APPENDIX

APPENDIX I CARGO MOVEMENT SURVEY AT PORT OF BALBOA

Orientations and Destinations of Cargoes at Port of Balboa

1. JICA Study Team conducted the cargo survey at the Port of Balboa. The cargoes subjected to the survey were those on the bills of lading (B/L) of 8 months from October 1995 through May 1996. The survey results discussed here are based on the B/L unless expressly indicated. It should be noted, however, that the simple multiplication of the results in proportion to one year over 8 months will be unjustifiable since the drastic changes in the cargo throughputs at the Port of Balboa took place during these 8 months, when Manzanillo International Terminals (MIT) began its operation. The cargo throughput of the Port of Balboa momentarily jumped in September and then sharply dropped to one third level of the previous.

Kinds and Throughputs of Cargoes

2. The total cargo throughputs during the above mentioned 8 months are 207,00 ton, of which the import, export and transshipment are 185,000 ton (89% of the total), 10,000 ton (5%) and 12,000 ton (6%) respectively. Table AI-1 and Figure AI-1 show the cargo volume through this period in import, export, transshipment and total.

3. Among these cargoes, 92,000 ton (44%) are the import solid bulk cargoes which are followed by the import containerized cargoes of 60,000 ton (29%). The others are not-containerized import general cargoes (19,000 ton, 9%), import liquid bulk cargoes (12,000 ton, 6%), transshipment of containerized cargoes (12,000 ton, 6%), export containerized cargoes (12,000 ton, 6%) and export containerized cargoes (5%). The reefer cargoes are 1,300 ton (0.6%) and almost imported.

Orientations and Destinations of Import Cargoes

4. All the cargoes imported during the survey period, with respect to their kinds, were identified by their loading ports and also by their destinations which are classified Colon Free Zone, US Army and other local destinations. On the right center of Figure AI-2, in the column of "Balboa", shown are the kinds and volume of

cargoes, where the volume is expressed in column height. On the left, the share of each loading port and kinds of cargoes are shown in heights of each column. On the right column, the destinations are shown.

5. The imported solid bulk cargoes mainly consist of corn, wheat, soybean powder. Their loading ports are Louisiana (22,701 ton of corn, 8,432 ton of wheat, 8,507 ton of soybean powder), Paulina (13,653 ton of corn, 7,658 ton of wheat), and New Orleans (9,265 of corn, 6,523 ton of wheat, 3,492 ton of soybean powder). In addition, Portland exports to Balboa 2,000 ton of sodium-carbon-dioxide, while Manatee exports 1,530 ton of silica sand.

6. The imported containerized cargoes are loaded at Hong Kong, Busan, Shanghai, Kobe, Yokohama, etc. in the Far East, Vancouver, Long Beach, Manzanillo, etc. on the West Coast of the North America, and, Buenaventura, Callao, San Atonio on the West Coast of the South America.

7. The imported containerized cargoes from the above mentioned ports except Vancouver are mainly consumable, electrical apparatus, car parts, industrial materials and parts. From Vancouver imported are containerized hop, corn starch and other raw materials for brewery of beer. One third of these cargoes are transported to Colon Free Zone and lightly processed and re-exported. The others have various destinations; directly to supermarkets, to factories as semi-finished products, to retailers' shops, etc.

8. The imported general cargoes are from Bourgas (cars), Antwerp (steel, etc. of industrial materials), San Lorenzo (alum), Nagoya (cars), Nurmansk (steel plates), Gdynia (steel materials), and Manzanillo (cars), etc. Cars occupy one third of the imported general cargoes and the remaining are mainly semi-finished industrial products.

9. With respect to other cargoes, the findings are; Liquid bulk cargoes such as soybean oil, lubricant oils, alkali, etc. are loaded at Houston, Rosario, San Lorenzo, Ul San; The import reefers, mainly containing fresh fruits and fish and shells, are from Manzanillo, San Antonio, Yokohama, etc.; Almost all the bulk cargoes have local destinations and are processed to beer, flour, edible oil, cars, construction products.

Orientations and Unloading Ports of Export Cargoes

10. All the cargoes exported during the survey period, with respect to their kinds, were identified by their unloading ports and also by their orientations which are classified Colon Free Zone, US Army and other local destinations. On the right center of Figure AI-3, in the Column of "Balboa", shown are the kinds and volume of cargoes, where the volume is expressed in column height. On the left, the share of each unloading port and kinds of cargoes are shown in heights of each column. On the right column, the orientations are shown.

11. An obvious fact is that the export cargoes are almost containerized and oriented from the Colon Free Zone. Their unloading ports are New York, Miami, Acajutra, Manzanillo, Callao, Guayaquil, San Antonio, Valparaiso, Buenos Aires, Montevideo, Hong Kong, Kaoshung, etc. To New York exported are mainly consumable while to other ports exported are electrical apparatus, car parts, consumable. Small volumes of containerized cargoes are exported to other ports, such as Buenaventura, Quetal, etc. Not containerized general cargoes are also exported to Iquique and Port of Spain.

Transshipment Cargoes

12. Almost all the transshipment cargoes at Port of Balboa, which is about 12,000 ton in total and 1,500 ton monthly in average during the survey period, are containerized. Figure AI-4 shows the loading and unloading ports of containerized transshipment cargoes.

13. From Hong Kong, Busan and Chinese Ports (Ning Po, Shanghai, Xingang, etc.), about 60% of the transshipment cargoes, mainly general cargoes such as consumable, are oriented. The other main orientation is Vancouver exporting dairy produce to Iquique. About 40% of the transshipment cargoes are destined to Guayaquil, Buenaventura, Callao and Iquique.

Graphical Indications of Orientations and Destinations of Cargoes

14. The orientations and destinations of the cargoes are shown on several figures; Figure AI-5 (1) through AI-(5) show the orientations of imported cargoes; Figure AI-6 shows destinations of the export containerized cargoes while Figure AI-7 shows both the orientations and destinations of the transshipment cargoes.

Monthly Throughputs of Containerized Cargoes

15. Monthly throughputs of the containerized cargoes at Port of Balboa from January 1994 through May 1996, 29 months, were shown on both Figure AI-8 and Table AI-2. In September 1995, the cargoes to/from the Colon Free Zone jumped and sharply dropped to one third level, in average, of those of the previous 9 months. The cargoes to/from the local destinations/ orientations slightly dropped while those of transshipment maintained almost unchanged to the previous level. The cargoes to/from US Army has no significant volume during these 29 months.

16. The sharp decrease of transshipment cargoes in October 1995, after the momentary increase in September 1995, attributed to the beginning of MIT operation with the 4 post-panamax quay-side container cranes. The momentary increase is due to the last shipments before closing of the services of several shipping lines to the Port of Balboa and the decrease is due to the shift of the services to MIT.

Maritime Transport Routes

17. The maritime transport routes of the shipping lines servicing the Port of Balboa are shown on Figure AI-9 (1) through AI-9(3). Obvious is the fact that no shipping line is servicing the routes connecting the Port of Balboa with the ports of the East Coast of South America except via Ushuaia, the port located at the southern tip of the continent.

Shipping Lines Transporting Cargoes to/from Colon Free Zone

18. Table AI-3 shows the monthly throughputs of the containerized cargoes, with respect to the shipping lines, to/from the Colon Free Zone passing through the Port of Balboa from January 1994 through May 1996, 29 months. Figure AI-10 shows the changes of the monthly throughputs carried by the top 9 shipping lines who had handled 98% of these cargoes. Among these 9 shipping lines, LYKES, SEALAND and COSCO ceased their services through the Port of Balboa.

Table AI-1 Total Cargo Volume through Balboa (Oct. 1995 - May 1996)

TON

	C	CR	BL	BS	G	TOTAL
IMPORT	60,012	1,312	12,299	91,867	19,497	181,987
EXPORT	9,398	74	-	-	478	9,951
TRANSSHIP	11,923	25	-	-	396	12,344
TOTAL	81,333	1,410	12,299	91,867	20,372	207,282

