10 TRANSPORTATION

10.1 Transport Network and Infrastructure

10.1.1 Road Network

The majority of inter-city roads in Chile are under the jurisdiction of the Road Department of MOP, except for urban streets and some private roads belonging to the mining and forestry companies. They are classified in five categories:

- Class A: National Roads including Route 5 and other trunk roads connecting Route 5 to regional capitals, ports and/or major marine customs as well as international airports.
- Class B: Primary Regional Roads are trunk roads not classified as national roads, connecting a national road to a province capital or to three communal capitals and those connecting provincial capitals to two communal capitals or frontiers.
- Class C: Secondary Regional Roads are roads not classified as national or primary regional roads, and have access to communal capitals and areas populated by over 1,500 habitants.
- Class D and E: Primary and Secondary Communal Roads are roads not classified as national or regional roads.

The road network classified by the Class A, B and C is called the basic network. In 1998, the total length of public roads was 79,200 km, while the basic network was composed of 23,382 km, accounting for 30% of the total (Table 10.1.1). Figure 10.1.1 shows the basic network that is dominated by the north-south stretch of Route 5, due to the long and narrow shape of the nation.

Figure 10.1.2 shows regional road length by surface type. Since the mid-1980s, the Government has given approximately of total infrastructure investment to the road sector, emphasizing road improvement rather than road construction. As a result, the total length of asphalt or concrete paved road increased approximately 1.5 times from 8,812 km in 1982 to 14,516 km in 1998. Nevertheless, the paved road ratio still remains low at 18.3%.

Table 10.1.1 Road Length by Category in Year 2000

Category			Length(Km)
Basic Network	(A)	National Roads	6,610
	(B)	Primary Regional Roads	7,198
	(C)	Secondary Regional Roads	9,574
Subtotal			23,382
Communal Network	(D)	Primary Communal Roads	24,495
	(E)	Secondary Communal Roads	31,323
Subtotal			55,818
Total			79,200

Source: MOP, Direccion de Vialidad

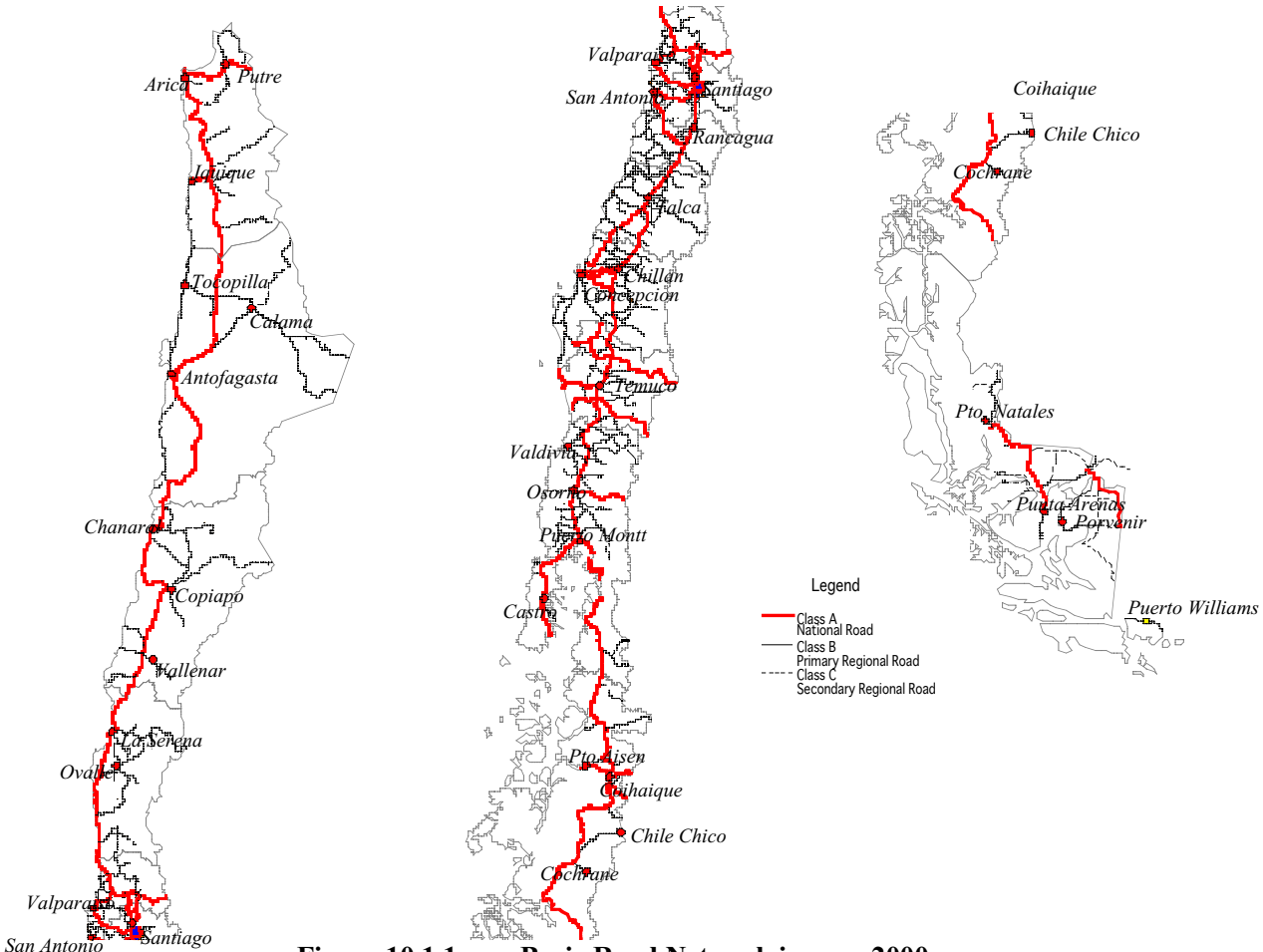


Figure 10.1.1 Basic Road Network in year 2000

Source: MOP, Dirección deVialidad

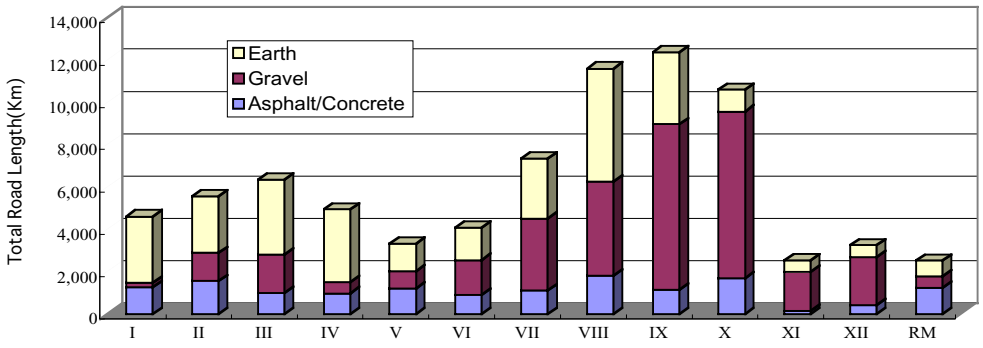


Figure 10.1.2 Road Length by Region in 1998

Source: MOP, Dirección de Vialidad

10.1.2 Port

There are more than 70 cargo ports in Chile along its coastline of 5,000 kilometers. Out of these, there are 36 ports commercially used, of which 11 ports are owned and administrated by the public enterprise, Emporchi (Empresa Portuaria de Chile) and 25

ports are private as indicated in Figure 10.1.3. The others are specialized ports, concentrating primarily in minerals and petroleum.

Emporchi was established in 1960 to undertake port charge collection for the Port Exploitation Service under the Ministry of Service. In the 1980s, the public ports underwent a series of restructuring, including the transfer of all operations (other than warfare and storage) by publicly owned ports to private stevedoring companies under concession agreements. Emporchi maintains ownership of port infrastructure and coordinates the various users of port installations. Between 1981 and 1989, efficiency of port works improved significantly due to this reform.

Law 19452, promulgated in December 1997, further promoted the privatization policy for public ports through the concession system. This policy stated that public ports under Emporchi would become independent as autonomous enterprises administrated by the executive boards assigned by the President. Each new port company would be operated by the private concessionaire companies selected and contracted through international open bidding. Afterwards, the company would be in charge of each new investment. As of June 2000, five companies have been established and started operation for the ports of Valparaíso, San Antonio, Talcahuano, San Vicente and Antofagasta.

Thus, the Chilean public ports entered the second stage of drastic reform. Each company, aiming at modernization and higher efficiency under the competitive port business environment, will conduct new investments. Table 10.1.2 shows the main facilities of selected public ports owned by Emporchi as of June 2000.

Table 10.1.2 Main Facilities of Selected Emporchi's Ports

EMPORCHI	Berth		Facilities
Port	No.	(m)	
Arica	6	1,024	6 cranes, 2 tanker terminals, container depot(1,600TEU)
Iquique	6	1,128	3 container berths with railway access, no crane
Antofagasta	7	1,572	6 cranes(all out of order), container depot(3000TEU)
Valparaiso	8	2,005	2 container berths, 7 cranes, container depot(4000TEU)
SanAntonio	9	2,005	3 container berths, 16 cranes(2 gantry cranes), container depot(1800TEU)
Talcahuano	2	360	2 cranes, 1 floating crane(ouned by Navy), 2 dry dock, 1 floating dock
San Vicente	2	603	2 mobil cranes, container dopot(1200TEU)

Source: Emporchi, 2000

EMPORCHI	Berth		Max water	Capacity
	No.	(m)	Depth(m)	Mill. t/yr
Arica	6	1024	9.40	2.00
Iquique	6	1128	9.30	1.50
Antofagasta	7	1572	11.25	5.00
Coquimbo	2	378	9.37	1.00
Valparaiso	8	2005	9.49	5.50
SanAntonio	9	2005	9.49	8.10
Talcahuano	2	360	8.84	0.70
San Vicente	2	603	12.19	2.00
Puerto Montt	2	385	10.40	1.00
Chacabuco	2	131	10.00	0.80
Punta Arenas	4	542	7.92	0.60

For Public Use
Tocopilla
Mejillones
Caldera
Ventanas
Oxiquim
Lirquen
Penco
Molo 500
Muelle CAP
Puchoco
Jueles
Coronel
Calbuco
B.gregorio

For Private Use
Patillos
Mitilla
Coloso
Chnaral
Huasco
Guayacan
Quintero
Las Salinas
TP.San Vicente
Cabo Negro

Figure 10.1.3 Location and Capacity of Main Ports in Chile

Source: JICA Study Team

10.1.3 Railway

The Chilean railway network is composed of lines owned by the State Railway Company (EFE) and several privately owned lines as shown in Table 10.1.3 and Figure 10.1.4. The latter includes railways of the Antofagasta - Bolivia Railway, Ferronor and several independent lines owned and operated by mining companies.

Since some thirty years ago, most railway lines have gradually been loosing demand, especially in cargo transport, due to severe competition against road transport. In spite of numerous measures to improve EFE's financial position undertaken by the Government such as raising tariffs and eliminating subsidies, reducing the number of staff, phasing out uneconomic lines, contracting maintenance work to private contractors and selling assets, its accumulated debt exceeded US$ 10 billion.

The Government decided to privatize the State Railway's operation in 1990 and enacted the law in August 1992, under which EFE would own the infrastructure, while private companies would undertake the operation of the passenger and freight trains. As of July 2000, freight transport of each line has been completed and passenger transport will follow.

