5. WATERWAY TRANSPORTATION SYSTEM

CHAPTER 5. WATERWAY TRANSPORTATION SYSTEM

5.1 General

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. In the proposed waterway transportation system, emphasis is given to iron ore transportation because this is the most critical factor in deciding capacity of the channel.

5.2 Existing Waterway Transportation System

5.2.1 Present Cargo Flow and Shipping

Most of the traffic in the area under study of the Lower Orinoco consists of the cargo generated by the various industrial activities located in the vicinity of Ciudad Guayana. The industries located here not only export products but also import raw materials and machinery/spare parts for production. The traffic flow is almost exclusively concentrated in the Rio Grande Channel of the Orinoco River, although a small portion of cargo 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.

Table 5.2.1 Vessel Traffic in the Orinoco River Canal (1988-1997)

year	Traffic of vessels in each direction					
	Iron	Petrol	General	Aluminum	Bauxite *	Total
1988	324	63	520	37		944
1989	366	47	563	42		1,018
1990	386	38	535	46		995
1991	386	19	503	55		963
1992	324	29	432	43		828
1993	308	44	444	53		849
1994	293	59	391	65		808
1995	279	64	462	55	**	**860
1996	299	86	389	55	51	880
1997	282	101	468	47	195	1,093
Average	325	55	470	50	103	930

Source : INC material *1)

* : Traffic recorded from El Jobal to the INTERALUMINA Terminal

** : There were differences in statistics from different INC sources.

Note : "General" Category includes: General Cargo and Primary Material ("Materia Prima")

: Downstream from Puerto Ordaz

According to the statistics on the vessels navigating in the Orinoco River Canal by INC, around 900