C : CONTAINER CARGO
G: GENERAL CARGO
CR:REFRIGERATED CONTAINER CARGO
BL:BULK LIQUID CARGO
BS:BULK SOLID CARGO

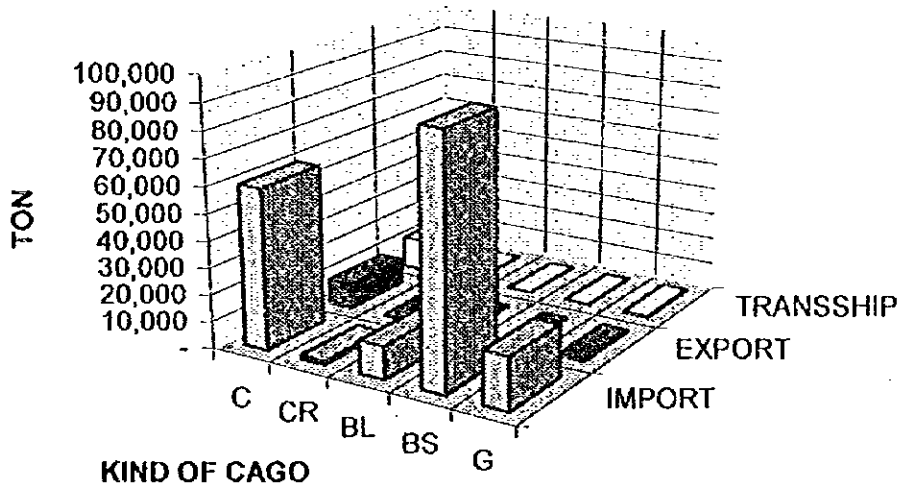
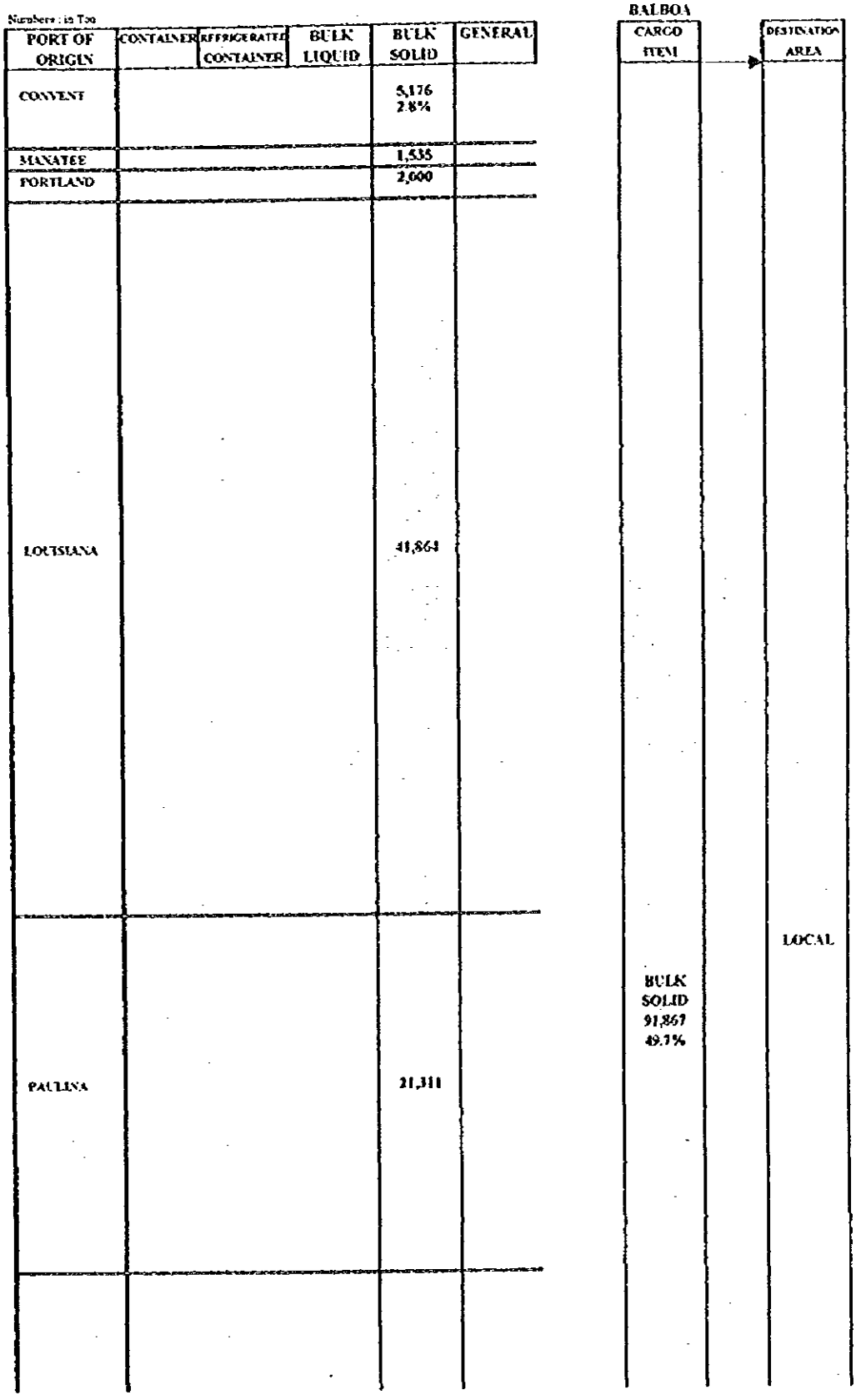
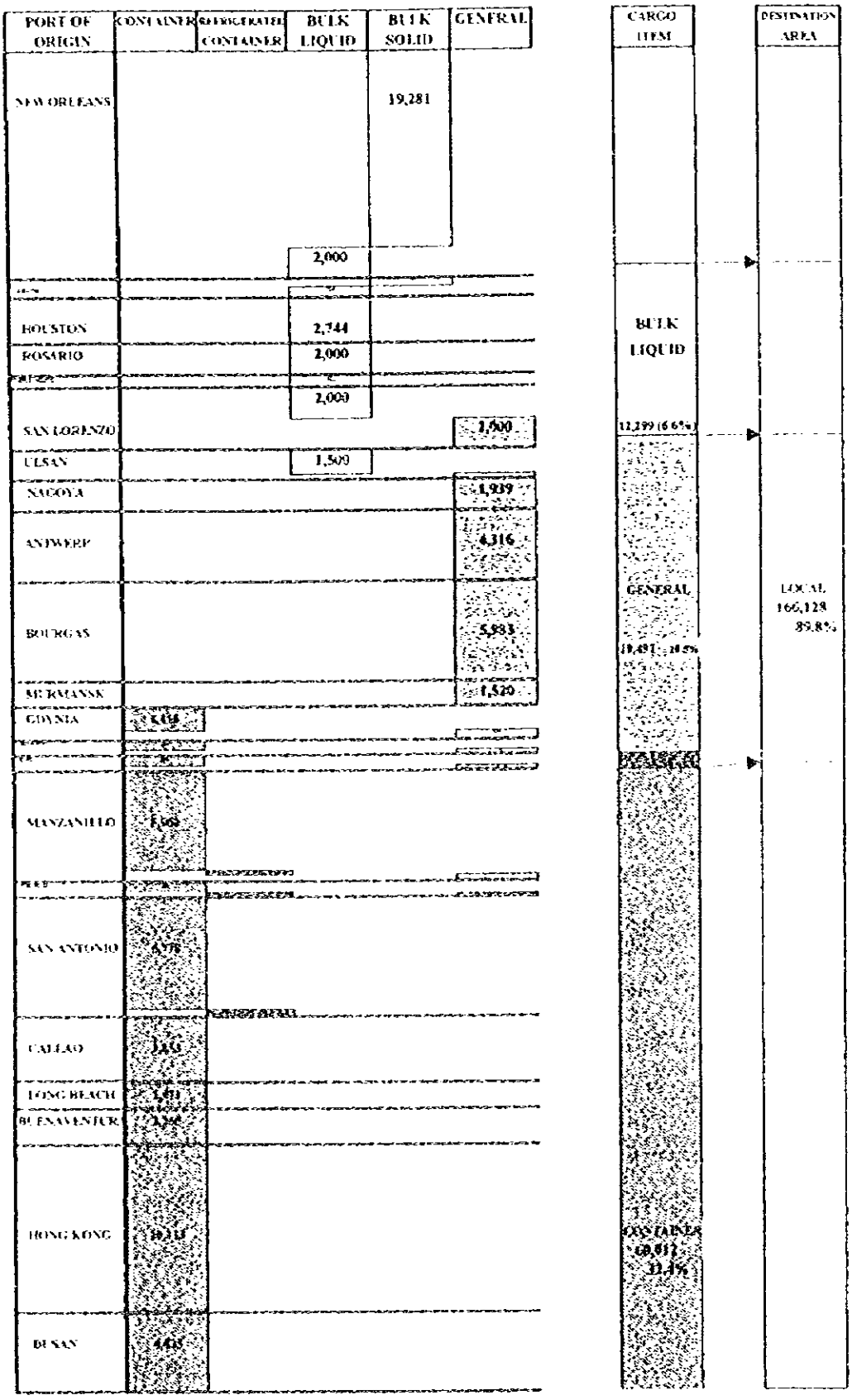