Table 10.1.3 Railway Lines and Locomotives in Chile, 1998

Railway Line	Gauge (M)	Line Length(Km) Main Line	Branches	Locomotives Electrics	Diesel	Steam	Total	Personnel (person)
National Railway		2,208	221	46	53	3	102	1,965
1 Valparaiso - Puerto Montt and branches	1.676	1,879	201	46	42	3	91	1,949
	1.000	123	-	-	-	-	-	-
2 Arica - Visviri - Bolivia	1.000	206	20	-	11	-	11	16
Private Railway		3,487	538	5	101	0	106	1,002
3 Antofagasta - Ollague - Bolivia	1.000	800	128	-	40	-	40	531
4 Chuquicamata	1.470	30	63	-	4	-	4	26
	1.000	30	63	-	-	-	-	-
5 Tocopilla - Pedro de Valdivia	1.067	117	56	5	11	-	16	86
6 Minas El Romeral - Pto. de Guayacan	1.000	38	6	-	5	-	5	49
7 Algarrobo - Planta Pellets	1.000	86	5	-	6	-	6	43
8 Potrerillo - Diego de Almagro - Chanaral - Barquito	1.000	153	47	-	7	-	7	63
9 Ferronor	1.000	2,233	170	-	28	-	28	204

Source: Estadistica de Transporte y Comunicaciones,1998

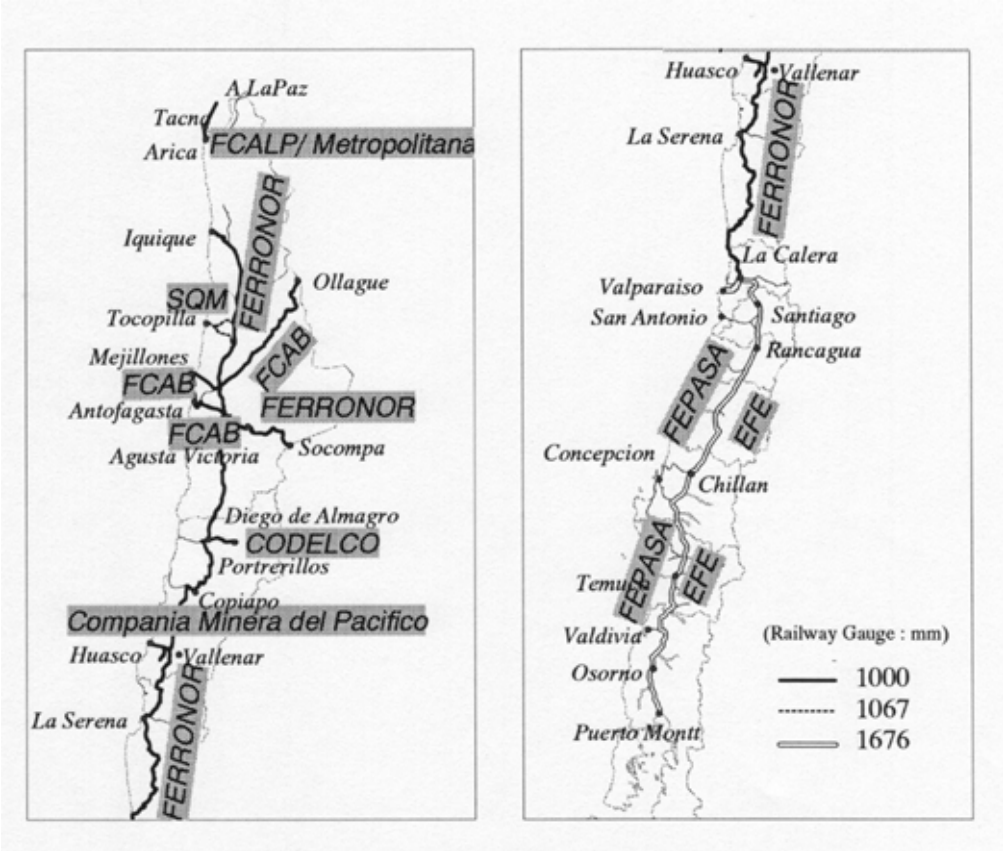


Figure 10.1.4 Railway Network as of year 2000

Source: JICA Study Team, 2000

10.1.4 Main Issues

- Due to continuous and vigorous investments and a resolute policy for privatization by the Government, road conditions have been much improved since the early 1980s. However, the ratio of improved sections and/or paved sections is still low on the entire network.
- The establishment of Trans-Andes routes or bi-oceanic routes is one of the important and challenging issues needed to expand the Chilean economy. At this moment, there is no route properly developed with respect to pavement, alignments, gradient, installation of safety devices and snow proofing.
- Most of the ports are not well equipped with cargo handling machinery, especially enough to cope with rapidly progressing containerization. However, each port company has a future investment plan in this area.
- Several important ports such as Valparaíso, Talcahuano and Antofagasta lack proper access routes. It is difficult to improve their accessibility due to the fact that urban areas surround them.
- Chile is one of the few countries that has successfully advanced privatization in the transport infrastructure sector. In the past decade, roads, ports and airports were significantly improved. On the down side, however, the following list of disadvantages related to the concession system should be carefully monitored and proper measures should be taken when necessary.

    1) Private capital tends to flow by its nature, seeking higher profit. As a result, gaps of improvement level between profitable and less profitable facilities will expand which may also expand regional or sectoral disparities.

    2) Private capital favors short-term recovery. Therefore, a huge-scale project such as the Mejillones Port Complex Development will be difficult to attract the private sector, without public initiatives for basic infrastructure.

- Although concessionaires are obliged to report their operational and financial performance to the Government, it will become more difficult to assemble and compose transport statistics, unless the Government establishes a proper system with an adequate budget.

10.2 Transport Demand Structure

10.2.1 Trend of Transport Demand and Modal Share

(1) Import and Export

The total transport volume including imports and exports in 1999 was approximately 65 million tons, of which about 60% or 38 million tons was exporting cargo. As for the modal share, maritime transport is predominant, handling approximately 90% of total tonnage. The share of road transport is only 8% of total transportation, however, the growth is remarkably high if one refers to the share of 5% in 1990. On the other hand, the share of railway transport is only 1% at present, with a decreasing tendency in modal share (Refer to Table 10.2.1).

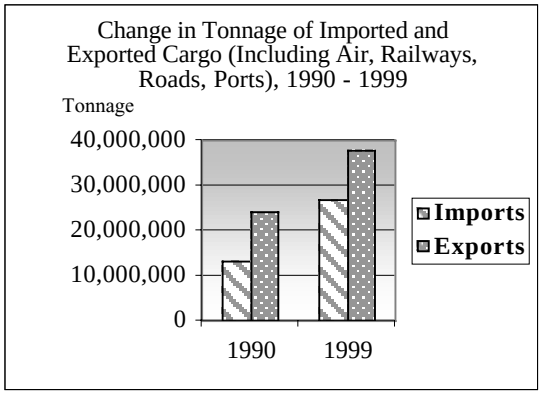
Table 10.2.1 Total Import and Export by Transport Mode

	Total Import / Export (ton)		Modal Share (%)	
	1990	1999	1990	1999
Airports	96,509	228,201	0.3	0.4
Railways	605,676	631,521	1.6	1.0
Roads	1,852,494	5,377,265	5.0	8.3
Ports	34,633,295	58,306,944	93.1	90.3
Total	37,187,974	64,543,931	100.0	100.0

Source: Estadística de Carga Transportada Comercio Exterior,1999, Cámara Marítima y Portuaria de Chile A.G.

From 1990 to 1999, the total tonnage of imports has doubled, with a higher growth rate compared to the growth of exports (Refer to Figure 10.2.1, Figure 10.2.2).

The import cargo value per ton in 1999 is estimated at US$ 593, which is higher than the export cargo value of US$ 463/ton. However, it is noted that the value of export cargo per ton has increased as much as 1.6 times during the last nine years, while the value of imports has a decreasing tendency. This fact implies that Chilean exporting goods have been more value added products; suggesting that the export growth in monetary term is much higher than the large increase in volume.



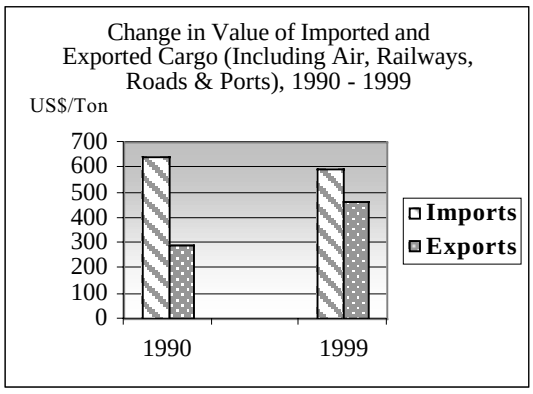


Figure 10.2.1 Trend of Import/Export **Figure 10.2.2 Cargo Value per Tonnage**

Source: Cámara Marítima y Portuaria de Chile (Estadísticas de Carga Transportada en Comercio Exteriror)

(2) Domestic Cargo

As for domestic cargo, road transport has the dominant share, accounting for approximately 57% of total domestic transport (ton-km). Road transport has increased

at about 6% per annum during the past several years, owing to vehicle registration and the increased length of paved roads. Coastal shipping also plays an important role, accounting for approximately 37% of domestic transport, with an increasing tendency in terms of ton-km from 1997 (Refer to Figure 10.2.3).

On the other hand, railway transport has continuously decreased in terms of the modal share. However, the ton-km statistics remain at more or less a constant level.

Mode	million ton - km	(%)
Road	24,813	56.7
Railway	2,650	6.1
Coastal Ship	16,233	37.1
Air	53	0.1
Total	43,749	100.0

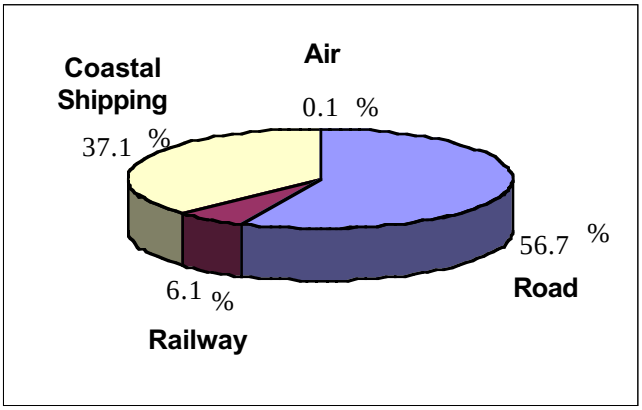


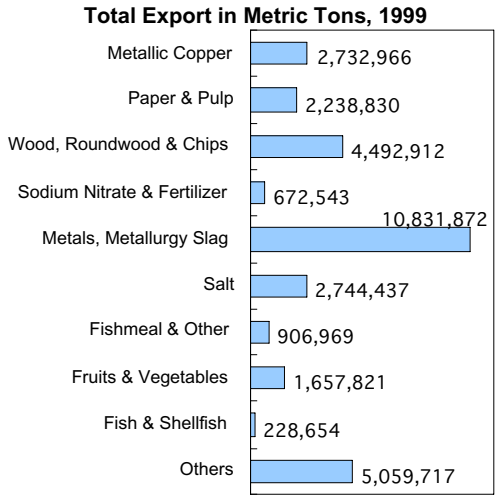
Figure 10.2.3 Domestic Transport Modal Share in ton-km in 1998

Source: Anuario de Transporte y Comunicaciones 1998, Estimated by study team.

10.2.2 Main International Cargo Movements and Transport Corridors

(1) Main Import/Export Goods

As shown in Figure 10.2.5, the main importing goods in terms of tonnage are solid and liquid fuel, cereals/flour meal, chemical products, etc. On the other hand, the main exporting goods are mineral products including copper and nitrate, wood/wood chips, salt and fruits, etc.



