CHAPTER 5. WATERWAY TRANSPORTATION SYSTEM

The purpose of this chapter is to present the future waterway transportation system, which is comprised of shipping, ports and channels, based on an evaluation of the existing transportation system and a review of previous studies emphasizing the iron ore transportation because this is the most critical factor in deciding capacity of the channel.

5.1 Existing Waterway Transportation System

5.1.1 Present Cargo Flow and Shipping

The traffic flow is almost exclusively concentrated in the Rio Grande Channel of the Orinoco River, although a small portion of cargo generated by the various industrial activities located in the vicinity of Ciudad Guayana is transported by roads to and from northern coastal ports. The scale of the total recent annual cargo flows is reported to be in the order of 20 million tons per year, (excluding the Bauxite flow of about 5 million tons per year from upstream to Puerto Ordaz), amongst which the largest one is the 9 million tons of iron ore annually exported by Ferrominera.

5.1.2 Present Iron ore Shipping

(1) Present Shipping of Iron ore Export

There are three ways of exporting iron ore.

1) TV System: Most commonly, exported iron ore is loaded onto two Shuttle Vessels at Puerto Ordaz and transferred to Cape size carriers via the Transfer Vessel (TV). Around 50 % of total exported iron ore was shipped in this way to Europe, Japan and China.

2) Additional Loading System: Exported iron ore is partially loaded onto Panamax size carriers at Puerto Ordaz up to the level that still allows them to navigate the channel and additional cargo is again loaded along side the Transfer Vessel up to full draft. Less than 20 % of the total exported iron ore was shipped to Europe by Panamax size carriers in this way of additional loading.

3) Direct Shipping System: Direct shipping to destinations in the United States, Central and South America and Europe from Puerto Ordaz represented more than 30 % of the total exported iron ore.

(2) Present Carriers Engaging in Iron Ore Export

More than 55 % of the total exported iron ore was shipped to destinations in Europe by either Cape size carriers or Panamax size carriers.

Around 30 % of the total exported iron ore was shipped to destinations in the United States and Central and South America by carriers less than Panamax size. The average export volume ranged from 30,000 to 40,000 tons per shipment according to the statistics.

It should be noted that 45 % of the total exported iron ore, more than 4.5 million tons, was shipped to destinations in Europe, the United States and Central and South America by Panamax size or smaller carriers. Typical sizes of vessels are shown in Table S.5.1.

Table S.5.1 Typical Sizes of Vessels

TYPE	DWT	Beam	Full load Draft
Cape size	150,000	45.0 m	17.5 m
Panamax	65,000	32.2 m	12.8 m
Handymax	45,000	30.5 m	11.8 m
Small Handy	38,000	28.5 m	10.9 m

(3) Existing Transfer Vessel

The Transfer System has been introduced since 1988 to minimize the shipping costs to remote markets. The Transfer Vessel was converted from a 227,500 DWT vessel with a 185,000 tons storage capacity and self-unloading equipment of 3,500 tons/hour. The Transfer Vessel can accommodate a vessel of up to 220,000 DWT for the destination port, and the Shuttle Vessel at the same time, which is a converted ship of over 80,000 DWT, with a cargo handling capacity of 67,500 DWT.

The normal operational life of an ocean going vessel is believed to be around 30 years, after which annual maintenance costs, including maritime insurance premium, rapidly increase. The present Transfer Vessel and the two Shuttle Vessels were built 25, 21, and 16 years ago, respectively. This means that a decision has to be made on the possible replacement of this system in the very near future.

5.1.3 Present Other Cargo Shipping

Although the channel can accommodate Panamax size carriers, ships smaller than Small Handy class vessels are used for transportation of 7 million tons of general cargo including direct reduced iron annually from the port. These ships are of the 5,000-30,000 DWT class. General cargo ships, numbering 460 vessels per year in each direction are in operation. This is because the shipping lots were less than 30,000 tons.

5.2 Existing Ports and Channels

5.2.1 Existing Ports

(1) Existing Port Facilities

Eleven ports in Ciudad Guayana are located almost on the right margin of the Orinoco River and have 19 berths which can handle 41.7 million tons per year in total.