Figure AI-1 Total Cargo Volume through Balboa



continued

Figure AI-2(1) Cargo Movement for Import into Balboa



continued

Figure A1-2(2) Cargo Movement for Import into Balboa

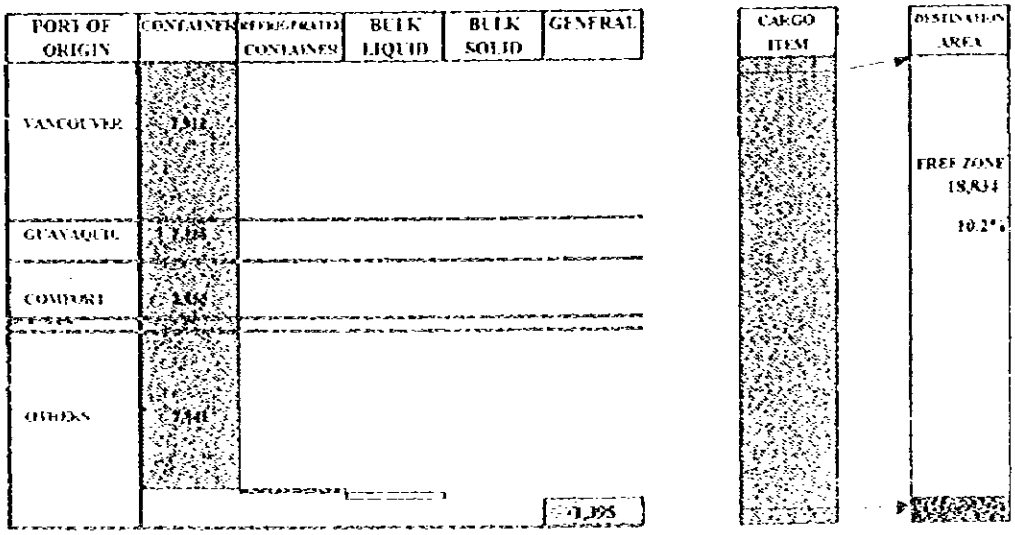