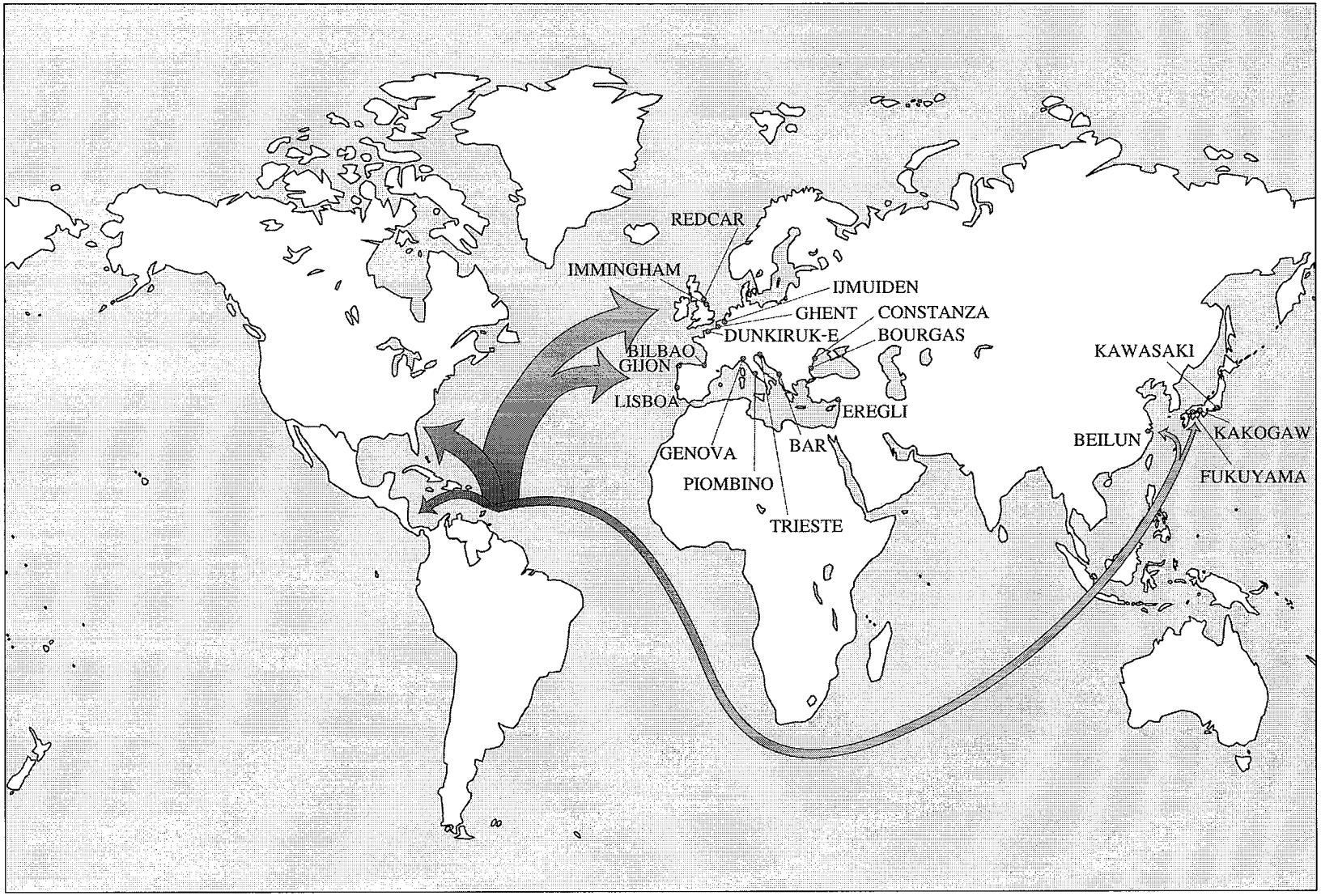
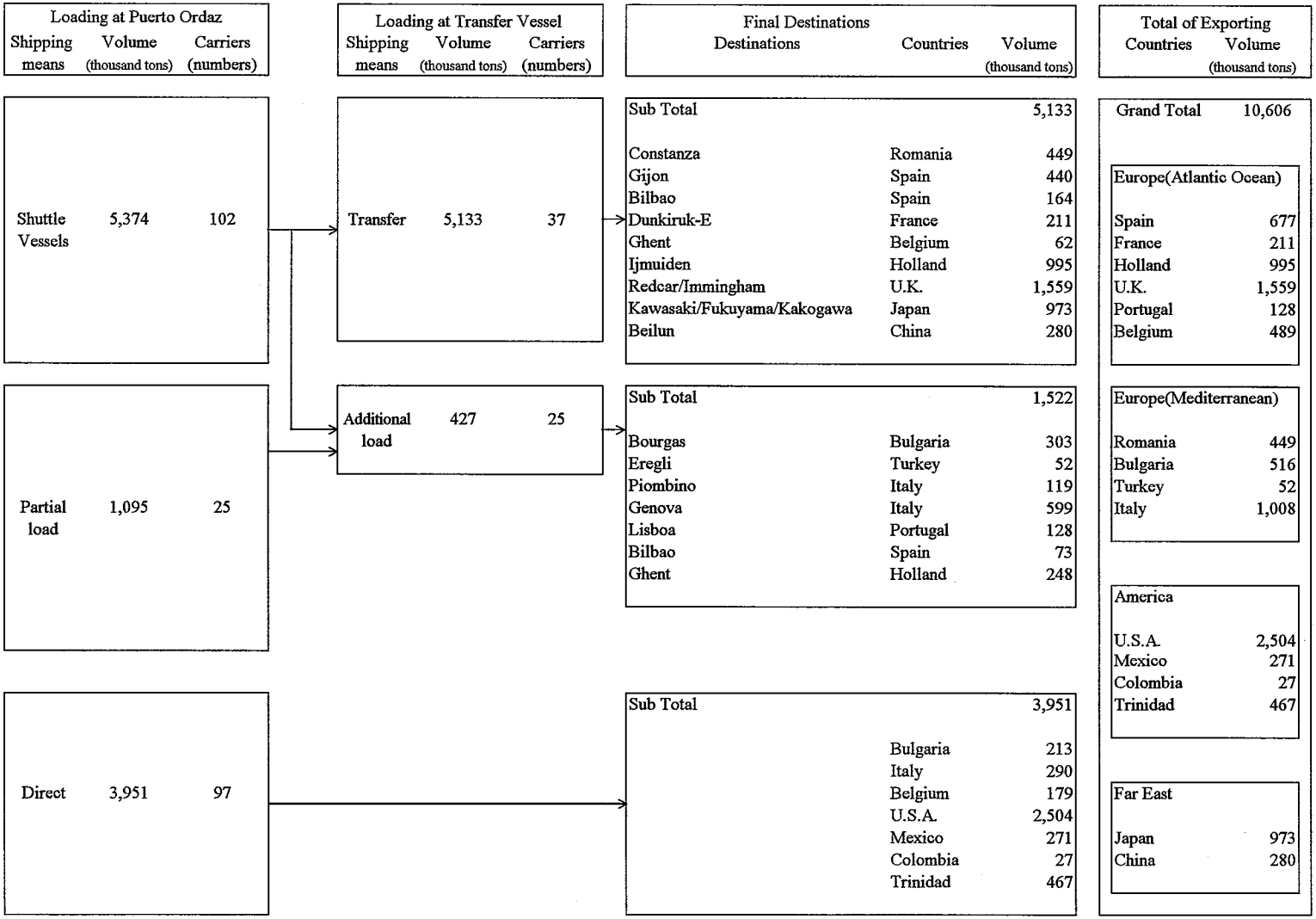