(2) Present Port Access

The ports accommodate the cargo transportation demands generated by the industries in Ciudad Guayana. All terminals except San Felix are, in principle, used for specialized cargo but several terminals are open for third party use due to leftover capacity. The San Felix Terminal is the only public port facility in the district. At SIDOR Terminals, 75 % of the cargo handled is its own and the remaining 25 % is the cargo of other third parties such as steel bar and industrial materials. This leftover capacity has been generated by the operating ratio of SIDOR plants' capacity, which was 60 % in 1998.

(3) Present Port Management

Up to 1992, the Commission for the Execution of the Orinoco River Authority was in charge of coordinating all the ports owned by CVG subsidiary enterprises. This arrangement was good to maintain effective authority for consolidating independent terminals to function as a whole. Since then there has been no appropriate organization for management and operation of the port of Puerto Ordaz.

5.2.2 Existing Canal

(1) Present Navigation in the Channel

Vessels must navigate the channel upward against a strong river current of 7-9 knots, and it takes at least 6 hours to pass the channel, depending on the size of vessel. At the entrance of 0-point, each in-coming vessel is forced to wait a long time because out-going vessels are given priority.

(2) Present Traffic Control

Although the Capitania of the Port in Puerto Ordaz is officially responsible for the monitoring of navigating vessels, Radio Marina Office belonging to Ferrominera is charged with registration of arrivals and departures of vessels and thus the Office controls the vessel traffic navigating the Rio Grand Canal. There are several areas for crossing in the Rio Grand Canal, where preference is

granted to loaded vessels navigating downstream because of vessels' maneuverability. Several buoys and markers have drifted to ineffective points due to a lack of maintenance.

(3) Present Pilot

Pilot service is regulated as compulsory in the Canal, but a shortage of personnel sometimes causes unnecessary waiting time at the entrance of the Boca Grande. There is a project proposed by INC for introducing a Satellite assisted navigational aid at a modest operational cost.

(4) Macareo Canal

Macareo Canal is the shortest waterway from Puerto Ordaz to the Transfer Vessel anchoring at the south open sea of Trinidad. The Canal branches off the Rio Grande at Barrancas. It is 211 km in distance from the divided point to the mouth of the river, and the Canal has a width of 200 m-300 m, a navigable waterway of 76 m, and 8 m in guaranteed depth. But at both ends, at the mouth of the river and at Barrancas, only 4.5-5.1 m of depth is maintained even in the rainy season. Additional dredging and installation of navigation aids are required for optional utilization of the channel. The channel has not been used by large size vessels since dredging was suspended 30 years ago.

(5) Manamo Canal

A discharge control gate was constructed upstream of the Manamo Canal, to the south of Tucupita, in 1967. Tucupita city has been protected against floods since its completion but the dam had the negative effect of dividing the Manamo Canal into two sections. The lower stream has become an independent channel stretching between the ocean and Tucupita, where some pusher barges are operated. The upper stream has no waterway for vessels to serve the route between Ciudad Guyana and Tucupita.

5.2.3 Review of Waterway Transportation System

(1) Freight Rate Trends of Iron ore

Iron ore is transported by chartered carriers which are contracted either on a long-term basis or on the spot in response to demand of steel industries.

The long time-charter makes it possible to lower the shipping cost from a loading port to a destination because of efficient operation and management. In order to contract with a long time-charter, it is necessary that the volume of iron ore bound for one destination is sufficient to operate a chartered carrier for a full year.

The iron ore of Ferrominera is exported to around fifteen destinations in Europe, America and Far East, and exported volume ranges from 100,000 to 2,000,000 tons. Most of these shipping routes are operated by spot charters according to the analysis on flow of exported iron ore.

(2) Export Competitiveness

It is emphasized that voyage days, namely sea miles, is a large factor in determining the shipping cost of iron ore when the same sized carriers are engaged in transportation to the same destination from different loading ports. In other words, shipping cost can be competitive if voyage days to the destination are fewer than from other exporting ports.

In addition, the export competitiveness of iron ore depends on various other factors such as the selling price and quality as well. Therefore, a detailed marketing study is required to ensure that Venezuelan iron ore remains competitive. Shipping cost in long time charter or in spot charter depends on the climate of supply and demand in the market. The demand means the transportation cost and volume requested by consignees and the supply is shown by the number of carriers available. The charterage in every carrier size has varied widely in the past decade, and the difference in cost between large carriers and small carriers was sometimes small. Accurately forecasting the shipping cost to a destination is difficult because shipping cost depends largely on the market charterage. Therefore, a prudent and comprehensive study is required on the market price, exporting volume for destinations, shipping methods and so on when considering investment.