Figure AI-2(3) Cargo Movement for Import into Balboa

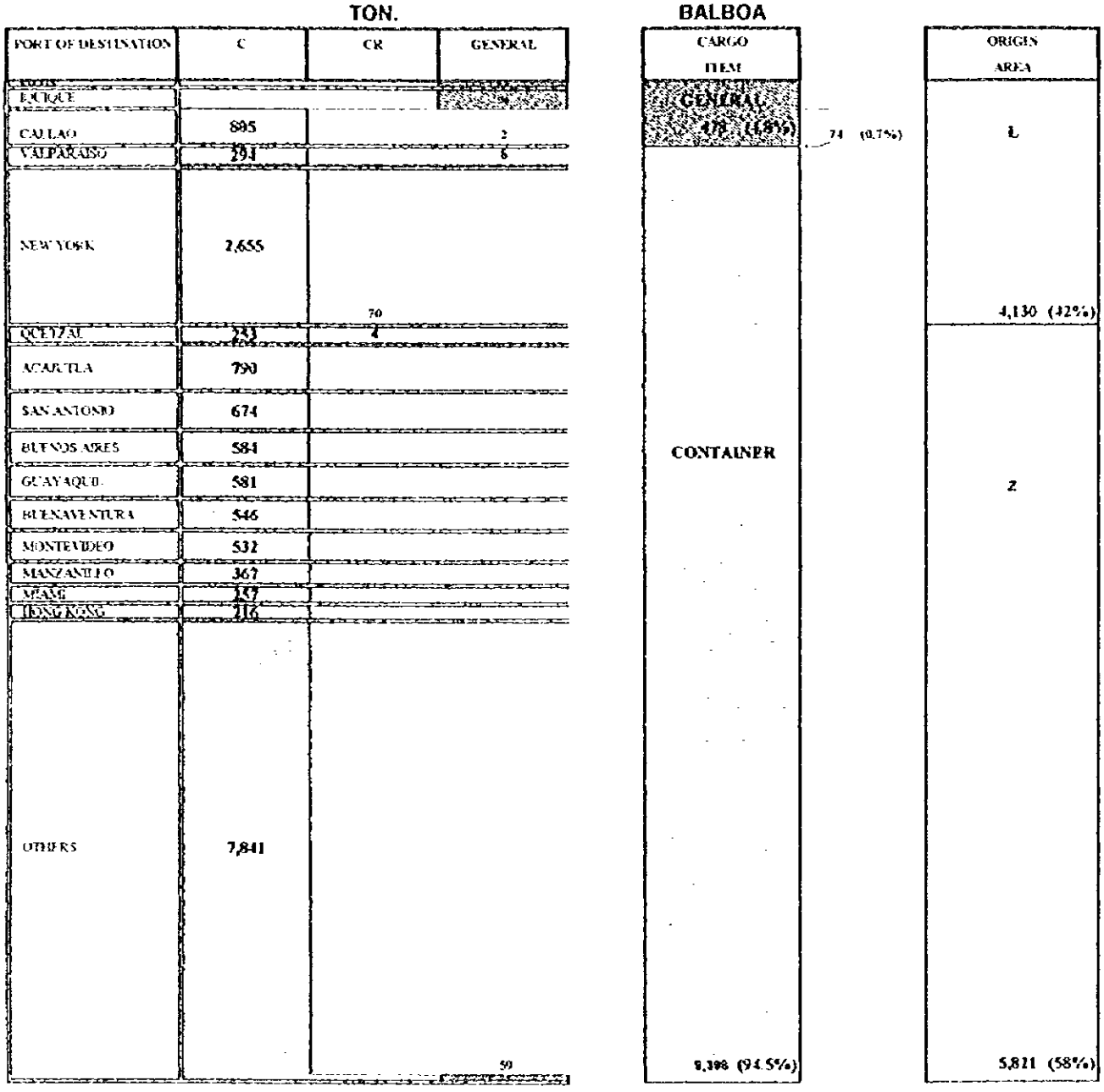


Figure AI-3 Cargo Movement for Export from Balboa

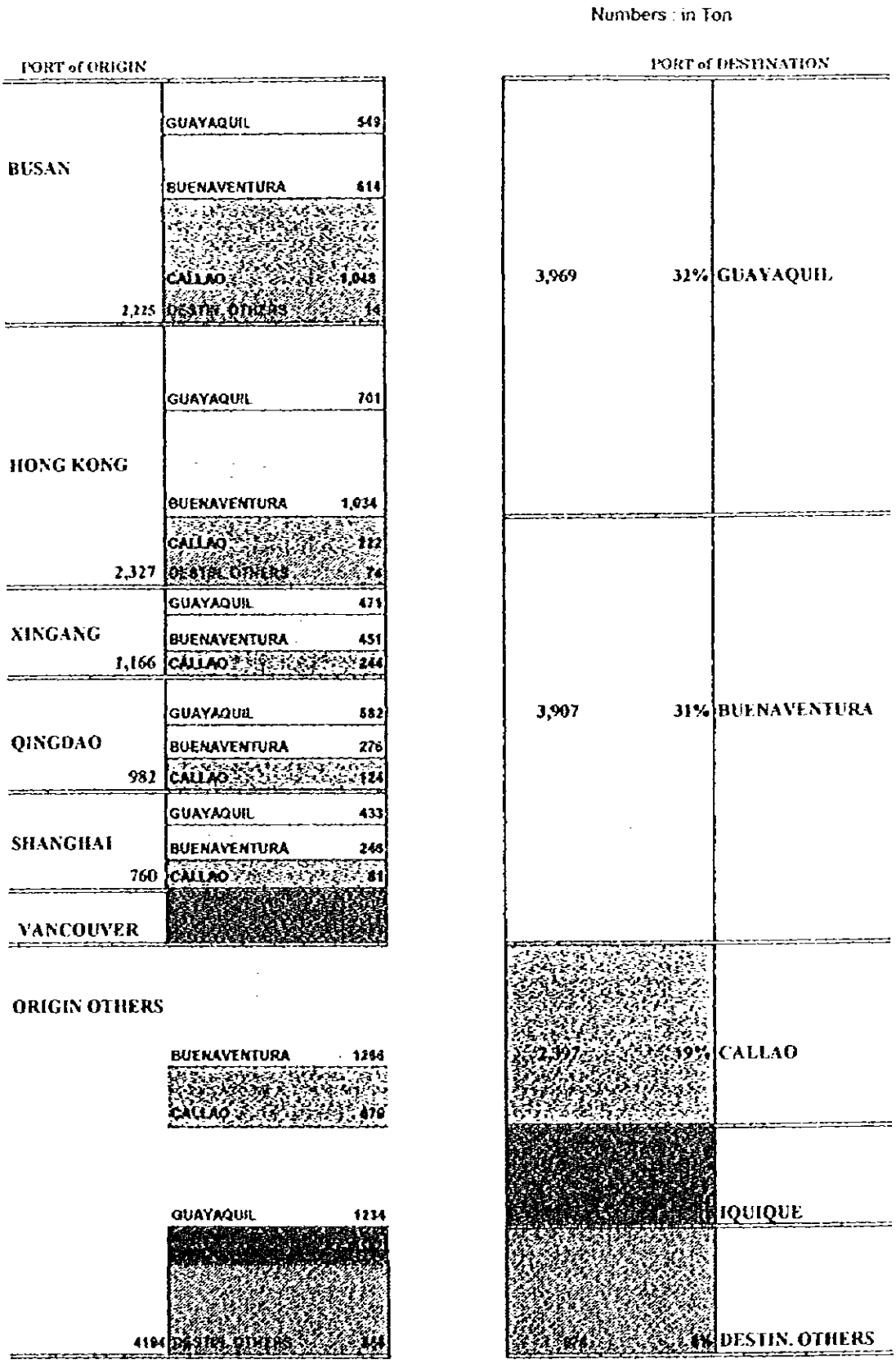
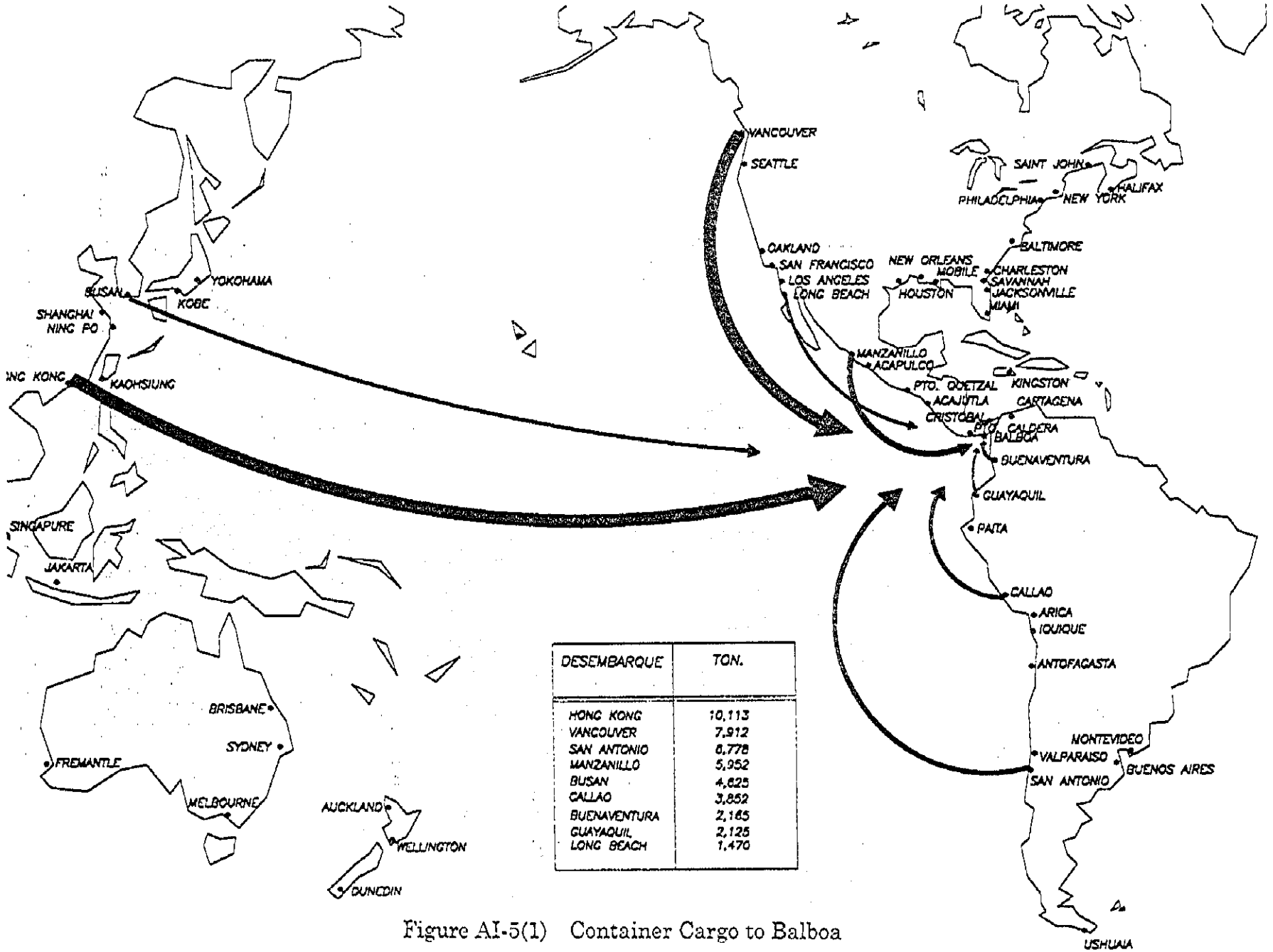
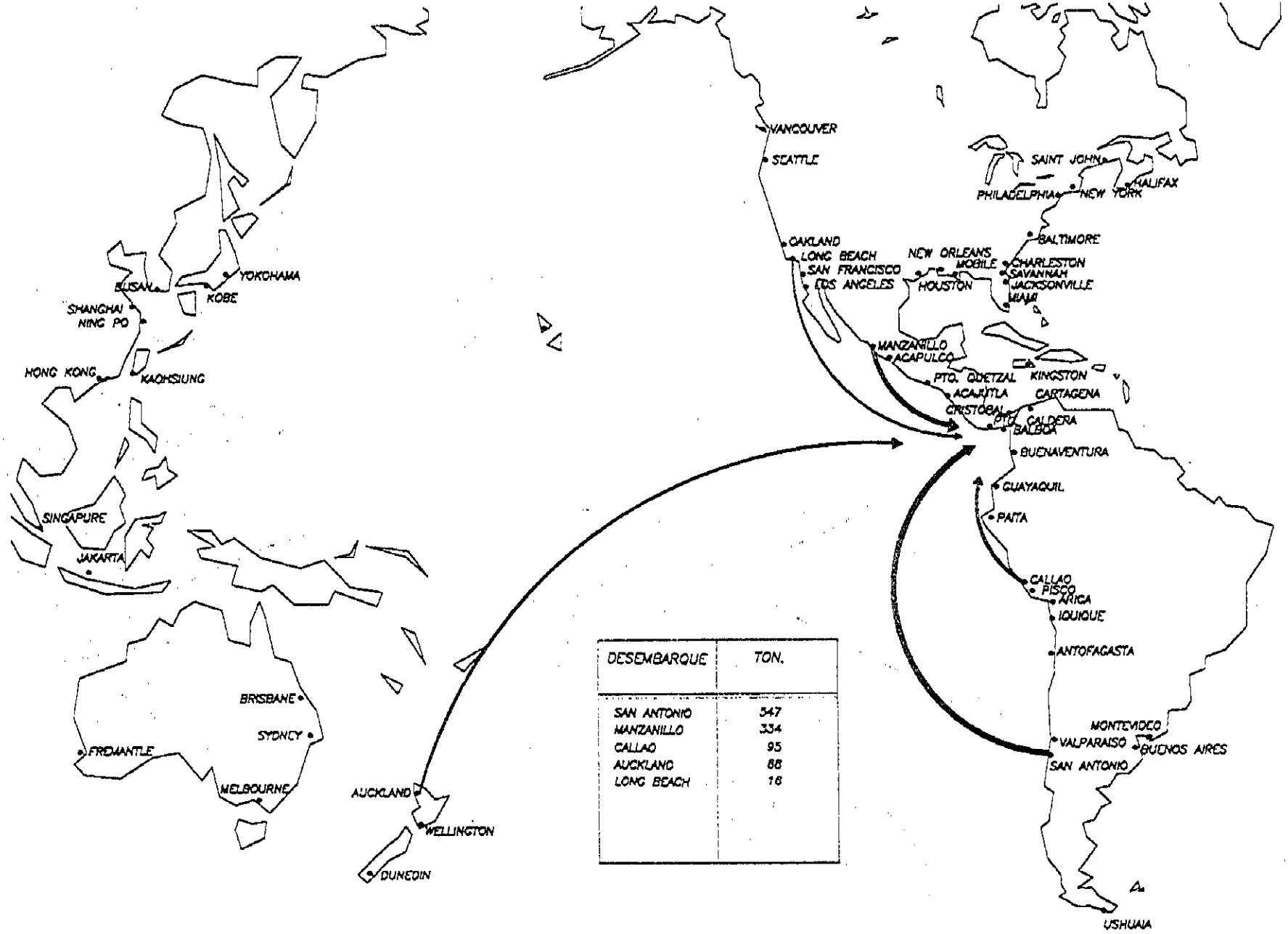