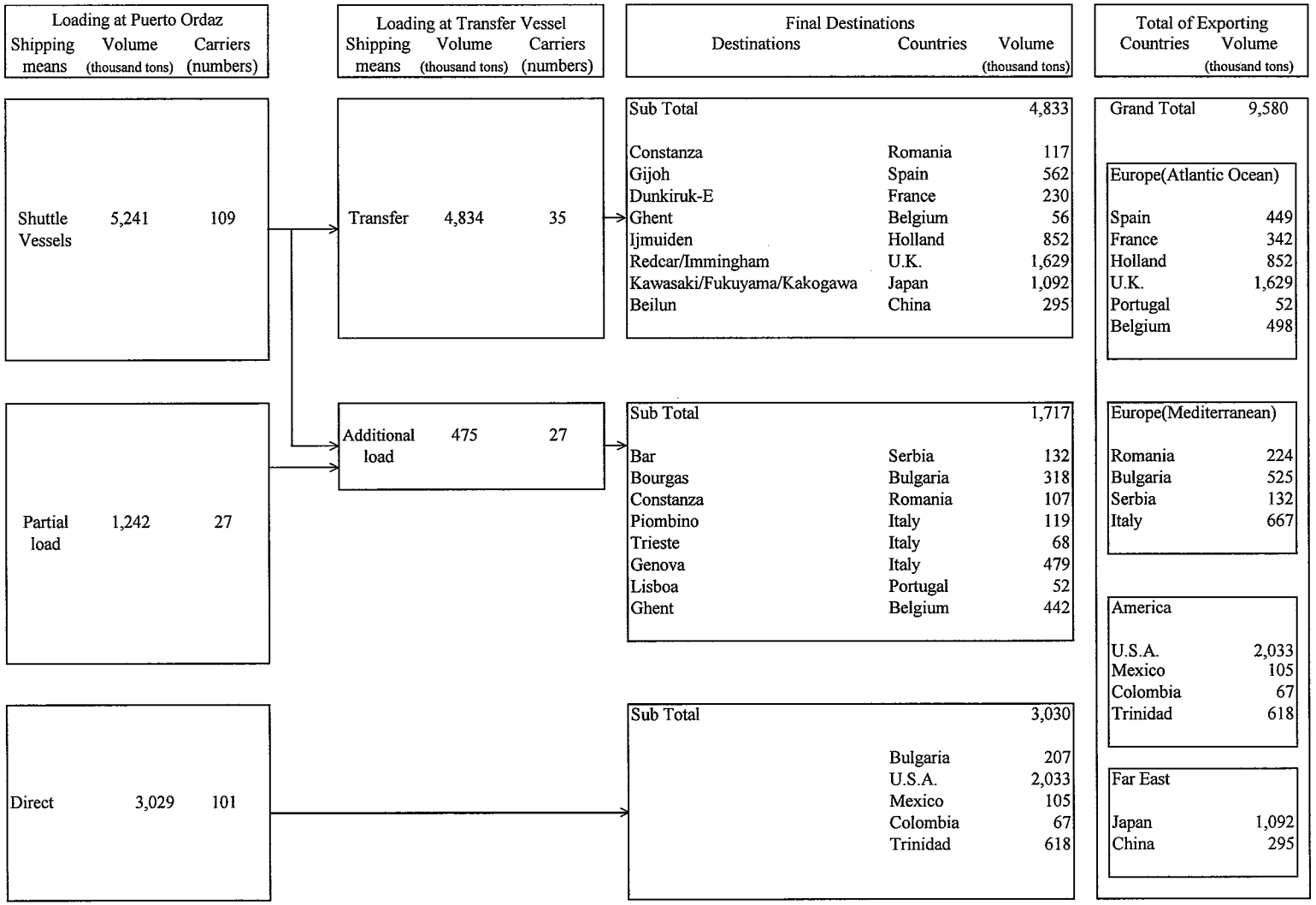