(3) Traffic Trends in the Channel

The annual number of iron ore carriers in each direction is 220 vessels at present but is estimated to drop to a maximum of around 90 vessels when the exported iron ore volume decrease to 4 million tons. The annual number of vessels carrying steel products and direct reduced iron is estimated to increase to around 500 vessels in 2010, 600 in 2020. The traffic of other cargo including export, import and domestic will likely remain unchanged. The total annual traffic in each direction in the channel is estimated at more than 1,100 vessels in 2010 and around 1,300 vessels in 2020 in case of high growth case in demand forecast.

(4) Channel Capacity and its Increase

The report by MTC in 1991 pointed out that the estimated capacity of the channel was 1,100 vessels per year in each direction, which meant 3 vessels per day in each direction, and the arrival of more than 3 vessels per day would quickly lead to congestion, since Boca Grande Canal is 42 sea miles of longitude in a single way and limits the capacity of traffic.

Possible measures to increase the capacity of the existing Boca Grande channel included in the MTC report were introduction of convoys of vessels. When the number of vessels arriving would get close to four per day, the authority concerned would order the formation of convoys. The convoy would consist of three to six vessels and the annual capacity of the channel would increase to 2,700 vessels per year in each direction with a convoy of three vessels on average. Furthermore, if a crossing zone sufficiently wide to accommodate six vessels per convoy (average of three) was introduced, the number of vessels navigating in each direction could be increased to 4,300.

In order to implement this convoy system, it would be necessary to develop a better management and control system for the vessels.

5.3 Review of New Port Development Plans

There are several new port development plans identified in relation to the improvement of the future waterway transportation system on the Orinoco River, with varying details from a mere conceptual proposal to a detailed project with design works. These plans can be categorized into three groups: one for Puerto Ordaz, one for the transfer ports, and one for regional ports in the Delta (See section 5.5).

5.3.1 Plans for Puerto Ordaz

(1) Multipurpose Terminal

This terminal was planned as a pioneering project for the large scale new industrial port complex zone development. This planned industrial development complex is located in a zone on the right margin of the Orinoco River to the west of SIDOR. To serve a wide range of new industries including the new steel and aluminum industry, 10 module terminals (to efficiently deal with specialized cargo) were planned along with a multipurpose terminal.

This multipurpose terminal is designed with three 600 m long berths and 23.5 ha. of cargo handling and storage space which can serve up to 1.4 million tons of annual cargo, of which 0.8 millions is for general cargo and 0.6 millions for bulk cargo. All 10 module terminals are designed with nineteen 3,700 m long berths and 114 ha. of cargo handling and storage spaces to serve up to 12 million tons of annual cargo forecasted for the zone. These terminals are linked with peripheral road and railway systems. The Multipurpose Terminal can be used at the construction stage of the industrial zone as a logistics base receiving construction materials. Projected investments are US$ 47.3 million for the Multipurpose Terminal and US$ 203.2 million for the 10 terminals as a whole. (1990 constant price at Bs. 50 = US$1).

(2) Orinoco Transshipment Terminal

Location of the planned terminal is between the SIDOR and VENALUM Terminals at mile 194.5. This terminal is designed as a detached steel pier on piles that can serve up to two 65,000 DWT vessels and barge trains at the same time. Target cargo of the terminal is briquettes, bauxite, copper concentrates, slag, and iron pellets. The terminal is facilitated with a loader/conveyor system of 500 (briquettes) to 4,000 (bauxite) tons/hour capacity and storage area.

ACBL proposed this project on a BOT basis, and the preliminary negotiation is reported to be in progress. Investments are planned as: Phase I (to be completed by the year 2000) with 1 berth for an amount of US$ 23.3 million, and Phase II (to be completed by 2003) with an additional berth and storage area expansion for US$ 127.8 million.

5.3.2 Plans for Transfer Ports

In pursuit of a more optimal river navigation system, in terms of economizing transportation costs in the course of expanding the market for Venezuelan iron ore export, a number of reports on improving the canal capacity have been prepared.