Figure AI-4 Container Cargo Transhipment at Balboa



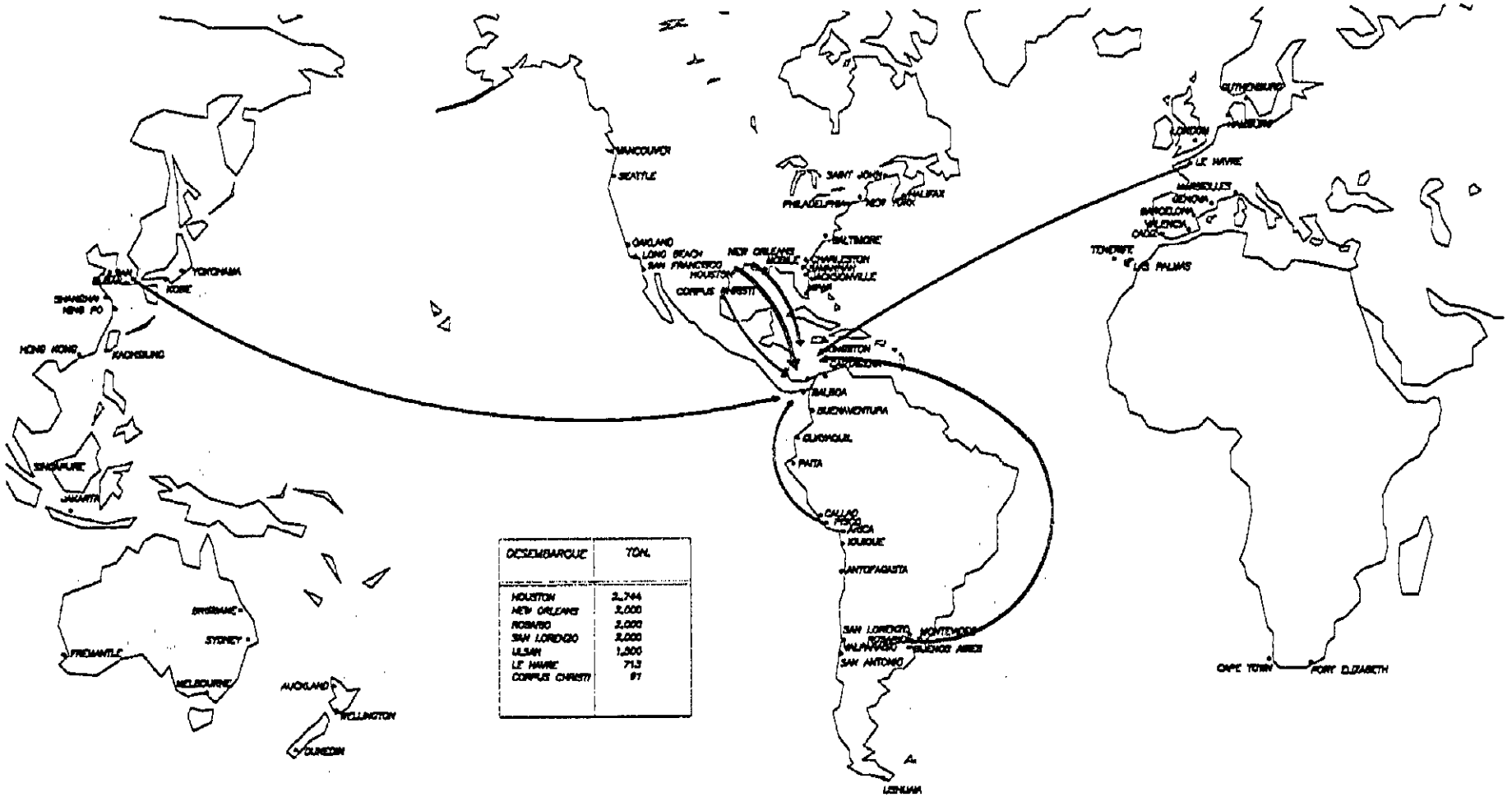
DESEMBARQUE	TON.
HONG KONG	10,113
VANCOUVER	7,912
SAN ANTONIO	6,778
MANZANILLO	5,952
BUSAN	4,625
CALLAO	3,852
BUENAVENTURA	2,165
GUAYAQUIL	2,125
LONG BEACH	1,470

Figure AI-5(1) Container Cargo to Balboa



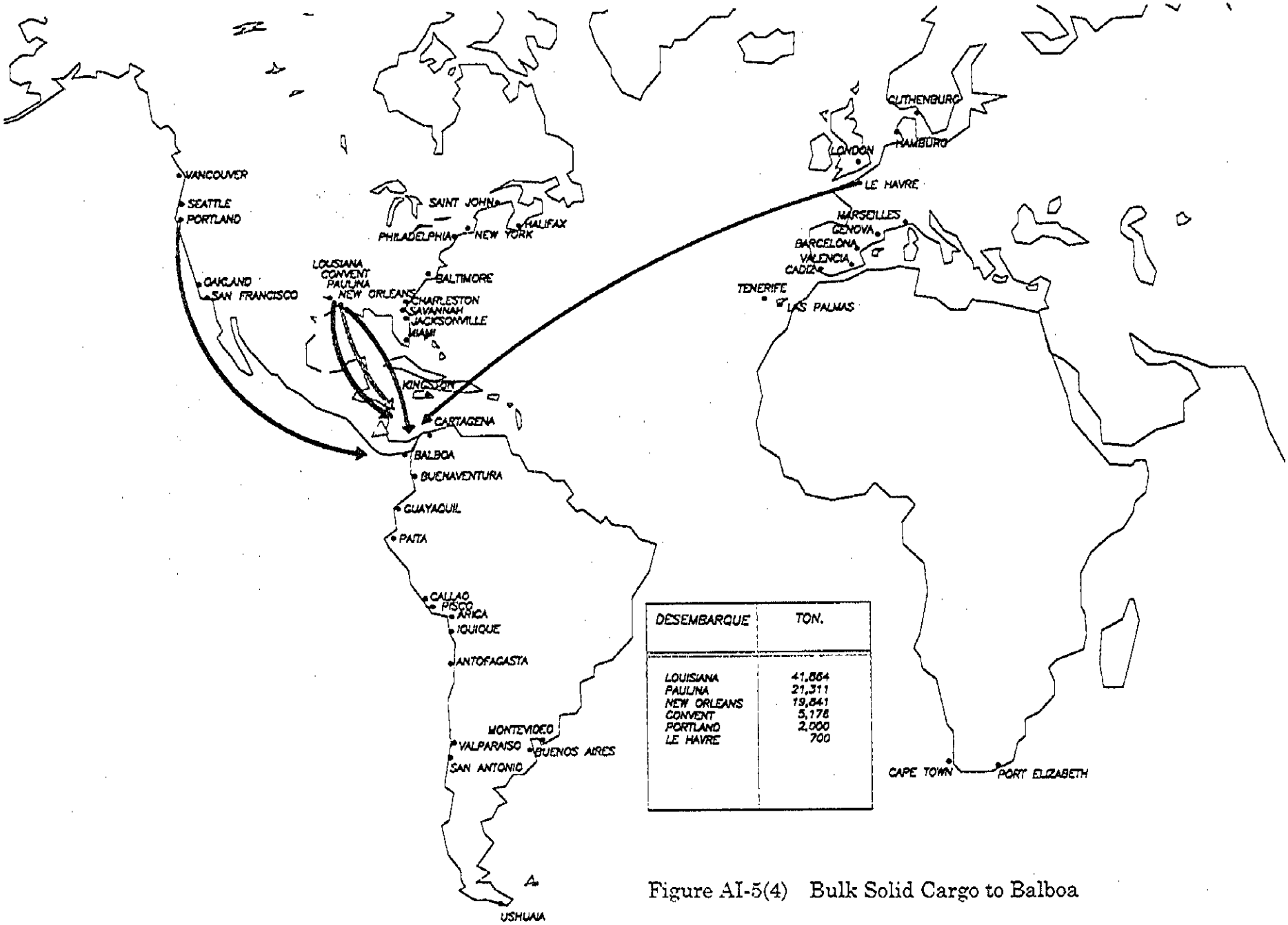
DESEMBARQUE	TON.
SAN ANTONIO	547
MANZANILLO	334
CALLAO	95
AUCKLAND	88
LONG BEACH	16

Figure AI-5(2) Refrigerated Container Cargo to Balboa



DESEMBARQUE	TON.
HOUSTON	2,744
NEW ORLEANS	2,000
ROSARIO	2,000
SAN LORENZO	2,000
ULSAN	1,300
LE HAVRE	713
CORPUS CHRISTI	87