Fig. 5-2-1 Final Destinations of Iron ore



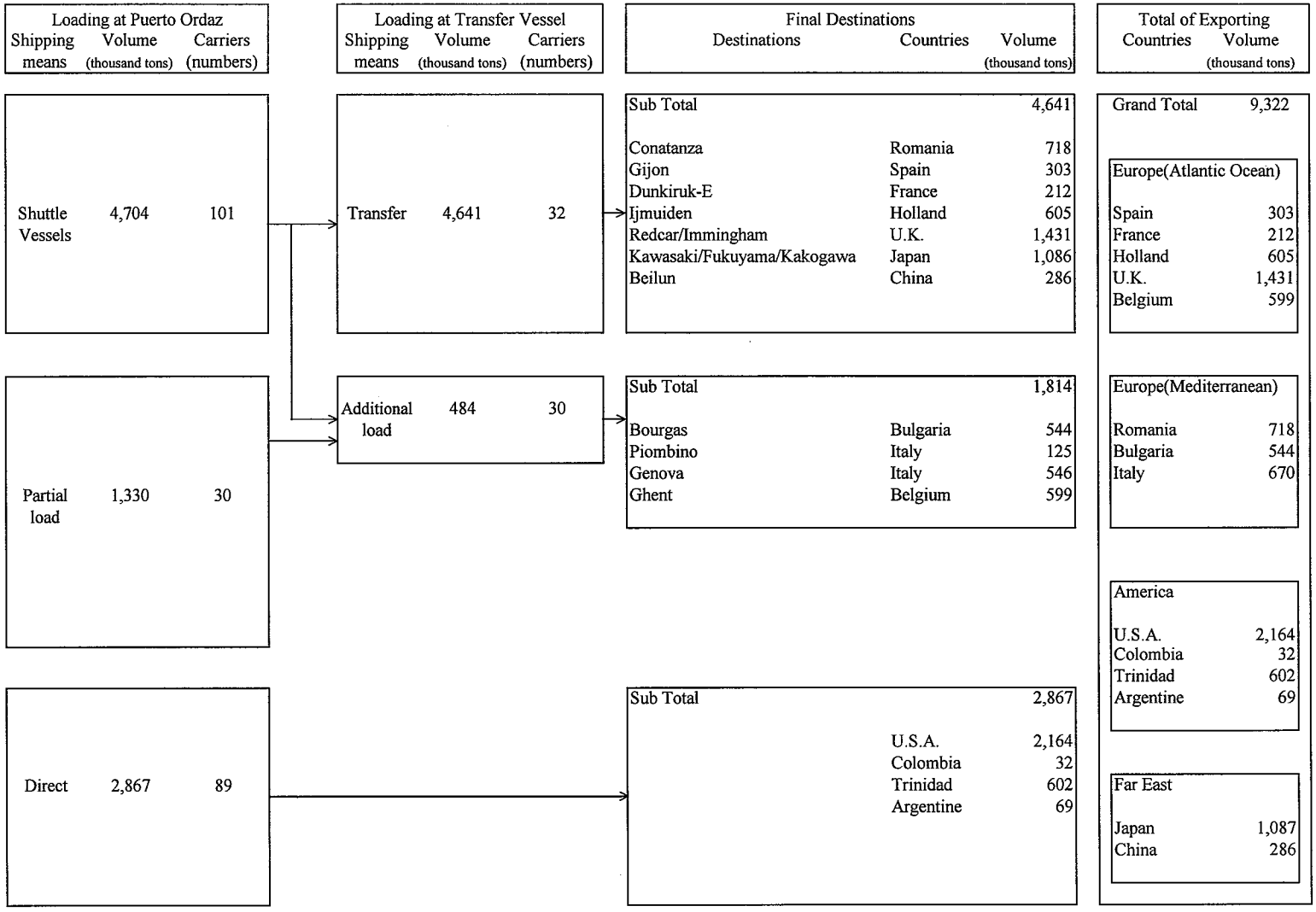
Source: Transfer Vessel Handling Records, Shuttle Vessels Operation Records, Exporting Records
Note: There are differences in volume because of different sources