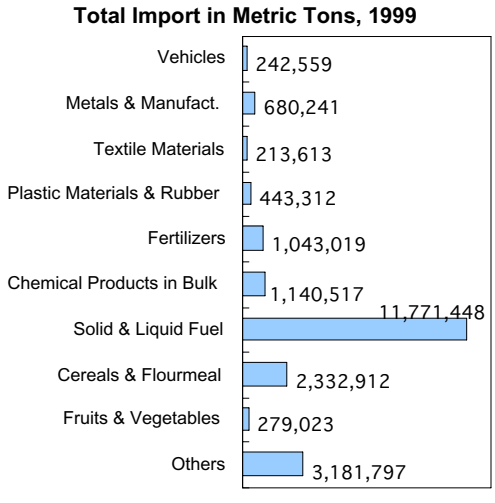


Figure 10.2.4 Main Exporting Goods **Figure 10.2.5 Main Importing Goods**

Source: Cámara Marítima y Portuaria de Chile (Estadísticas de Carga Transportada en Comercio Exterior)

(2) International Cargo Movement

Figure 10.2.6 shows the movement of international cargo with Chile in 1999. The largest volume is observed in the central zone, consisting of Regions IV, V, and the Metropolitan Region. In addition to the imports and exports of about 22 million tons through the ports in the central region (San Antonio, Valparaíso, etc.), bi-lateral trade between Chile and Argentina accounts for approximately 2.3 million tons, while the transit of cargo to/from Argentina via trans-Andes routes accounts for about 250,000 tons.

As for the northern region, the relationship with Bolivia is remarkably high compared to other countries. It should be emphasized that the transit of cargo of about 1.2 million tons passes through the ports in the northern region (Antofagasta, Arica, etc.) to/from Bolivia.

(3) Transport Corridors

The transport corridors for major exporting goods from the production area to the main ports are illustrated in Figure 10.2.7. The total volume of the following three commodities accounts for approximately two thirds of total national exports.

a. Copper and Other Mineral Products

Copper and other mineral products are the predominant exporting goods, amounting to a total of 1.3 million tons per year. These products are mainly produced in Region II and transported by either railway or road to the nearest main ports such as Antofagasta.

b. Wood and Wood Chips

Wood and wood chips are mainly produced in Region XIII and IX. Wood is transported to major cities in the region (Concepción, Temuco) and later processed and exported through the ports of San Vicente, Puerto Montt, etc.

c. Fruits and Vegetables

Fruits and vegetables for export are produced in an extensive geographic area ranging from Region IV to Region IX. The main exporting ports are Valparaíso and San Antonio. Valparaíso, for example, handles approximately 1.1 million tons per year.

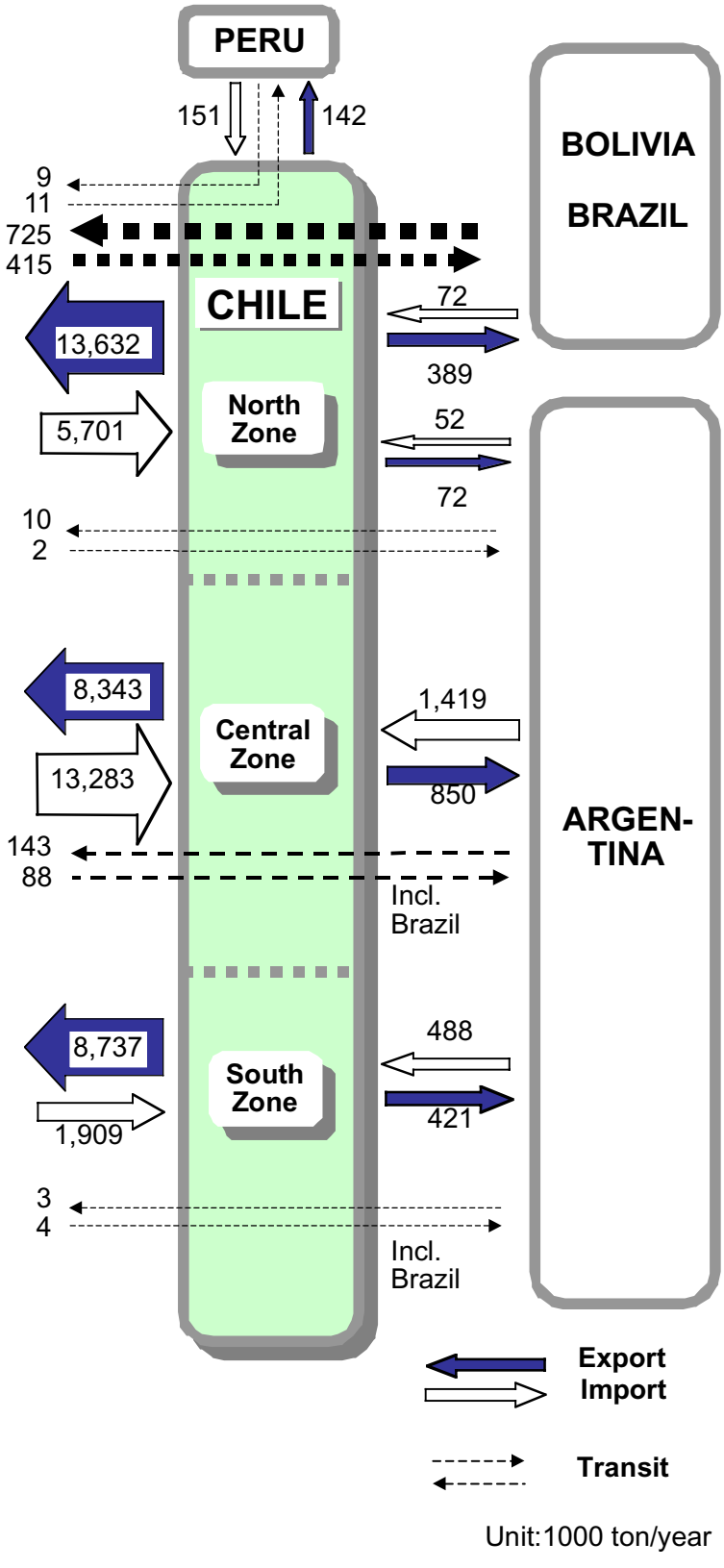


Figure 10.2.6 International Cargo Movements in 1999

Source: Camara Maritima y Portuaria de Chile A.G. Aduana in Valparaiso, Trafico Terrestre Avanzadas Fronterizas

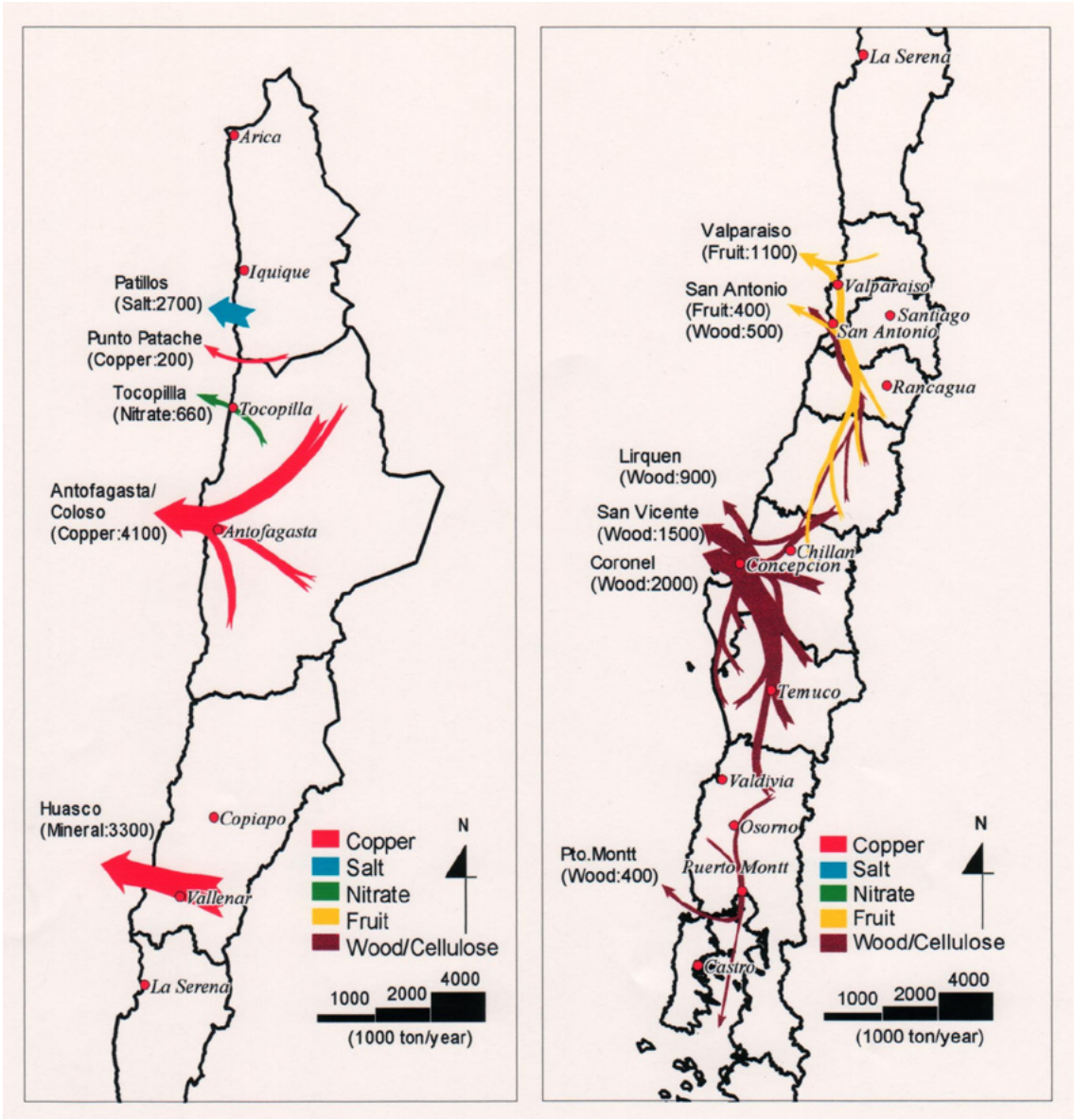


Figure 10.2.7 Main Transport Corridors

Source: Camara Maritima y Portuaria de Chile (Estadisticas de Carga Transportada en Comercio Exterior), CODELCO, Study Team

10.3 Transport Development and Investment Plan

10.3.1 Past Investment in Transport Sector

The past trend of public investment, according to data from MIDEPLAN ("Evolution and Structure of Public Investment in Chile", November 1999), is shown in Figure 10.3.1. Reflecting vigorous economic growth, the total amount of public investment had been increasing beginning in the early 1990s at a high rate of 13% per annum. Since 1997, however, the increasing trend has begun to level off ranging from 1,800 to 1,900 billion pesos at the value of 1998 pesos. This is due partly due to the Asian financial crisis that began in 1997.

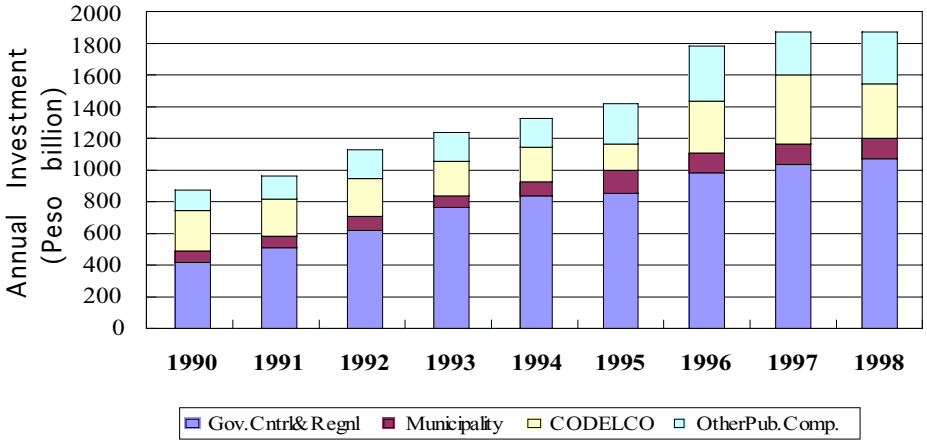


Figure 10.3.1 Trend of Public Investment in Chile
Source: MIDEPLAN "Evolution and Structure of Public Investment in Chile", 1999

Table 10.3.1 shows the distribution of public investment among various sectors. The share of the transport sector has historically been dominant, reaching as high as 45%. This statistic is followed by the housing and urban development sector that accounts for 21% of the total. Together, these top two sectors represented two thirds of the total. Investment towards the water supply sector has also been significant, accounting for 10% of the total.