Figure AI-5(3) Bulk Liquid Cargo to Balboa



DESEMBARQUE	TON.
LOUISIANA	41,864
PAULINA	21,311
NEW ORLEANS	19,641
CONVENT	5,178
PORTLAND	2,000
LE HAVRE	700

Figure AI-5(4) Bulk Solid Cargo to Balboa

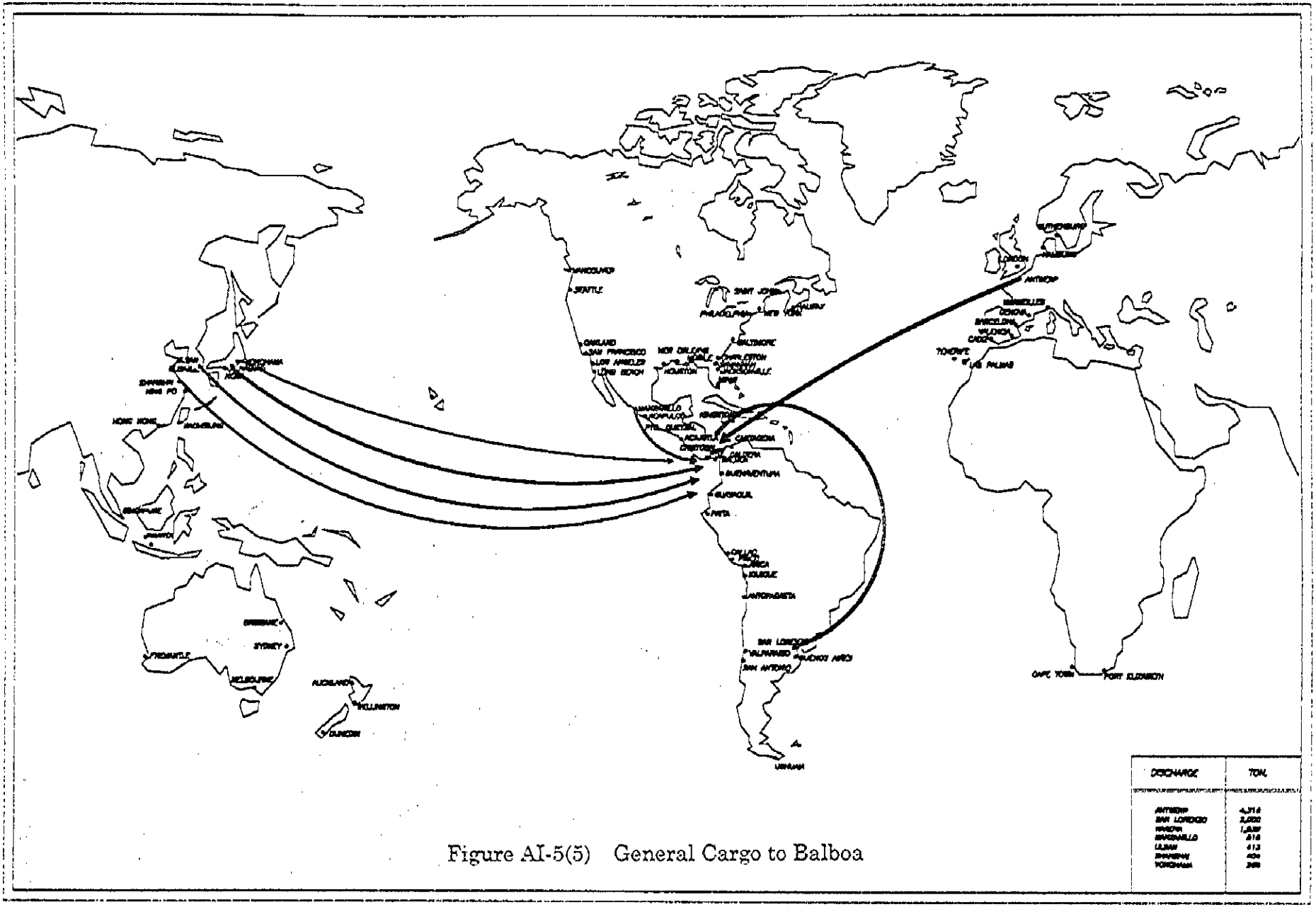
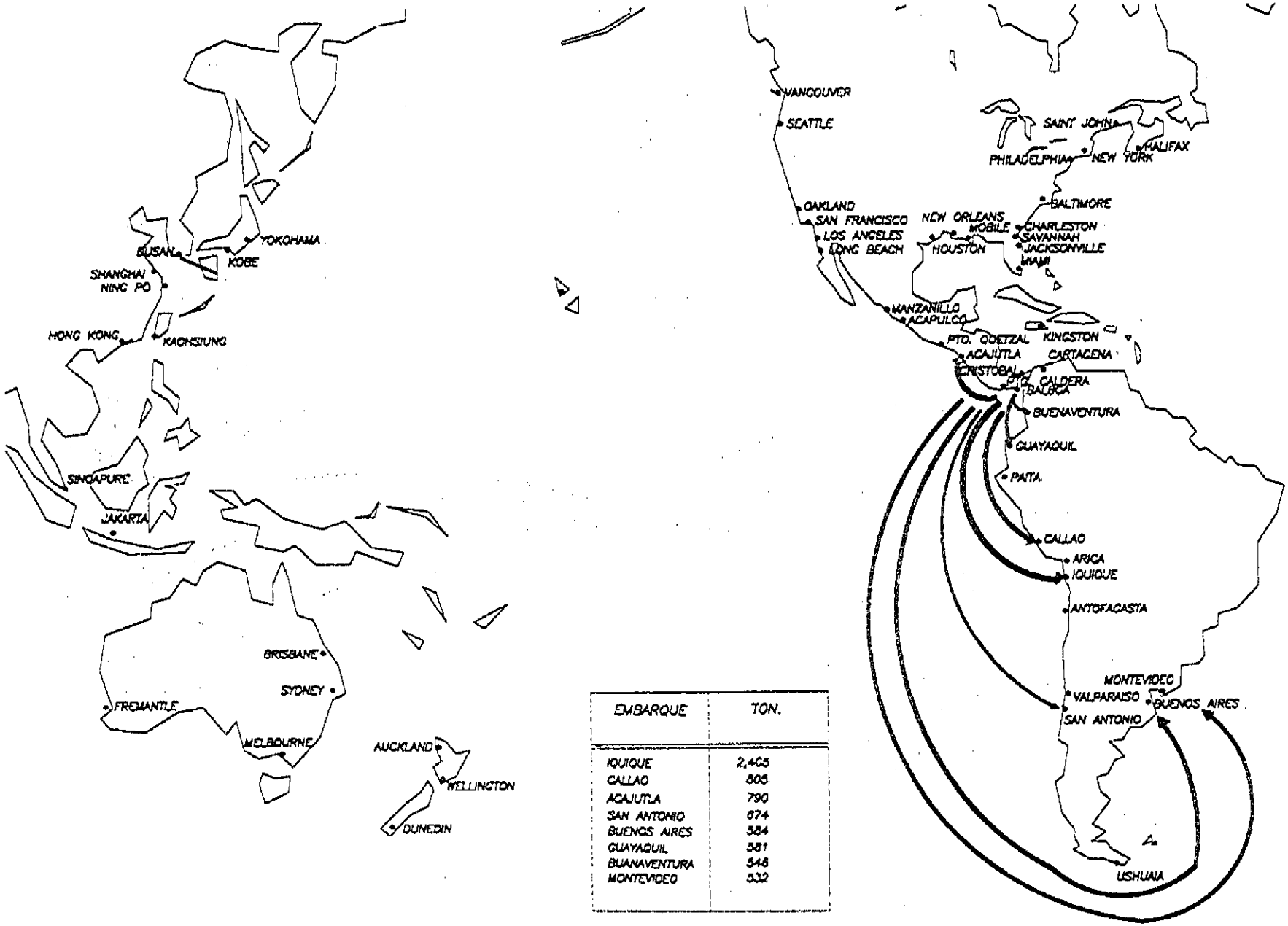
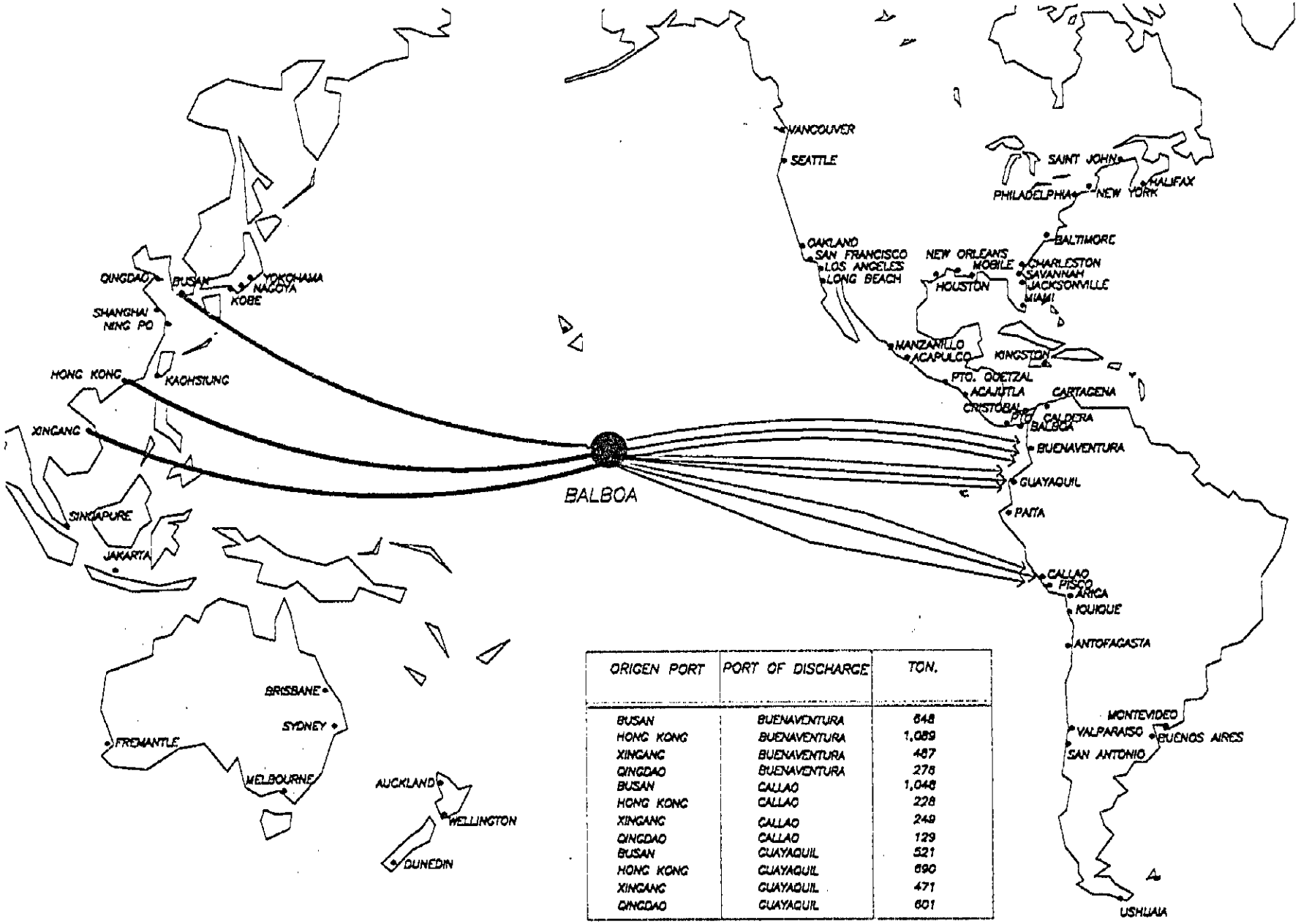