Fig. 5-2-2 Exported Iron Ore Flow in 1995



Source: Transfer Vessel Handling Records, Shuttle Vessels Operation Records, Exporting Records
Note: There are differences in volume because of different data sources

Fig. 5-2-3 Exported Iron Ore Flow in 1996



Source: Transfer Vessel Handling Records, Shuttle Vessels Operation Records, Exporting Records
Note: There are differences in volume because of different data sources

Fig. 5-2-4 Exported Iron Ore Flow in 1997

Of all the carriers navigating in the channel from Puerto Ordaz to the mouth of the river in each direction, about 25 % or 220 carriers were loaded with iron ore according to annual statistics. There were 100 trips by the two Shuttle Vessels, 25-30 trips by carriers additionally loading at the Transfer Vessel and less than 100 trips of other carriers directly shipping to destinations in the United States, Central and South America and Europe.

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 according to the statistics of 1995-1997.

(2) Present Other Cargo Shipping

Carriers navigating the channel, numbering 60-100 per year for each direction, shipped around 3 million tons of petroleum annually from Puerto Ordaz. These carriers were of the 35,000 DWT class according to information obtained during the investigation.

One million tons of aluminum and aluminum ingot was transported annually from Puerto Ordaz by approximately 50 ships in each direction. These ships varied within the range of 5,000 to 30,000 DWT of bulk carriers or general cargo ships.

General cargo ships, numbering 460 vessels per year in each direction, transported 7 million tons of general cargo including direct reduced iron annually from the port. These ships were of the 5,000-30,000 DWT class.

Although the channel can accommodate Panamax size carriers, ships smaller than Small Handy class vessels were used for transportation of those cargoes. This is because the shipping lots were less than 30,000 tons, making these smaller vessels preferable in terms of both navigation cost to the destinations and volume required at the destinations.

5.2.2 Existing Ports

(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 as shown in Table 5.2.2.

Past studies on the Orinoco River navigation system, such as the INC instruction [*2)], IDB study [*3)] and the MTC study [*4)] filed a good inventory of the relevant port facilities. During onboard port inspection only a few changes to the inventory of the port facilities were identified. One is the construction of a new terminal at Punta Piedra at progressive mile 163, dedicated to wood chip exports by Veneston, which is scheduled to go into operation in January 1999, to accommodate exporting vessels from 20,000 to 50,000 DWT. The other is the Lagoven oil terminal at mile 177 which is in a rundown condition [*5)*6)*7)]. Also, a floating dock was identified a mile downstream from the INTERALUMINA Terminal which is owned by BAUXILUM; this dock is used to transport bauxite from upstream by a barge train system and is used exclusively for the system's maintenance and repair.

Table 5.2.2 shows port facilities in Ciudad Guyana, Fig. 5-2-5 shows locations of the port terminals, and photographs of the terminals are attached in the Appendix.

Table 5.2.2 Port Facilities in Ciudad Guyana

	Name of Terminal	No. of Berths	Capacity (Million tons/year)	Type of Cargo
A.	SIDOR/No.1 & 2	2	1.30	Bulk Primary Materials
	No.3 & 4	2	3.00	Steel Products
	No.5 & 6	2	1.00	General Cargo
B.	VENALUM	2	0.60	General Cargo
C.	Cementos Guayana	1	0.30	Bulk Cement
D.	ALCASA	1	0.50	Bulk Black Materials
E.	INTERALUMINA	2	5.00	Bulk Bauxite
F.	Corpoven (Punta Cuchillo)	1	3.00	Hydrocarbons
G.	Ferrominera	1	15.00	Bulk Iron Ore
	(Puerto Ordaz)	1	0.40	General Cargo
H.	Ferrominera (Palua)	1	10.00	Bulk Iron Ore
I.	Palua	2	0.20	General Cargo (not used very much)
J.	San Felix	1	0.20 (0.40	GeneralCargo Bulk Grain)
K.	Veneston (Pta. Piedra)	1	1.20*	Bulk Wood chip
	TOTAL	20	41.7	
Transfer Vessel - "Boca Grande" (moored at Boca Serpiente)		1	5.50**	Iron ore storage & transfer 3,500 tons/hour unloader receiving iron ore from a shuttle vessel
Shuttle Vessels		2	5.50**	with 2,500 tons/hour self- unloader