Table 10.3.1 Public Investment by Sector

(Million Pesos at 1998 price)

Sector	1995	1996	1997	1998	1995 - 98 Total	
					Amount	%
1 Transport	435,350	583,924	566,966	597,993	2,184,233	45.4
2 Housing & Urban Development	247,075	256,067	245,040	242,856	991,038	20.6
3 Health	62,329	65,595	60,896	56,080	244,900	5.1
4 Water Supply	101,566	103,691	124,402	143,460	473,119	9.8
5 Education and Culture	24,390	43,985	36,392	57,730	162,497	3.4
6 Others	162,142	158,458	208,849	221,993	751,442	15.6
Total	1,032,852	1,211,720	1,242,545	1,320,112	4,807,229	100.0

Source: MIDEPLAN "Evolution and Structure of Public Investment in Chile" ,1999

Approximately half of total investment in the transport sector was assigned to the road sub-sector, while 20% was used for urban roads as shown in Table 10.3.2. Investment by various public companies or by MOP to other modes such as air, railway, river and

lake transport has been limited. From the 14.1% representing "others," the Concession System Administration of MOP invested approximately 6%. This percentage was used for land acquisition, financial inspection, IVA payment, subsidies and the implementation of studies.

Table 10.3.2 Public Investment in Transport Sector

(Million Pesos at 1998 price)

Sector	1995	1996	1997	1998	1995 - 98 Total	
					Amount	%
1 Road	210,105	271,841	293,666	291,163	1,066,775	48.8
2 Urban Road	100,248	119,379	109,522	117,845	446,994	20.5
3 Public Companies	71,028	127,602	66,009	98,569	363,208	16.6
4 Others	53,969	65,102	97,769	90,416	307,256	14.1
Total	435,350	583,924	566,966	597,993	2,184,233	100.0

Source: MIDEPLAN "Evolution and Structure of Public Investment in Chile" ,1999

Note: Others include public works for port, air aviation, airport and concessions.

Investment in the road sub-sector equaled 291 billion pesos in 1998. As demonstrated in Figure 10.3.2, more than 40% of the total was allotted to national roads, followed by municipality roads (29%) and regional roads (24%). National roads have a more advanced design standard compared to others and, therefore, the cost per km is higher. On the other hand, municipality roads are less expensive to construct or improve; however, its total length is more than 80,000 km. Receiving 29% of the total, some 400 km of municipality roads are paved annually.

In the road sub-sector, about 90% of investment is used for maintenance, realignment and repair of existing roads, 8% for new road construction and 2% for others. In the case of the urban road sub sector, 58% is spent on new roads and 41% on existing roads.

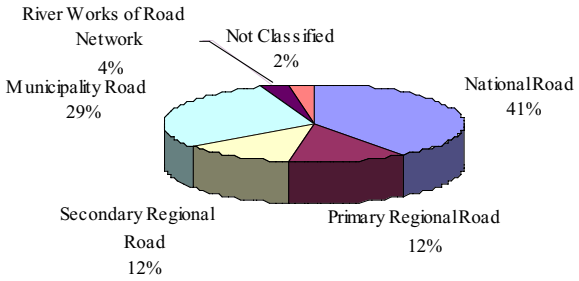


Figure 10.3.2 Public Transport in Road Sub-sector by Road Class in 1998

Source: MIDEPLAN "Evolution and Structure of Public Investment in Chile", 1999

10.3.2 Current Investment Plan

In April 2000, Ricardo Lagos was inaugurated as President, succeeding ex-President Eduardo Frei. In accordance with customs, he started to establish an investment plan for the following six years. The infrastructure portion of the plan is currently under final adjustment between MOP and local Governments and reportedly, will be published shortly.

The plan is composed of three parts: long-term guideline aiming at 2020, medium-term plan at 2010 and action plan for 2000 to 2006. The basic policy and main projects were already referred to in the President's inauguration account before the plenary congress. The contents on transport are summarized as follows:

(1) Basic Policies

Privatization

In order to widen and improve the national highways, association with private investors will continue. Historically, this policy has been successful in Chile.

Decentralization

The Government will continue to increase regional decision investment until it reaches at least 50% of total public investment. In addition, the decentralization of investment with a local impact will continue by shifting functions to the municipalities. In order to ensure good performance of municipal finances, the Municipal Revenues Law should be amended so as to decrease the immense resource gap between the wealthy and poor municipalities.

Physical Integration of National Land

To physically integrate the territory, the quality of the road net of 80,000 km should be improved, while a road length of 13,000 km should be paved. In addition, the communal capitals should be connected with the provincial capitals by means of a paved road.

(2) Main Road Projects

Widening to Four lane road by the Concession Scheme

La Serena – Caldera
Caldera – Antofagasta
Antofagasta – Arica

New Road Construction

Cartagena – Algarrobo
Los Andes – the ports in RegionV
Pelequen – San Antonio

Coastal Road Construction

Pisgua – Tal Tal
Tal Tal – Sicuncho – Huasco
Huasco – La Serena

Development of Precordillera Route

Development of International Route

Paving of four border crossings (in addition to the existing 5 crossings)

Urban Development

Improve pollution (Santiago, Concepción)
Mitigate congestion (Santiago, Rancagua, Curico, Tarca, San Fernando, Valdivia)
Improve and preserve urban scenery (Valparaíso, Antofagasta)
Develop cruising ports (Arica, Iquique, Puerto Montt, Punta Arenas)
Develop service functions (San Antonio)

(3) Port Development

Most major ports are already administrated and operated by the private concessionaires. Later, the Concessionaires, in accordance with the concession contracts, will administer future investment in infrastructure and equipment. Table 10.3.3 shows investment by port planned for the next decade.

The Port of Arica plans to invest a total of US$ 25 million for an improved berth, the construction of a grain terminal and new equipment. The Port of Iquique will invest around US$ 50 million, of which US$ 30 million will be used for infrastructure, while the remaining will be invested in equipment.

For the other ports, investment amounts are estimated based on the terms of contract. This assumes that average economic growth will be 5% in the next 10 years, while the elasticity of trading volume to GDP will equal 1.3. Cargo will then increase at 6.5% per annum from 53 million tons in 2000 to 100 million tons in 2010.

Table 10.3.3 Investment in Port Sub-sector during 2000 - 2010

Port	Investment (US$ Million)		
	Private	Public	Total
Valparaíso	90		90
San Antonio Frente Norte	20		20
San Antonio Molo Sur	100		100
San Vicente	44		44
Talcahuano		10	10
Mejillones	104		104
Mejillones (2nd Stage)	100		100
Mejillones (4th Berth)	17		17
Iquique	50		50
Arica	25		25
Other Ports		70	70
Total	550	80	630

Source: Emporchi and Concessionaire Companies

Total investment in the port sub-sector is estimated at US$ 630 million for the next decade. This corresponds to about 85% of the US$ 747 million that was invested in the last decade.

(4) Railway

As in the past decade, actual investment in the railway sub-sector was very limited and, therefore, there are many projects carried over to this century. The major existing projects are as listed in Table 10.3.4. Most of them are considered socially feasible with enough economic benefit such as the reduction in passenger travel time, decentralization of the urban population and mitigation of urban traffic congestion and air contamination.

Table 10.3.4 Existing Railway Projects

Project	Investment (US$ Million)	Financial Source
Merval 4th Stage (Valparaíso Regional Metro)	300	State Company
Santiago – Valparaíso Rapid Train North Corridor Central Corridor	 750 900	Private Sector
Metropolitan Region Suburban Train Santiago Melipilla Train Santiago – Til Til Train	 170 – 200 250	Private Sector
Travel time reduction between Santiago – Chillan and Chillan – Temuco	111	State Company
Santiago – Rancagua improvement	n.a.	State Company
Rancagua – San Fernando extension	n.a.	State Company
Talcahuano – Chiguayante improvement	n.a.	State Company
Transport of sulfuric acid	25	Private Sector

10.3.3 On-going and Committed Projects

(1) Road projects

Major roads have been developed within the framework of the concession program ever since the approval of the concession law in 1991. This policy is likely to continue to the next decade as well. Accordingly, most major road projects will be undertaken by using the concession scheme whenever it is applicable. The on-going projects are shown in Table 10.3.5 of which international roads, including the trans-Andes route, are described in more detail in Section 10.4.2. The major road under construction is the widening of Route 5 into a 4-lane road, which is expected to finish in 2003. The other major projects under plan are as follows.

a. Coastal Road Construction

The project intends to provide better access for the scattered cities along the coastal area from Antofagasta to the central region and from Concepción to the southern parts of Chile. The road is also expected to function as an alternative route of Route 5.

b. Los Andes - Valparaíso

A new highway will be built providing better access from Cristo Redentor to the major ports in Chile by constructing a bypass along the north bank of the Aconcagua River.

Table10.3.5 Major Road Development Projects

No	Road Projects	Length (km)	Investment (US$million)	Present Status	Concession or Gov't	Scheduled yr of Operation
1	Route 5 (La Serena-Los Vilos)	225	245	construction	concession	2001
2	Route 5 (Santiago-Talca)	266	650	construction	concession	2002
3	Route 5 (Chillan-Collipulli)	160	210	construction	concession	2003
4	Route 5 (Collipulli-Temuco)	171	226	construction	concession	2003
5	Route 5 (Temuco-Rio Bueno)	171	190	construction	concession	2003
6	Route 5 (Rio Bueno-Puerto Montt)	114	24	construction	concession	2000
7	Rehabilitation of La Selena - Cabildo	396	n.a.	construction	Gov't	2002
8	Rehabilitation of Altamira - Copiapo	170	n.a.	construction	Gov't	2002
9	International Highways (16 routes)	-	n.a.	construction	Gov't	n.a.
10	Central Coastal Road network	24	78	bidding prepar	concession	n.a.
11	North-West Access to Santiago	21	770	bidding prepar	concession	n.a.
12	Milipilla Bypass	-	5	bidding prepar	concession	n.a.
13	Route 60 Ch, Los Andes-Valparaiso	-	188	under study	concession	n.a.
14	Route 66 Ch. Camino de la Fruta	135	100	bidding prepar	concession	n.a.
15	Rehabilitation of North Route 5	1603	n.a.	under study	concession	n.a.
16	Route 5 (Arica-Iquique) Widening	250	175	under study	n.a.	2020
17	Coastal Rd.(Antofagasta - Taltal)	213	96	under study	n.a.	2010
18	Coastal Rd.(Caldera - La Higuera)	290	169	under study	n.a.	2010
19	Coastal Rd.(Concepcion - Valdivia)	429	113	under study	n.a.	2010
20	Coastal Rd.(Valdivia - Maullin)	250	175	under study	n.a.	2020
21	Chacao Channel Bridge	7	300	under study	concession	n.a.
22	Mejillones-Calama	160	n.a.	under study	n.a.	n.a.
23	North-bank of Bio bio	15	177	construction	concession	2002
24	East-West System , Santiago	38	286	construction	concession	n.a.
25	North-South System Santiago	61	440	bidding prepar	concession	n.a.
26	Americo Vespucio System, Santiago	26	250	bidding prepar	concession	n.a.