Figure AI-5(5) General Cargo to Balboa



EMBARQUE	TON.
IQUIQUE	2,405
CALLAO	805
ACAJUTLA	790
SAN ANTONIO	674
BUENOS AIRES	584
GUAYAQUIL	581
BUANAVENTURA	548
MONTEVIDEO	532

Figure AI-6 Container Cargo from Balboa



ORIGEN PORT	PORT OF DISCHARGE	TON.
BUSAN	BUENAVENTURA	648
HONG KONG	BUENAVENTURA	1,089
XINGANG	BUENAVENTURA	467
QINGDAO	BUENAVENTURA	276
BUSAN	CALLAO	1,048
HONG KONG	CALLAO	228
XINGANG	CALLAO	249
QINGDAO	CALLAO	129
BUSAN	GUAYAQUIL	521
HONG KONG	GUAYAQUIL	690
XINGANG	GUAYAQUIL	471
QINGDAO	GUAYAQUIL	601

Figure AI-7 Transhipment Container Cargo through Balboa

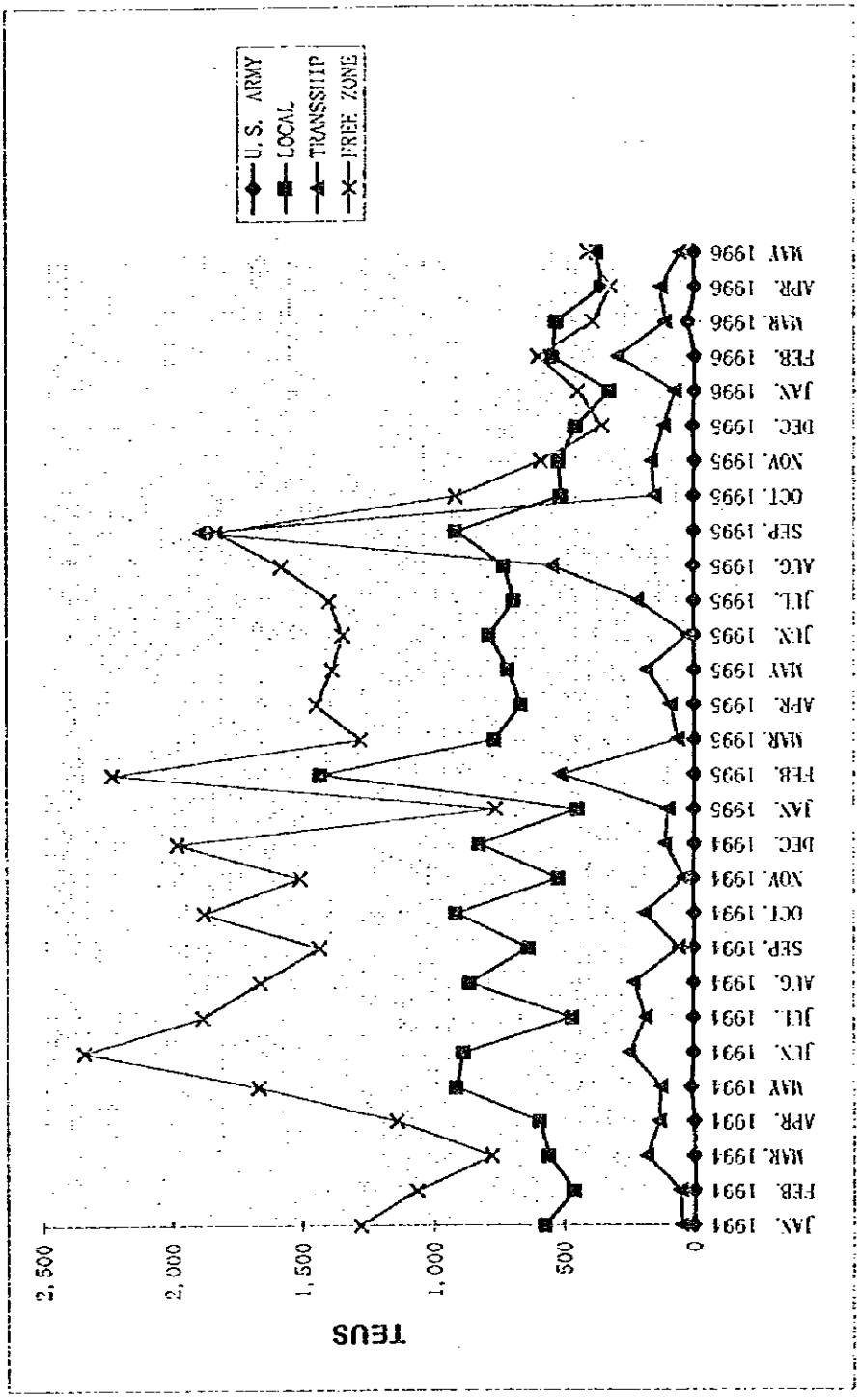


Figure AI-8 Number of Containers through Balboa

Table AI-2 Number of Containers through Balboa Port (monthly)

	U.S. ARMY	LOCAL	TRANSSHI	FREE ZONE	ULL TOTA	EMPTY
JAN. 1994	2	573	50	1,279	1,904	800
FEB. 1994	0	463	54	1,069	1,586	579
MAR.1994	1	560	185	782	1,528	636
APR. 1994	0	593	137	1,141	1,871	611
MAY 1994	14	918	129	1,667	2,728	1,122
JUN. 1994	4	891	251	2,344	3,490	951
JUL. 1994	4	471	189	1,885	2,549	991
AUG. 1994	3	869	235	1,665	2,772	1,065
SEP.1994	4	638	60	1,438	2,140	635
OCT.1994	2	918	192	1,880	2,992	891
NOV.1994	5	523	42	1,510	2,080	831
DEC. 1994	0	830	111	1,983	2,924	903
JAN. 1995	1	450	102	766	1,319	
FEB. 1995	0	1,432	515	2,234	4,181	
MAR.1995	0	769	63	1,277	2,109	
APR. 1995	1	667	92	1,449	2,209	
MAY 1995	0	716	185	1,386	2,287	
JUN. 1995	2	791	27	1,345	2,165	
JUL. 1995	1	694	220	1,397	2,312	
AUG. 1995	3	733	548	1,579	2,863	
SEP.1995	2	921	1,893	1,830	4,646	
OCT.1995	4	511	152	922	1,589	
NOV.1995	0	520	166	589	1,275	
DEC. 1995	7	457	120	360	944	
JAN. 1996	0	329	75	449	853	
FEB. 1996	0	545	298	602	1,445	
MAR.1996	27	531	113	393	1,064	
APR. 1996	0	359	130	326	815	
MAY 1996	3	378	55	413	849	