* planned handling capacity ** actual cargo handled in 1996
Capacity is calculated as : (maximum daily capacity)x(24hours/day)x(365days)
General Cargo including primary material as follows:
Exports: Alumina, Spools, Steel Bars, Slabs, Steel Billets, Sheet Steel, Ferrosilicon, Aluminum and Alloy
Imports: Caustic Soda, Coke, Talomite, Ferromanganese and Ferrosilicon

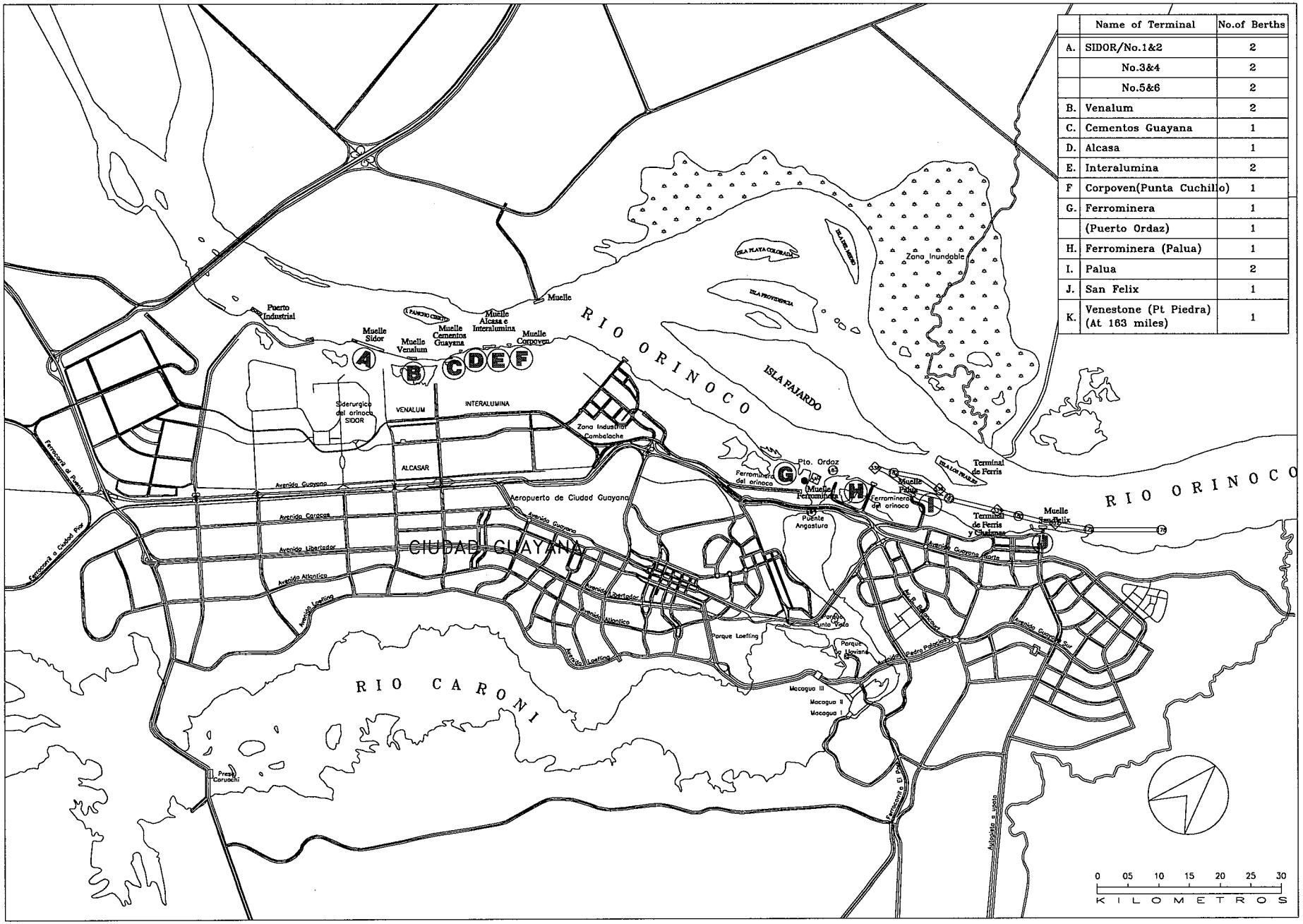


Fig. 5-2-5 Location of Port Terminals in Ciudad Guayana

Precise information on the designed depth of each facility has not been collected except the SIDOR terminal where the depth, measured by the fixed level, is readily available. It should be noted that water level records at each point of the River Section of the Canal were measured based on the NAB (Lowest Low Water Level) which differs from point to point.

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 was its own and the remaining 25 % was the cargo of other third parties such as steel bar and industrial materials. This leftover capacity was generated by the operating ratio of SIDOR plants' capacity, which was 60 % in 1998. Third party use at SIDOR Terminals will be allowed until SIDOR operates its plants in full.

Each enterprise owns it's terminal or has direct access by either railway link or belt conveyor link. San Felix Terminal, as a public port, is directly accessible by the public trunk road network. For a growing number of industries in the area that cannot afford their own specialized port facilities, port access to either San Felix or one of the other specialized terminals is difficult. The former is almost 10 to 20 km away from the growing industrial zone to the west of the city center and the latter has to be reached by going through the factory site, in some cases even on an unpaved winding road.

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 a good alternative 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.

(2) Existing Transfer Vessel

The Transfer System has been introduced to minimize the shipping costs to remote markets like Japan. 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. This is permanently moored at the Boca Serpiente, 100 miles north of Boca Grande. The Transfer Vessel can accommodate a

vessel of up to more than 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.

5.2.3 Existing Canal

(1) Rio Grande Canal and Boca Grande Canal

1) Existing Canal