Source: MOP, The Chilean Concessions System Project, 1999-2001.

(2) Port Projects

Based on Law 19452 in 1997, the 10 major public ports have been independently administrated by the Empresa Portuaria de Chile. Each port has made a master plan and an implementation schedule. The master plan with the target year being 2015 is realized by almost exclusively using the private fund within the concession program little by little. Among the ten ports, the ones that have been granted a concession are San Antonio, Valparaíso, San Vicente/Talcahuano and Iquique. For other ports, the bidding preparation work or review of the contents of the project remains on going (Table 10.3.6).

Table 10.3.6 Port Development Plan (Master Plan)

No	Port	Main Terminal		Other Terminals		Total Project Cost (US$million)	Present Status
		Terminal Facilities	Equipments	Terminal Facilities	Others		
1	Arica	Deepening of draft 12.5m, Expansion of Terminal Area 4ha.,Warehouse	Mechanical Transfer System	Repare of 2 Berths, Dredging 12m	Instalation of 2 Gantry Cranes	181.9	No bidding has been made
2	Iquique	Development of 3 berths,Deepening 12-14m,Container yard 6ha.	Installation of 4 Gantry Cranes	Seismic Reinforcement, Extension of site, Dredging 12m	Pavement of back area berth	112.6	Concession started in 2000
3	Antofagasta	Widening of wharf area, Dredging 15m, Extension of breakwater 300m	Installation of 2 gantrycranes, mechanical handle system	Change into Cruise Terminals, Turism Area	Park for public	under study due to the change of master plan	under study
4	Mejillones	Construction of 3 berths(General cargo,containers), max draft 12.5m	Equipments with max.capacity 100 tons	Construction of additional berth 250m, max draft 12.5m	Mechanical Transfer system	122	D/D:2000, Construction: 2001 - 2002 by concession
5	Cquimbo	Construction of new berth of 250m with 12m in depth	n.a.	Rehabilitation and pavement 1.2ha.	n.a.	20.85	Preparation of concession
6	Valparaiso	Remodeling of container berths 620m with 12.5 m in depth	Installation of 4 gantry cranes	Construction of new container berths 650m with depth 15.5m	Construction of breakwater 900m, 5 gantry cranes	428.1	Concession of main terminal started in 1999
7	San Antonio	Widening of wharf by reclamation, construction of new inner whalf (container)	Installation of 6 gantry cranes	Construction of 3 berths 720m, yard 8 ha.	Installation of 4 gantry cranes, new backyard, warehouse	308.9	Concession (multi-operation) started in 1999
8	San Vicente /Talcahuano	Terminalexpansion by backfill/dredging with 12m depth, 4ha.	n.a.	Construction of new berth 600m&200m with depth 12-14m, yard 7.4ha.	Extension of breakwater, 2 gantry cranes	167.5	Concession started in 2000
9	Pto.Montt	Extension of wharf 35m, yard 770m2, dredging	n.a.	Construction of bulk cargo terminal, depth 10m	Widening of access canal	18.3	Preparation of concession
10	Chacabuco	Construction of new berth of 200m with 10m in depth	n.a.	Construction of berth by backfill/dredging	n.a.	27	Preparation of concession
11	Pta.Arenas	Extension of pier: 200m, yard: 1ha.	n.a.	Extension of pier: 150m, yard: 1ha.	n.a.	22	Preparation of concession

Source: Empresa Portuaria de Chile

In the case that the condition of the concession does not include the implementation of all the projects described in the master plan, Empresa Portuaria of each port needs to either make another concession or revise the master plan itself.

(3) Railway project

As for railway development projects, the aim is to primarily improve passenger transport, particularly the development of new railways for commuters in the Santiago vicinity. The project for freight transport is the re-operation of the section between San Antonio and Los Lorios for transporting sulfuric acid produced at CODELCO in Caletones. A private transport company has signed a contract with CODELCO to transport the sulfuric acid with an expected volume of 1.2 tons per year by investing US$25 million for the railway track rehabilitation.

Table 10.3.7 Railway Development Projects

Project	Summary of the Project	Total Investment	Status	Start of Operations
1. Fast Train Santiago – Valparaiso (Private Investment)	Construction and operation of a railway system of high velocity between Valparaiso and Santiago. There will be a north passage and a central passage. The time of travel will be 60 minutes.	US $1,650	Under study	n.a.
2. Train Santiago – Melipilla (Private Investment)	Construction of a new system for the transport of passengers between Santiago and Melipilla. The travel time will be greatly reduced and the project will directly benefit 8 communities. Max velocity will be 140 km/hr, with the capacity of transporting 500 passengers. 7 new stations will be constructed.	US $170 m to $200 m	Under study	2004
3. Train Santiago – Til Til (Private Investment)	Construction of a system for the transport of passengers between Santiago and Til Til. Estimated demand for passengers for the first year of operation is 31 million, this figure will grow 4% annually.	US $50 m	Under study	2006
4. Reduction in Travel Times: (State Investment)		US $37 m	Under study	End of 2001
a. Santiago – Chillan	Improvement of the track and the acquisition of 5 new trains in order to reduce the travel time from 5 hours 30 minutes to 4 hours 15 minutes.	US $37 m		
b. Chillan - Temcuo	Improvement of the tracks and the incorporation of 2 new trains. This will allow for a reduction in the travel time from 12 to 9 hours	US $37 m	Under study	End of 2002
c. Metrotrain Extension Santiago – Rancagua, until the city of San Fernando	The construction of a double track with concrete crossties and incorporation of 2 new box cars.	US $37 m	Under study	2001
5. Transport of Sulfuric Acid (Private Investment	Creation of a passage between Los Lirios until San Antonio – Barrancas (5th Region), including the rehabilitation of the tracks and the acquisition of equipment. It is expected that 1.2 million tons of sulfuric acid will be transported annually.	US $25 m	Under study	January 2001

Source: EFE

10.4 Current Issues for Transport Development

10.4.1 Transport Development and Regional Economy

(1) Road Density

Chile with land area of 756,626 km^2 has an inter-urban road network of approximately 70,000 km in length. Its average road density is 104 m/km^2. Paved road density is about 20 m/km^2. The highest density of paved road is observed in Metropolitan Region at 80 m/km^2, followed by Valparaíso Region at 74 m/km^2. Regions VI to X are in the range of 25 to 50 m/km^2 and the figures for other regions are less than 25 m/km^2. These levels of paved road density do not seem high enough to support a balanced development of the national land.

Although a simple comparison is meaningless because of the differences in socio-economic conditions, take Japan as an example. Japan has national land about half of Chile's and yet it keeps a 270,000-km road network. Its average road density is 730 m/km^2.

Table 10.4.1 Road Density by Region

Region		Area (km^2)	Population in 1998	Road Length(km)				Road Density	
				Asphalt/ Concrete	Gravel	Earth	Total	Paved Rd. (m/km^2)	All Road (m/km^2)
I	Tarapaca	58,698	386,226	1,260	217	3,145	4,622	21.5	78.7
II	Antofagasta	126,444	456,083	1,561	1,332	2,670	5,563	12.3	44.0
III	Atacama	75,573	264,464	1,001	1,824	3,535	6,360	13.2	84.2
IV	Coquimbo	40,656	561,665	984	540	3,433	4,957	24.2	121.9
V	Valparaiso	16,396	1,525,494	1,206	831	1,281	3,317	73.5	202.3
VI	Bernaldo O'higgins	16,365	768,663	903	1,662	1,525	4,089	55.2	249.9
VII	Maule	30,302	898,418	1,115	3,417	2,827	7,358	36.8	242.8
VIII	Bio Bio	36,929	1,895,160	1,828	4,431	5,359	11,618	49.5	314.6
IX	Araucania	31,858	855,585	1,145	7,833	3,401	12,379	35.9	388.6
X	Los Lagos	66,997	1,039,478	1,701	7,879	1,024	10,605	25.4	158.3
XI	G. Carlos Ibanes del Campo	109,025	92,214	158	1,840	553	2,551	1.5	23.4
XII	Magallanes	132,034	155,274	420	2,274	556	3,250	3.2	24.6
RM	Metropolitana de Santiago	15,349	5,922,990	1,234	550	746	2,530	80.4	164.8
Total		756,626	14,821,714	14,516	34,629	30,055	79,199	19.2	104.7

Source: MOP and INE

Note: Paved road includes asphalt and concrete paved road, not gravel road.

(2) Regional Competitiveness Index of Infrastructure

The Regional Development and Administrative Sub-secretariat of Ministry of Interior issues "*Regional Competitiveness Report*" annually where regions' comprehensive competitiveness is compared with each other, using a number of social and economic indicators. The report selects five indicators as variables which indicate the level of infrastructure development in the regions: road length per inhabitant, industrial capital stock per inhabitant, coverage ratio of water supply, sewage and housing. The infrastructure competitiveness index is expressed as the normalized sum of regional deviations of each variable. The indices listed in the 1999 report are shown in Table 10.4.2.

Region II shows the highest index value and the Metropolitan Region is the second highest, followed by Region V, Region XII and Region I. It may be noted that regions with comparatively high road density are ranked low here, while regions with lower density are generally ranked higher. This is because all the variables calculate the level of infrastructure stock per capita. The densely populated regions do not have infrastructure stock commensurate with its population.

Table 10.4.2 Competitiveness Index of Infrastructure

	Region	Industrial Capital (1000$/pax)	Road Network (Km^2/pax)	Deficit of Housing (%)	Coverage of Water Supply (%)	Coverage of Sewage (%)	Competitive-ness Index of Infrastructructure
I	Tarapaca	1,199	0.2726	14.9	95.4	91.2	0.79
II	Antofagasta	2,125	0.2806	21.3	99.0	95.0	0.96
III	Atacama	459	0.1574	10.9	93.4	89.6	0.61
IV	Coquimbo	177	0.1984	14.9	89.8	75.4	0.65
V	Valparaiso	530	0.3635	19.3	95.4	87.9	0.86
VI	Bernaldo O'higgins	264	0.2207	17.8	85.8	70.0	0.68
VII	Maule	466	0.1508	16.2	77.7	65.8	0.62
VIII	Bio Bio	1,162	0.1573	17.0	85.1	73.8	0.72
IX	Araucania	370	0.0925	10.3	70.8	65.5	0.49
X	Los Lagos	383	0.1604	14.6	69.6	64.5	0.59
XI	G. C. Ibanes del Campo	126	0.0621	14.8	88.6	75.2	0.62
XII	Magallanes	1,129	0.1291	17.1	94.5	94.3	0.81
RM	Metropolitana de Santiago	587	0.4875	19.7	99.0	91.9	0.94
	Max	2,125	0.4875	21.3	99.0	95.0	Threshold=
	Min	126	0.0621	10.3	69.6	64.5	1.00
	Data Source	INE(96)	MOP(98)	CASEN(98)	CASEN(98)	CASEN(98)	-

Source: Ministerio del Interior, SDRA, "Informe de Competitividad Regional"

(3) Infrastructure and Regional Economy

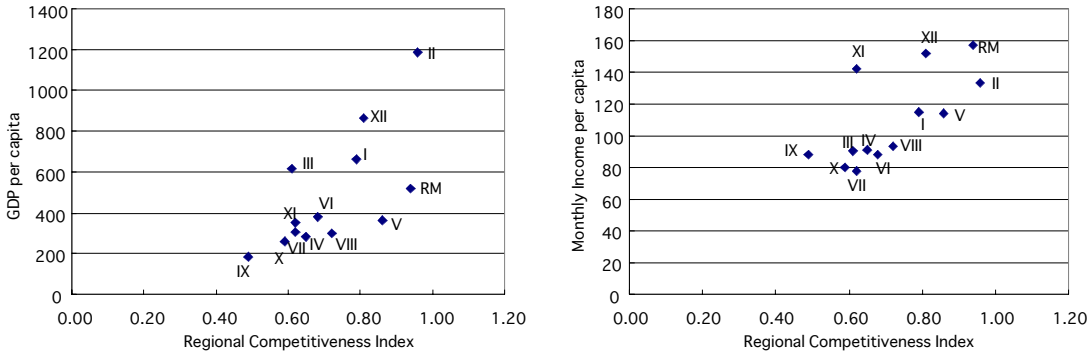
The aforementioned report of 1997 edition pointed out that “a strong correlation between infrastructure development and economic development has been duly documented in the investigations realized on the matter. Thus, roads, ports, telecommunication systems and related services are an integral part to the productive activities of a country. And also, preparations of housing, water supply and sewage are an essential part required by the population in the region” .