(1) Rio Grande Channel:Boca Grande Area

An OMC & INC report of 1970 examined the feasibility of a new transfer port at the Boca Grande area as opposed to other alternatives of channel deepening projects and a railway to the northern coast port of Guanta, on the basis of 22 million tons per year of cargo movement related to iron ore export. The report discarded this alternative as economically unfeasible, leaving room for further consideration of a direct vessel to vessel transfer system.

Another report by MTC in 1991 examined the feasibility of a new transfer port at Punta Yatica, at channel mile 42, among a wide range of alternatives including canal deepening or widening, reuse of the Macareo Canal, on the basis of 15 million tons of annual iron ore export. This alternative was discarded as uneconomical.

(2) Macareo Channel:Punta Pescador Area

The MTC report of 1991 also examined the feasibility of a new transfer port at Punta Pescador at the mouth of the Macareo canal. It assumed the reuse of the canal for the transiting of return trips of the existing shuttle vessels, or for round trips of 17,000 DWT barges equipped with self-unloading systems. Although these alternatives related to the reuse of Macareo canal were not justified as economically feasible, the report mentioned future possibilities of this project as a substitution of the

Transfer Vessel at Boca Grande, in case of the increased demand to the point where a second Transfer Vessel would be required, or in the case of Vessel replacement after its useful life.

Another idea of a new deep-water port at Punta Bombeador on the out-skirts of the Macareo river mouth was proposed by a CVG study.

(3) Manamo Outlet Area

A report for INC in 1986 studied the feasibility of the use of the Manamo Canal and mentioned the possible installation of a transfer port at either Pedernales, Capure, or Isla Cotorra in the Manamo Outlet area. Conclusions in favor of further detailed studies were drawn only on a preliminary analysis basis. The same engineer wrote a paper for the seminar "EL RIO ORINOCO: Aprovechamiento Sustentable" ("THE ORINOCO RIVER: Sustainable Exploitation") held on Nov., 1998 to maintain his notion of comparative economic competitiveness of reopening the Manamo Canal with a huge navigation lock which could accommodate up to 80,000 DWT at a cost of US$ 200 million. A comparison with the Rio Grande Channel was made, assuming a discount rate of 8 % per annum with 20 years for amortization which seems to be unrealistic given the recent economic and financial climate in Venezuela.

The MTC report also studied the use of the Manamo Canal in less depth than the other alternatives and concluded in disfavor of this alternative.

(4) Ports on the Northern Coast

The OMC & INC report examined the feasibility of a railway link to the port of Guanta and strongly denied the economic feasibility of this alternative. Again it should be remembered that this study was undertaken on the basis of 20 million tons of annual iron ore export. It also justified deepening the Channel to accommodate up to 40 million tons of annual exports.

5.4 Future Waterway Transportation System

5.4.1 Viewpoint of Study

The waterway transportation system should be examined taking into account of the benefit and the tariff on users navigating the channel. The proposed waterway transportation system should be examined to economize, as far as possible, the transportation cost of iron ore as the main exporting cargo at present and to save the initial and maintenance cost of the channel in order to balance the benefit and the user tariff.

5.4.2 Alternatives of Waterway Transportation System

Table S.5.2 shows a list of possible alternative projects for future waterway transportation system taking into the consideration of navigation route, iron ore export with or without a transfer port along with their location and vessel types.

Based on the preliminary evaluations, alternatives other than P1, P2, P3, A1 and A2 are not selected for further considerations as they are uneconomical and/or inadequate for required transportation. In these alternatives P1, P2, P3, A1 and A2, navigation routes are the same, Rio Grande and Boca Grande Canal. The differences are vessel sizes, Panamax, Handymax or Small Handy, and whether cargo is transshipped at Boca de la Serpiente or not.

It should be noted that the service life of the existing Transfer Vessel will likely expire around 2003, and that of the two Shuttle Vessels will expire approximately 10 years after. Also the exported iron ore is expected to decrease to 4 million tons in 2003.

Therefore the proposed transportation system of iron ore export should be flexible enough to respond to the changes that would occur in the near future. The flexibility of the system is a key point to economize transportation cost. By saving the initial investment and maintenance cost of the channel, the benefit and the service tariff can be balanced better.