Due to the existence of a huge bar at Boca Grande, the use of the Rio Grande could not be started without capital investment and maintenance dredging of an artificial canal by INC [*8) *9)].Design of the Canal from Matanzas to Boca Grande is as shown in Table 5.2.3.

Table 5.2.3 Configurations of the Canal

Designed Vessel Size	:	65,000 DWT	
Designed Depth			
at Boca Grande	:	13.2 m	(44 feet)
at the River Section	:	10.2 m	(34 feet)
Total Length		361 Km	(195 miles)
Dredged Section	:	141 Km	(76 miles)
Natural Canal	:	220 Km	(119 miles)
Width of the Dredged Section			
at Boca Grande	:	122 m	(400 feet)
at the River Section	:	91m	(300 feet)

Source: "Derrotoro Para La Navigacion En El Canal Del Rio Orinoco Tramo Matanzas-Boca Grande" published by Instituto Nacional De Canalizacions in 1997.

To avoid misunderstanding, it should be noted that designed depth of the dredging is different from the authorized navigable draft. Normally, a certain amount of depth should be discounted as a safety factor for determining the navigable draft of the vessel, considering trim, squat, density of water, and other factors related to the vessel's movement. According to INC, 2 feet is taken into account as a safety factor for the navigation on the dredged section of the Canal [*2) *10)].

In order to maintain the canal depth to accommodate navigating vessels up to the designed size, annual maintenance dredging has to be undertaken in the order of 20 million cubic meters per year, with all the costs borne as tolls by the users, that are imposed, according to the law, on a tonnage of cargo basis rather than on vessel tonnage. According to INC, four sections are identified as places of major dredging works; Boca Grande, Guarguapo, Aramaya, and Guasina [*10)].

2) Present Navigation in the Channel

One of the major problem areas for navigation is the one-way channel from 0-point to 42-point sea mile of the Boca Grande Canal. 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 to enter the channel.

3) 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 traffic of the vessels 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.

4) 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 that was proposed by INC for introducing a Satellite assisted navigational aid at a modest operational cost. In the long run, these efforts and costs will be compensated by the possible reduction of maritime insurance costs.

5) Accidents

Thanks to the integrated efforts by the Capitania, INC, and other related organizations and experts, the number of accidents is reportedly on the decline.