Figure 10.4.1 illustrates the relationship between the infrastructure competitiveness indices and one of the two economic indicators, regional GDP per capita and monthly income per capita. In both cases, a strong positive correlation is observed. As for the regional GDP per capita, a number of regions are distributed along the line connecting Metropolitan Region and Region IX. The correlation is remarkably strong. Regions I, II, III and XII are plotted far above the line, showing higher GDP per capita than the general cases. One possible explanation for this is the huge amounts of investment made in those regions for exploitation of mineral and non-mineral resources. However, in terms of monthly income per capita, Regions I, II and III do not stand out. This may be so because some of the value added generated in those regions flows back to the Metropolitan Region or abroad. By contrast, Regions XI and XII, which are less populated, show higher income per capita than other regions.

Transportation is one of the most important factors that influence the location of manufacturing industry. The relation of road density with industrial capital stock is shown in Figure 10.4.2, where a strong exponential correlation is seen. In this analysis, capital stock is expressed in million pesos per square kilometer. The Metropolitan Region has the highest capital stock (226 million pesos/km^2), followed by Regions VIII and V at 50 to 60 million pesos/ km^2.

Road condition is another important factor affecting industrial location but it is not a sufficient condition to decide the locations. Obviously, industrial operations require

materials, energy, water, labor force, ports and so on other than roads. Therefore, road development will not automatically induce capital investment. Nevertheless, it should be noted that road development is a necessary condition for industrialization as clearly demonstrated by Figure 10.4.2.



(1) Competitiveness Index vs. GDP per capita (1000 $ p.c.)

(2) Competitiveness Index vs. Monthly Income (1,000$ p.c.)

Figure 10.4.1 Competitiveness Index of Infrastructure and Regional Economy

Source: JICA Study Team

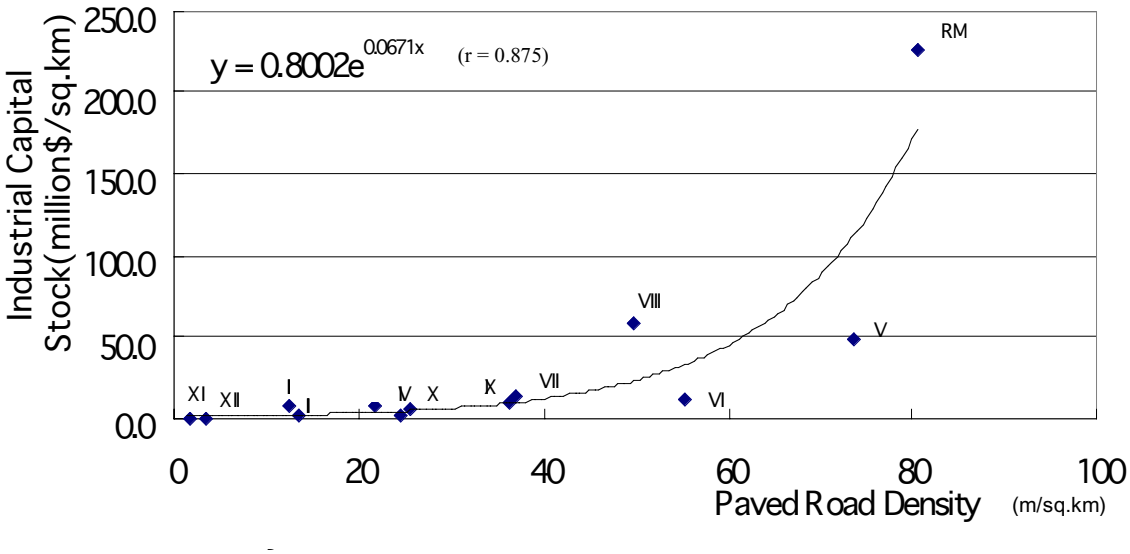


Figure 10.4.2 Road Development and Industrial Capital Stock

Source: JICA Study Team

10.4.2 Port Capacity and Containerization

(1) Port Capacity

According to EMPORCHI, estimates regarding the present capacity of each port are shown in Table 10.4.3. The case of Talcahuano/San Vicente, the actual handling volume has exceeded the estimated capacity, implying that the actual port efficiency might be slightly higher than the estimates demonstrate. Even so, however, the handling capacity should be expanded as quickly as possible.

The statistics for the other ports show that the actual demand does not yet seem to have reached its capacity. However, there are some ports where the demand is quite close to capacity when one considers seasonal or annual fluctuations. As for the Port of Valparaíso, the peak demand approaches approximately double the monthly average during the period of February to April due to the exports of fruit. For the Ports of San Antonio and Iquique, the actual volume has at one time reached estimated capacities in recent years. The expansion of the handling capacity is also urgently required for these ports. From 1999-2000, concessions were initiated for the ports of Valparaíso, San Antonio, Talcahuano/San Vicente and Iquique. The handling capacity is expected to increase by the expansion of the terminal facilities and installation of modern types of cranes and handling equipment. This will be done by the concessionaires in line with the master plan of each port.

Table 10.4.3 Port Capacity

Port	Present Situation				Future Situation by Masterplan		
	No. of Berth	Port Efficiency ton/hr-nave	Annual Capacity million ton	Cargo in 1999 million ton	No. of Berth	Port Efficiency ton/hr-nave	Annual Capacity million ton
Arica	6	68	2.00	1.36	8	163	6.4
Iquique	6	51	1.50	0.99	7	241	8.3
Antofagasta	7	145	5.00	2.70	8	181	7.1
Coquimbo	2	102	1.00	0.24	3	129	1.9
Valparaiso	8	140	5.50	3.72	12	285	16.8
San Antonio	9	183	8.10	6.49	14	297	20.4
Talcahuano/ San Viente	4	137	2.70	3.10	8	244	9.6
Pto. Montt	2	102	1.00	0.46	3	170	2.5
Chacabuco	2	61	0.60	0.08	2	153	1.5
Pta. Arenas	2	81	0.80	0.12	2	153	1.5
Total	48	120	28.20	19.25	67	231	76

Note: Coastal Shipping is not included.
Source: EMPORCHI, Cámara Marítima y Portuaria de Chile

Table 10.4.4 shows the present conditions of the availability of access routes to each port. In most cases, because the urban areas have been developed around the ports, the port traffic is mixed with urban traffic. Historically, this has been know to cause congestion problems. It should be noted that railways generally account for less of the transport share when compared to truck transport. This is due to road network development, as well as to the fact that railways have a similar tariff rate as a result of

severe competition among small truck companies.

Table 10.4.4 Port Access Conditions

Port	Port Access	
	Railway	Road
Arica	Sufficient capacity for demand	2-lane road, mixed with urban traffic
Iquique	Not available	2-lane road, too narrow because mixed with merchandize traffic
Antofagasta	Sufficient capacity for demand	4-lane road, mixed with urban traffic
Coquimbo	Used only for iron ore	Narrow road, mixed with urban traffic
Valparaiso	Available but low frequency	2-lane road, mixed with urban traffic
San Antonio	Sufficient capacity for demand	Tow entrance roads, but mixed with urban traffic
Talcahuano/ San Viente	Sufficient capacity for demand	South access “Timber Road” was completed. North access under constr.
Pto. Montt	Available but low frequency	Passing through the urban area
Chacabuco	Not available	Narrow road connection
Pta. Arenas	Not available	Passing through the urban area

Source: JICA Study Team

(2) Containerization and Draft

According to the *Containerization International Yearbook* in 1999, the 1997 world total of container traffic was about 164 million TEU, indicating an 8.6% growth from the previous year. In the majority of ports throughout the world, the increasing trend of containers has been continuing. Major global hub ports, such as Hong Kong, Singapore, Rotterdam, have individually handled more than 5 million TEU, which is comparable to709,000 TEU of Chile’s1997 national total. Also in Chile, the total number of container cargo has rapidly increased from half million TEU in 1993, to more than one million TEU in 1998. The average growth rate is estimated at 14%. Table 10.4.5 shows the changes in container handling by port in Chile.

Table 10.4.5 Container Handling by Port

Port	Present Situation				Containerized Ratio (%)
	1993	(%)	1998	(%)	
Arica	40,397	8.1	75,268	7.0	66.7
Iquique	61,433	12.3	104,903	9.7	57.2
Antofagasta	3,599	0.7	38,779	3.6	10.5
Coquimbo	19,014	3.8	2,215	0.2	12.8
Valparaiso	250,157	50.0	255,687	23.8	52.6
San Antonio	95,553	19.1	415,001	38.6	78.5
Talcahuano/ San Viente	8,206	1.6	12,951	1.2	41.6
Pto. Montt	4,257	0.9	53,210	4.9	21.8
Chacabuco	89	0.0	2,533	0.2	57.3
Pta. Arenas	17,258	3.5	21,468	2.0	25.5
Total	501,956	100.0	984,013	91.2	49.7

Source: Cámara Marítima y Portuaria de Chile A.G.

Container handling in the Port of San Antonio has grown at an extremely high speed; more than four times from 1993 to 1998. This indicates that San Antonio has become highly competitive due to the expansion of the container yard and the introduction of two gantry cranes. By contrast, Valparaíso has decreased its percentage from 50% in 1993 to 24% in 1998 because of inferior handling efficiency. This is best reflected in the containerized ratio. In the case of San Antonio, the ratio in 1998 was nearly 80%, while those of other ports remained primarily at less than 60%. For the case of San Antonio, the rate is still lower when compared to major global ports, i.e., more than 95%. Containerization is a necessary factor in achieving the status of a Pacific Coast gateway port.

Another factor of high importance on a global level is the size of the vessels. The size of container vessels employed in the main international routes has become increasingly larger during the past decades in order to reduce transport costs. Currently, the post panamax style with the capacity of 4,500 to 5,000 TEU is normally used. Therefore, the previously employed smaller vessels are transferred to secondary services. According to the Containerization International Yearbook, the major shipping companies have begun to service further units with more than 6,000 TEU, i.e., extra post panamax. In order to be consistent with the above tendency, it is indispensable to build a wharf with a deeper draft, as well as equip cranes of greater size. As shown in the previous section, the drafts of the Chilean ports are primarily less than 10 m, which is insufficient to accommodate even the panamax vessels. San Vicente is the only port of has a deep draft sufficient for the post panamax. Therefore, the master plan of each port includes the deepening of the draft by dredging or widening the wharf, as well as the renovation of handling equipment. This will be realized only by the concession system as the national policy. However, for a port such as Arica, no bidders have emerged in spite of the intension of the Empresa Portuaria. For this reason, the port may not be able to compete with other ports. In order to survive as a major port, it will be crucial to include a comprehensive review of the development plan, as well as a re-consideration of the privatization scheme including concession.

10.4.3 Development of Trans-Andes Route

(1) Past Studies on Bi-Oceanic Corridors

During the past decade, the concept of the Bi-Oceanic Corridors has been frequently discussed among member and associate member countries of MERCOSUR. This idea is recognized to have development potentials for transport linkages connecting the Atlantic and Pacific coasts of South America.

