports.

The port development project recommended in this study is mainly to facilitate Guyana’s trade. When this mandate can
be fulfilled efficiently then the marketing of Georgetown as a transhipment port can be considered. Since 1776 Adam Smith underscored the advantages of maritime transport and he argued that the improvement of industry as a whole in any country is only possible if it is preceded by improvement in port based industries\(^1\). This, coupled with the fact that the condition of port based industries are directly related to the condition of the port, suggests that national development is only possible if the condition of the port improves. Therefore, it is imperative that the development of the port be made a national priority.

APPENDIX 1

WIDTH OF THE CONTINENTAL SHELVES OFF THE EAST AND WEST COASTS OF SOUTH AMERICA.

Reproduced from Admiralty Chart Number 527, Approaches to Demerara and Essequibo Rivers
APPENDIX 4

Present port dues for Georgetown, Guyana

<table>
<thead>
<tr>
<th>GRT</th>
<th>IN/OUT</th>
<th>DOCKING/UNDOCKING</th>
<th>ANCHORING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 500</td>
<td>81</td>
<td>21</td>
<td>18</td>
</tr>
<tr>
<td>5,001-1,000</td>
<td>89</td>
<td>21</td>
<td>18</td>
</tr>
<tr>
<td>1,001-2,000</td>
<td>95</td>
<td>21</td>
<td>18</td>
</tr>
<tr>
<td>2,001-3,000</td>
<td>99</td>
<td>24</td>
<td>18</td>
</tr>
<tr>
<td>3,001-4,000</td>
<td>105</td>
<td>24</td>
<td>18</td>
</tr>
<tr>
<td>4,001-5,000</td>
<td>109</td>
<td>25</td>
<td>18</td>
</tr>
<tr>
<td>5,001-6,000</td>
<td>115</td>
<td>29</td>
<td>18</td>
</tr>
<tr>
<td>6,001-7,000</td>
<td>121</td>
<td>31</td>
<td>20</td>
</tr>
<tr>
<td>7,001-8,000</td>
<td>125</td>
<td>34</td>
<td>20</td>
</tr>
<tr>
<td>8,001-9,000</td>
<td>131</td>
<td>36</td>
<td>21</td>
</tr>
<tr>
<td>9,001-10,000</td>
<td>136</td>
<td>43</td>
<td>21</td>
</tr>
<tr>
<td>10,001-11,000</td>
<td>141</td>
<td>46</td>
<td>25</td>
</tr>
<tr>
<td>11,001-12,000</td>
<td>149</td>
<td>50</td>
<td>31</td>
</tr>
<tr>
<td>12,001-13,000</td>
<td>156</td>
<td>57</td>
<td>37</td>
</tr>
<tr>
<td>13,001-14,000</td>
<td>163</td>
<td>64</td>
<td>44</td>
</tr>
</tbody>
</table>

In addition for every 1,000 GRT in excess of 14,000 US$7.00.

Tonnage Dues US$ 0.55 per NRT

Light Dues US$ 0.20 per NRT

SOURCE: Harbour Master’s Office, Georgetown.
Calculation of the quantity of material to be dredged. This is an approximate calculation based upon several assumptions, namely:

1) The channel at present has a uniform depth of 6.9 metres throughout its entire width of 14 nautical miles, that is 25.2 kilometres.

2) The width of the channel is uniform.

![Diagram of channel dimensions]

The calculation is simplified by first assuming the channel as a uniform dimensions, as above.

Volume of entire block = 25,200*140*6.2 = 21,873,600 m$^3$

Volume of B = 25,200*15.5*6.2 = 2,421,720 m$^3$

Volume of C ($C_1+C_2$) = 25,200*19.5*3.6 = 1,769,040 m$^3$

Volume of A + C = 25,200*109*3.6 = 9,888,480 m$^3$
Therefore, volume of A = 9,888,480 - 1,769,040
= 8,119,440 M³

Volume to be dredged = 21,873,600
Less volume of A = 8,119,440
Less volume of B = 2,421,720

----------
Total 11,332,440 M³
----------

Due to the inherent errors in estimating the volume of material to be dredged, a subjective allowance of 20% of the above quantity is added as a compensation against underestimation. Therefore, the volume of material to be dredged is considered as 13,598,928 M³.
3.1) Derivation of Forecasted Gross Registered Tonnage (GRT)

This is an approximate total of the GRT of vessels visiting port during 1991 (taken from Customs Statistics, Guyana). Of this 2.59 million grt was from non bauxite traffic while 1.49 was from the bauxite traffic. Therefore, if it is assumed that the non bauxite traffic increases by 5% and the bauxite traffic increases as stated in chapter 4. It is from this that the amounts in table 7.3 are derived.

3.2) Calculation of port dues and charges payable by the presently used vessel and the suggested one for 1994.

1)  

<table>
<thead>
<tr>
<th>Description</th>
<th>Present</th>
<th>Proposed</th>
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<tbody>
<tr>
<td>27,000 dwt</td>
<td>40,000</td>
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</tr>
<tr>
<td>16,200 grt</td>
<td>24,000</td>
<td></td>
</tr>
<tr>
<td>10,800 nrt</td>
<td>16,000</td>
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</tbody>
</table>

Pilotage         510       734
Tonnage dues      5,940     8,800
Light dues        2,160     3,200

---

8,610            12,734
---
---

With 177 trips for 1994    With 103 trips
Total dues = (8,610*177)   (12,734*103)
            = 1,523,970 US$    1,311,602 US$

Similarly, the port dues payable for the other years are computed.

At present there is no conservancy charges, but the total
conservancy charges that would be payable by the bauxite companies over the ten year period will be:

Discovered GRT = 8.57 million

* discounted conservancy charge per GRT = 0.277 US$

PV of the Total Conservancy charges = 2.4 million US$
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A port infrastructural development plan for the

<table>
<thead>
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<tbody>
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<td>98-09-04</td>
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</table>

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