In 1996, IDB initiated a study on the development of Bi-Oceanic Corridors with the use of Japanese funding. The study examined several bi-oceanic corridors through a diagnosis of current transport facilities, highway networks, railways, ports and river transport in the region, with special emphasis on Chile and Argentina. The study concluded that among other findings, the developments of the following highway corridors are particularly important:

1) Valparaíso – Santiago – Buenos Aires
2) Arica/Ilo – La Paz – Cuiaba – Sao Paulo
3) Concepción – Bahia Blanca

The highway connections between Argentina, Brazil, Paraguay, and Uruguay are much better than Chile owing to geographical conditions. Even inferior, however, are the highway connections from Bolivia to the Region, thus being an important limit to the development of the Bi-Oceanic Corridor. The non-existence of a direct connection with the Mato Grosso area is causing strong limitations for trade from this area to Chile.

As for the railways, the development of specific corridors has yet to be identified, although several railway connections have been examined. The main reason for the lack of development is due to high investment costs to construct the missing sections.

In 1997/1998, another study on the Bi-Oceanic Corridors was initiated with Brazilian funding. The study recommended that the highways between Bolivia and Brazil should be developed: namely, the highway connections between Santa Cruz and Cuiaba, Campo Grande. The study also suggested that agricultural products, particularly soya produced in Mato Grosso, should be transported primarily by river transport to Brazilian or Argentinean ports. Since this time, there has not been significant progress regarding the development of Bi-Oceanic Corridors.

In Brazil, the principal project at present is the development of a railway linkage between Mato Grosso, Cuiaba and the existing national railway network. This connection will facilitate the transportation of grain from the production center to the major Atlantic ports.

(2) Development Potential

With regards to the Bi-Oceanic Corridors, the JICA study team agrees that higher priority, particularly for Chile, should be given to the three corridors mentioned above. However, not only highways but also railway connections (or a combination of both) should be taken into account for some corridors. In addition, the route between Antofagasta/Mejillones and Resistencia via Calama, Salta (through the route of Jama or

Sico) appears to be important judging from its development potential, however it should be described as a bilateral corridor rather than a bi-oceanic corridor (Refer to Figure 10.4.3).

a. Valparaíso – Santiago – Buenos Aires Corridor

The Valparaíso-Santiago-Buenos Aires corridor is the largest between Chile and Argentina, while concentrating more than 80% of highway flows. There is a railway track along the corridor, Transandino, but the operation was stopped in 1984 due to continuous winter interruptions such as blizzards and floods. Accordingly, it is connected by only one highway with totally asphalt paving. This highway, the Cristo Redentor, possesses good infrastructure but also has a strong limitation. This is due to the winter snowstorms that interrupt the flow of traffic at the crossing point of the cordillera for 15 to 84 days per year. Hence, MOP has conducted a pre-feasibility study regarding a new highway (low altitude, 1800m) between Rancagua and Mendoza including a tunnel of 13 km in length. This project would demand high investment costs (approximately US$ 1.2 billion) and, thus, will be a matter of discussion with MERCOSUR countries, particularly Argentina.

b. Arica/Ilo – La Paz – Cuiaba/Campo Grande – Sao Paulo

The most undeveloped section of this corridor is between La Paz and Cuiaba. Between Arica and La Paz, the corridor has already been developed by means of a highway and railway. In addition, from Cuiaba to Sao Paulo, there is a highway connection that is in quite good condition. However, the road section between La Paz and Cuiaba is very poor, particularly for the section connecting Santa Cruz – Cuiaba. Therefore, the majority of products from Mato Grosso, Brazil, are transported to the ports of the Atlantic. In order to establish the Bi-Oceanic Corridor, it is vital to construct a new highway between Cuiaba and Santa Cruz, while improving the section between Santa Cruz and Oruro.

There is a railway connection from Campo Grande to Santa Cruz, which is mainly used for transport towards San Paulo. Due to the non-existence of a railway between Santa Cruz and Cochabamba, the transport from Santa Cruz to Arica is made by using trucks to Cochabamba, and later transferring to the Arica rail connection. Accordingly, it is worthwhile to again study the missing railway connection to facilitate the flow of bulk from Mato Grosso and Santa Cruz towards the Pacific. According to a preliminary study, the estimated investment is greater than US $1,500 million, thus making it difficult to initiate the project. In order to promote development of the Corridors, increased coordination between the related countries is required, particularly for solving financial problems.

c. Concepción/San Vicente – Bahia Blanca

The highway from Zapala to Bahia Blanca via Neuquen is in fairly good condition. The main issue nonetheless is how to cross the Cordillera to establish the Bi-Oceanic corridor. In this regard, there are two alternative highway routes crossing the Cordillera, Pino Hachado and Cardinal Samoe.

The Chilean side of Pino Hachado is completely paved, while unpaved sections remain

in Argentina. Cardinal Samoe links Osorno with San Carlos of Bailoche, being an important passage due to better vertical road alignment. However, it should be noted that there still exists approximately 60 km of debris.

There is a strong initiative by the Neuquen Province to connect the missing railway link between Zapala in Argentina and Lonquimay in Chile. Railway tracks already exist for the section from Zapara to Bahia Blanca as well as for the section connecting Lonquimay with Concepción. An approximately 20 km section from Zapala towards the border was constructed, though there still remains approximately 40 km that has not yet been constructed. Accordingly, it is also important to study the feasibility of the railway connection as well as the multi-modal transit system by changing from rail to road at the missing link.

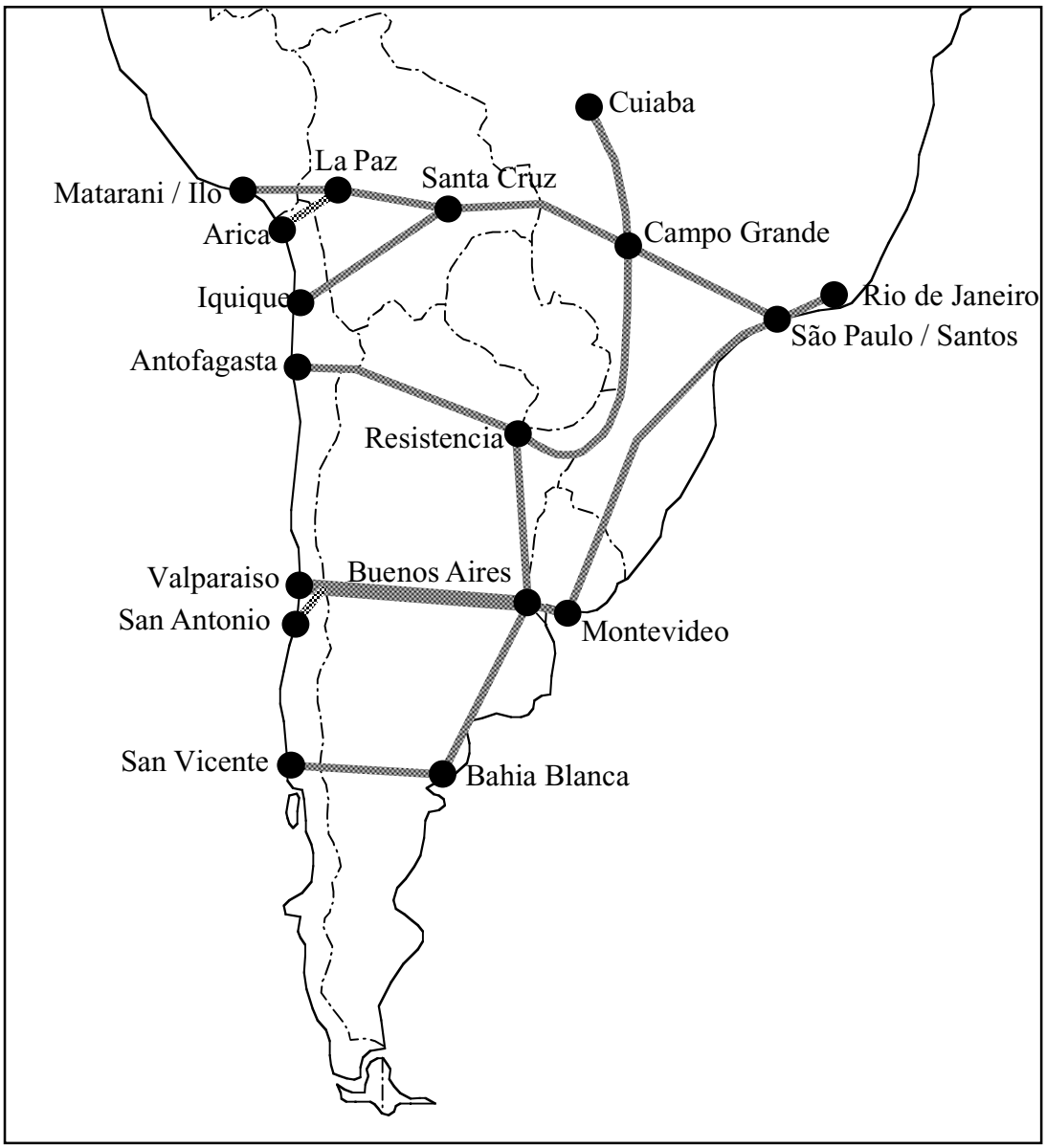


Figure 10.4.3 Bi-Oceanic Corridors

(3) Other Trans-Andes Road Connections

There are 16 major international roads crossing the borders between Chile and neighboring countries, including those identified as Bi-Oceanic Corridors. The roads that connect the east to the west and vice versa generally have unfavorable geographical conditions at the crossings of the Andes.

Between Chile and Bolivia, there are two highways, Tambo Quemado and Colchane. The former, connecting Arica with La Paz, has been completed with asphalt in recent years, while the latter, connecting Iquique with Oruro, has unpaved sections particularly on the Bolivian side. According to MOP, the Chilean Government will invest US$ 30 million to complete the Chilean side in the next few years.

As for the borders between Chile and Argentina, there are 40 crossing points including the 13 major routes, as listed in Table 10.4.6. Among them, the only one completed with pavement is the Cristo Redentor, connecting Valparaíso with Mendoza and Buenos Aires, forming one of the Bi-Oceanic Corridors. Other roads are not yet completed, though the development is proceeding little by little.

During the Governmental term of President Frei, an agreement on the bilateral corridor development program was made between Chile and Argentina. Priority was given to the following five roads: (1) Cristo Redentor (2) Jama (3) Sico (4) Pino Hachado (5) Integración Austral. Since the Chilean sections have been completed except for Sico and Pino Hachado, the new President has announced to additionally complete four more routes. According to MOP, Colchane, Pehuenche and Cardenal Samoe are the candidates for the development of additional routes, though another agreement with Argentina will be required.

Table 10.4.6 exlains the current conditions of the highways that cross the borders. The priority corridors should be decided from the following measures: (1) existing traffic demand; (2) connection with major ports; (3) potential demand for future development; and (4) location of the road in terms of vertical alignment, highest altitude, etc. Taking the above factors into account, Colchane and Cardenal Samoe should be given higher priority, in addition to those routes already agreed upon by the two governments. (Refer to Figure10.4.4).

Table 10.4.6 Conditions of Bilateral Roads

	Road name	Start/ Destination	Unpaved Length	Daily Traffic Volume (1998)	Advantages and Disadvantages	Priority by Govern-ment	Remarks
1	**Arica -Tacna**	Arica - Tacna	Chile 0 km Peru 0 km	1,447	Very good condition	-	Expanded to 4-lane road
2	**Tambo Quemado**	Arica – La Paz	Chile 0 km Bolivia 0 km	283	Only one paved road to La Paz	-	Completed
3	**Colchane**	Iquique – Oruro	Chile 176 Bolivia 226	139	Nearest route to Potosi and Sta. Cruz	High	Higher priority should be given
4	**Jama**	Antofagasta – Jujui	Chile 0 Argentina 243	218	Pavement completed on Chile side	Already Agreed	Completion in 2002
5	**Sico**	Antofagasta – Salta	Chile 177 Argentina 252	7	Shortest linkage from Mejillones to Salta	Already Agreed	Completion in next 5 years
6	**San Francisco**	Diego de Almagro – Aimogasta	Chile 222 Argentina 203	130	Passing high altitude points (interruptions in winter)		
7	**Pircas Negras**	Copiapo Villa Union	Chile 194 Argentina n.a.	n.a.	Poor conditions, better access to Cordoba		
8	**Del Agua Negra**	Coquimbo – San Juan	Chile 111 Argentina 140	658	Passing high altitude points (interruptions in winter)		
9	**Cristo Redentor**	Valparaíso – Mendoza	Chile 0 Argentina 0	1,192	Pavement completed but snow problems	Already Agreed	Pre – F/S of New route
10	**Pehuenche**	Valparaíso-Talca-Malargue	Chile 100 Argentina 82	116	Alternative route for Redentor	High	
11	**Pino Hachado**	San Vicente – Zapala	Chile 26 Argentina 12	137	Direct link to San Vicente, high gradient	Already Agreed	Completion in 2002
12	**Cardenal Samoe**	San Vicente/ Pto. Montt – Bailoche	Chile 0 Argentina 22	591	Corridor linking Bahia Blanca – San Vicente better than P. Hachado	High	Higher priority should be given
13	**Coihaique**	Coihaique – Rio Mayo	Chile 50 Argentina 129	24	Poor road conditions		
14	**Huemules**	Coihauque/ Balmacra-Rio Mayo	Chile 0 Argentina 150	33	Better conditions than Coihaique		
15	**Integración Austral**	Punta Arenas – Rio Gallegos	Chile 0 Argentina 59	275	Major link between Punta Arenas and Rio Gallenas	Already Agreed	Chilean side has been completed
16	**San Sebastian**	Punta Arenas – Rio Grande	Chile 136 Argentina 11	45	Connection inside the Fuego Island		

Note: Traffic volume is the average of those in February, June and October in1998.
Source: MOP

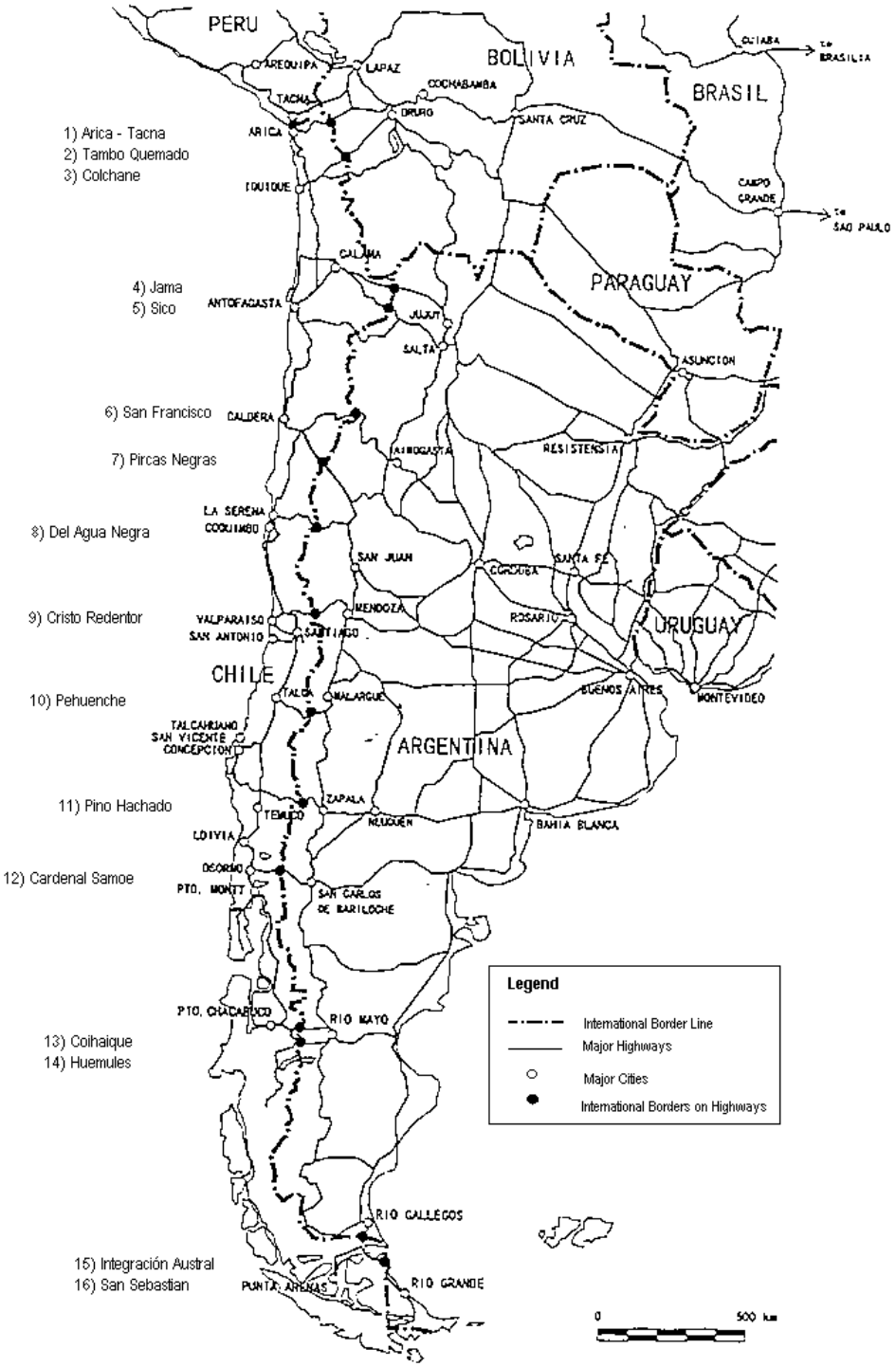


Figure 10.4.4 Location of International Borders on Highways between Chile and Neighbor Countries

10.4.4 Privatization in Transport Sector

As reviewed in the previous sections, the Chilean Government has adopted a policy of private financing incentives (PFI) since the early 1980s in the transportation sector as well as in other public works sectors. In 1991, the Public Works Concession Law was promulgated to promote infrastructure development.

The PFI scheme in Chile is commonly called "concession system" under which management or operation of a state-owned transport facility is entrusted to a private concessionaire for some period specified in the contract. This scheme aims at introducing private capital to construction of transport facilities and improving operational efficiency as well as making users duly shoulder the costs of infrastructure development, maintenance and operation.

A concession contract usually stipulate the following conditions both to control the concessionaire's performance as manager/operator and to protect the concessionaire's interest as investor:

- A maximum level is set for the user charge;
- The Government guarantees the concessionaire, for the concession period, a minimum revenue which corresponds to 70% of the total revenue forecasted by the Government;
- In the case when actual revenue exceeds the forecasted revenue, half of the surplus should be paid to the National Treasury; and
- The concession period cannot exceed 50 years.

As shown in Table 10.4.7, there are a variety of PFI schemes currently adopted in the world. The schemes differ in where private finance comes, how property is managed and how property is owned.

Table 10.4.7 Schemes of Private Finance to Infrastructure Development

Abbrevi-ation	Full Name	Contents
BOT	Build – Operate – Transfer	Private sector builds a facility and manages/operates it for a contract period and then transfers ownership of the facility to the Government.
BTO	Build – Transfer – Operate	Private sector builds a facility and after completion transfers ownership to the Government and operates it.
BOO	Build – Own – Operate	Private sector builds a facility, owns and operate it permanently. Private railway lines in Japan are under this scheme.
BLT	Build – Lease – Transfer	Private sector builds and leases a facility to a public operating agency for a certain period and after the period transfers the right of operation. This scheme is to separate ownership and operation to avoid investor's market risk.
BMT	Build – Maintain – Transfer	Private sector builds and leases a facility to a public operating agency for a certain period and transfers ownership to the agency.
AOT	Acquire – Operate - Transfer	In a subway project, for example, public sector develops infrastructure and private sector acquires rolling stock and operates the subway for a certain period and transfers ownership of rolling stock to the Government.

Source: JICA study team

The Chilean concession scheme used for road projects is similar to BOT in that a concessionaire is usually obliged to improve or widen the existing road. In case of port projects, the scheme is similar to AOT because the concessionaire manages and operates a existing port facilities while acquiring new equipment. In some port projects, it is further necessary to construct additional wharves. This type of scheme much resembles BOT. In general, the concession scheme used for roads and ports in Chile may be classified as a type of BOT scheme.

Up to the present, the Chilean Government's concession policy has been very successful as indicated by the road and port systems that have been significantly improved in the past two decades. Nevertheless, too much dependence on the private sector to develop and manage transport infrastructure may result in some problems in the long run both for the concessionaire and for the public. Following are several such possibilities.

(1) Concessionaire's Risks

Transport Demand

The transport demand forecast is an important basis for the planning of any concession project. Forecasting demand is not easy, however, as the demand is subject to unpredictable events such as macroeconomic changes, a sudden implementation of a competing project and a delay in the construction of supporting facilities. Although the Chilean Government guarantees a minimum demand, it is the concessionaire who in principle takes demand risk.

Fare Revision

If the concessionaire can freely determine the fare levels, his risk will be smaller. However, the Government intervenes in fare setting to keep the fares low because transport services are a kind of public goods.

Construction Delay

A project which has many agencies concerned has a high risk of construction delay. Possible causes include a delay in concession procedure, difficulties in land acquisition and time-consuming coordination among the agencies. Such a delay will directly affect the financial position of the project.

Financial Risks

The concessionaire has to bear such financial risks as fluctuations in the exchange rate and restrictions on the remittance of foreign currency.

Project Implementation Capacity of Concessionaire

The Chilean Government has made great efforts in fovor of public works, sometimes disregarding short-term benefits, to raise funds and develop necessary technologies. As a result the government now owns a enormous sophisticated capacity to manage the infrastructure system under it. By contrast, the private sector generally lacks such a comprehensive capacity. Even though private enterprises have become highly capable of project implementation, it should not be easy for them to shoulder all the public works projects in place of the government. Not many enterprises can raise enough funds, cope with an economic change or have sufficient technology and experience in

maintenance and operation of facilities. A consortium could better do those things. However, as a group of enterprises with conflicting interests, it could create other problems in project implementation.

(2) Public Aspects

From the investor's standpoint, a project is successful if it generates profit, avoiding every risk. From the public's points of view, however, things are not so straightforward. Even if a project is financially viable, it should also be scrutinized with other respects.

Regional Balance

Private capital tends to select only those projects with a high return. Then private transportation development will be limited to some profitable areas such as the central area, major seaports and trunk corridors with a large demand. This would result in a regional imbalance.

Profit Pooling

In order to develop a well-balanced nation-wide network, the profit pooling system is appropriate and justified in some cases. By pooling the profit from high-demand areas and internally subsidizing it to less profitable projects, such projects could also become feasible. The concession scheme makes this system unworkable. If the government takes up only those less profitable projects, it will be a problem.

Fare Rise

Because of the various kinds of risks involved in such a project, the total costs tend to rise higher than projected. The concessionaire then seeks to transfer the extra costs to the users in terms of higher fares. Though this is not readily allowed in the Chilean projects, pressure is always there on the concessionaire's side to increase fares as costs overrun the projection.

Low Level of Maintenance

It is often pointed out that a concessionaire has a strong inclination to maintain his facilities at the minimally workable level, considering the limited contract period.

Environmental Impact

Private enterprises tend to be reluctant to take propoer environmental measures which will bring no profit. Even when they are forced to, they would select easy-going and economical ways to save cost.