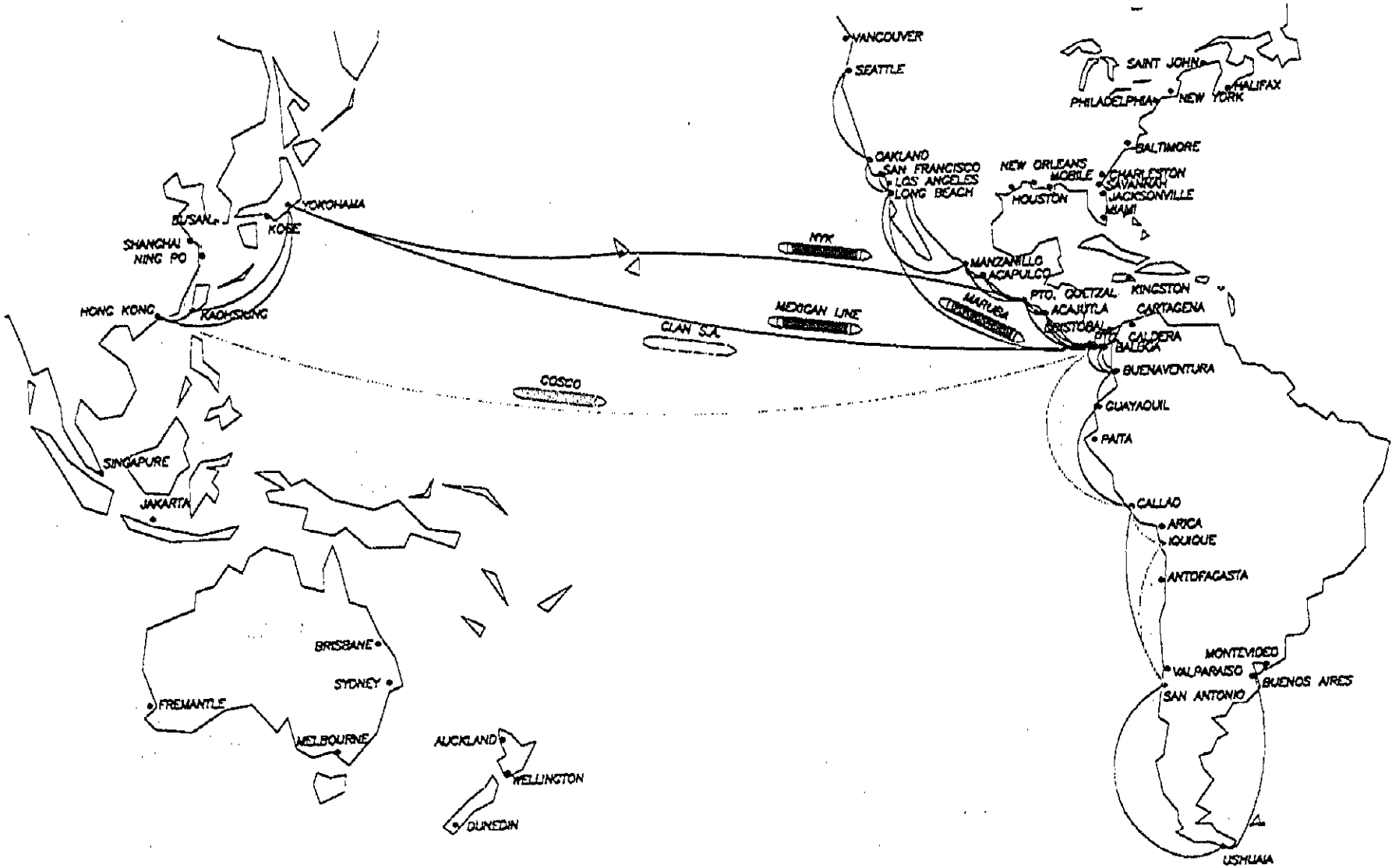


Figure AI-9(1) Shipping Routes: Visiting Balboa

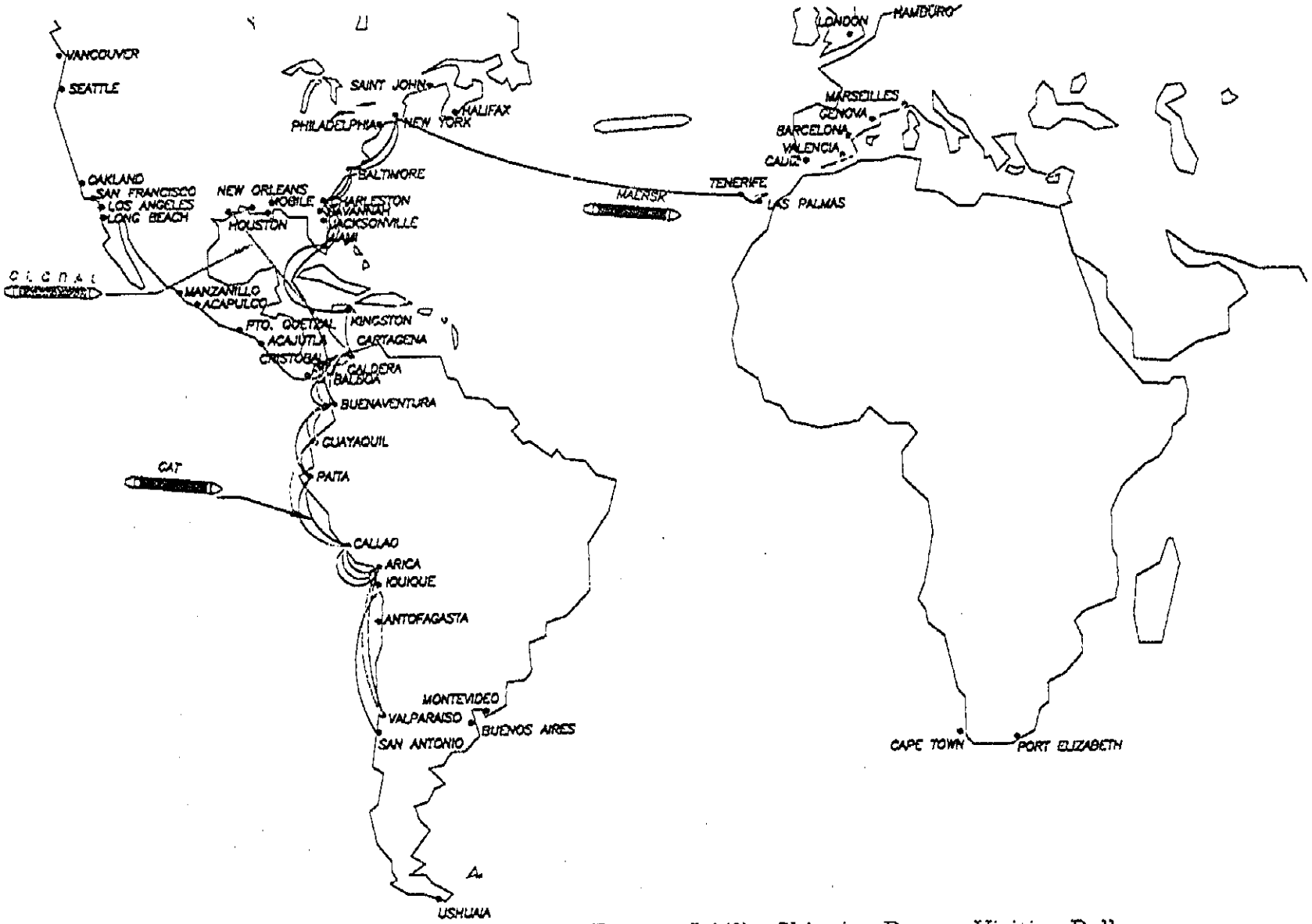


Figure AI-9(2) Shipping Routes: Visiting Balboa

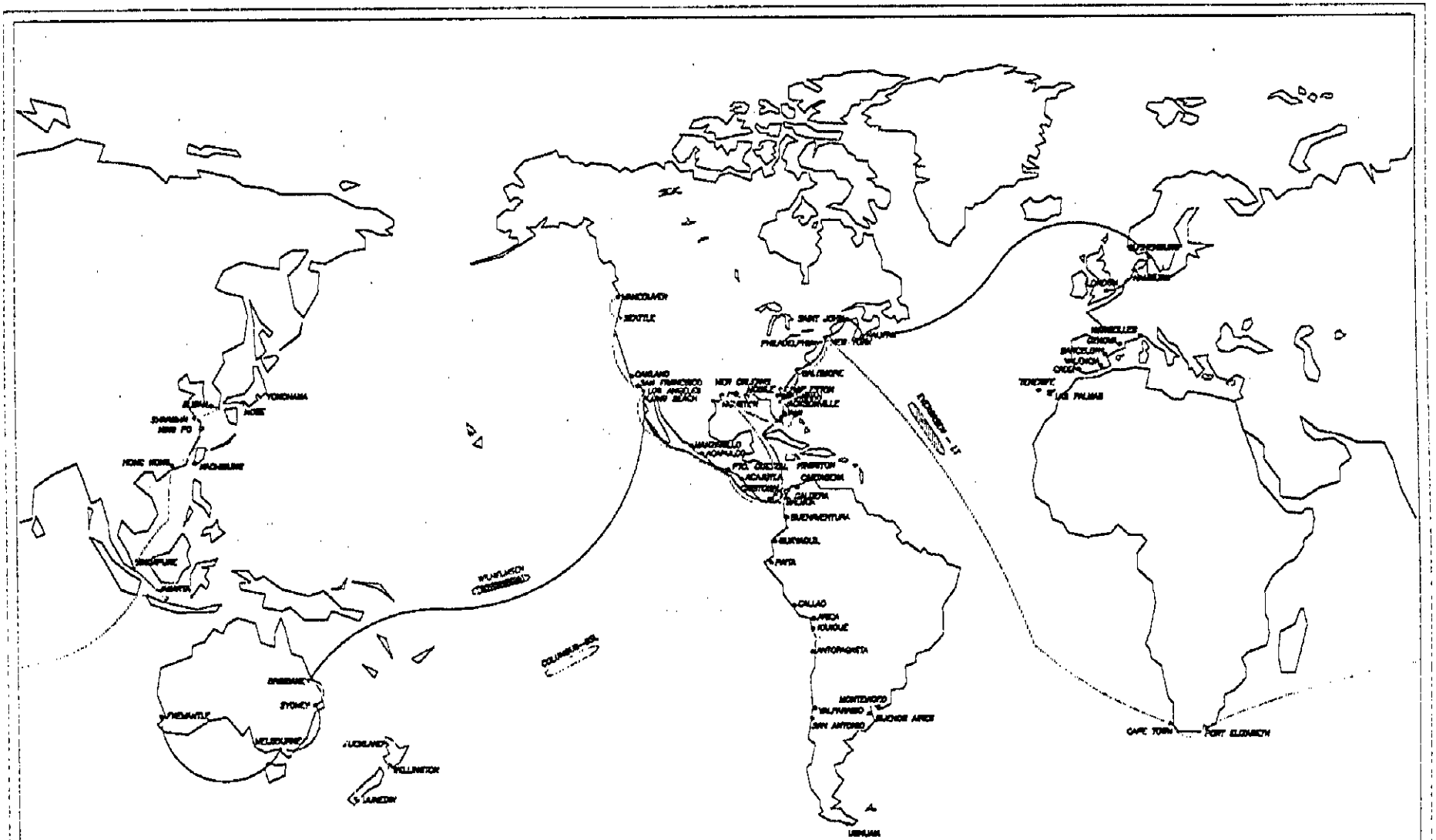


Figure AI-9(3) Shipping Routes: Visiting Balboa

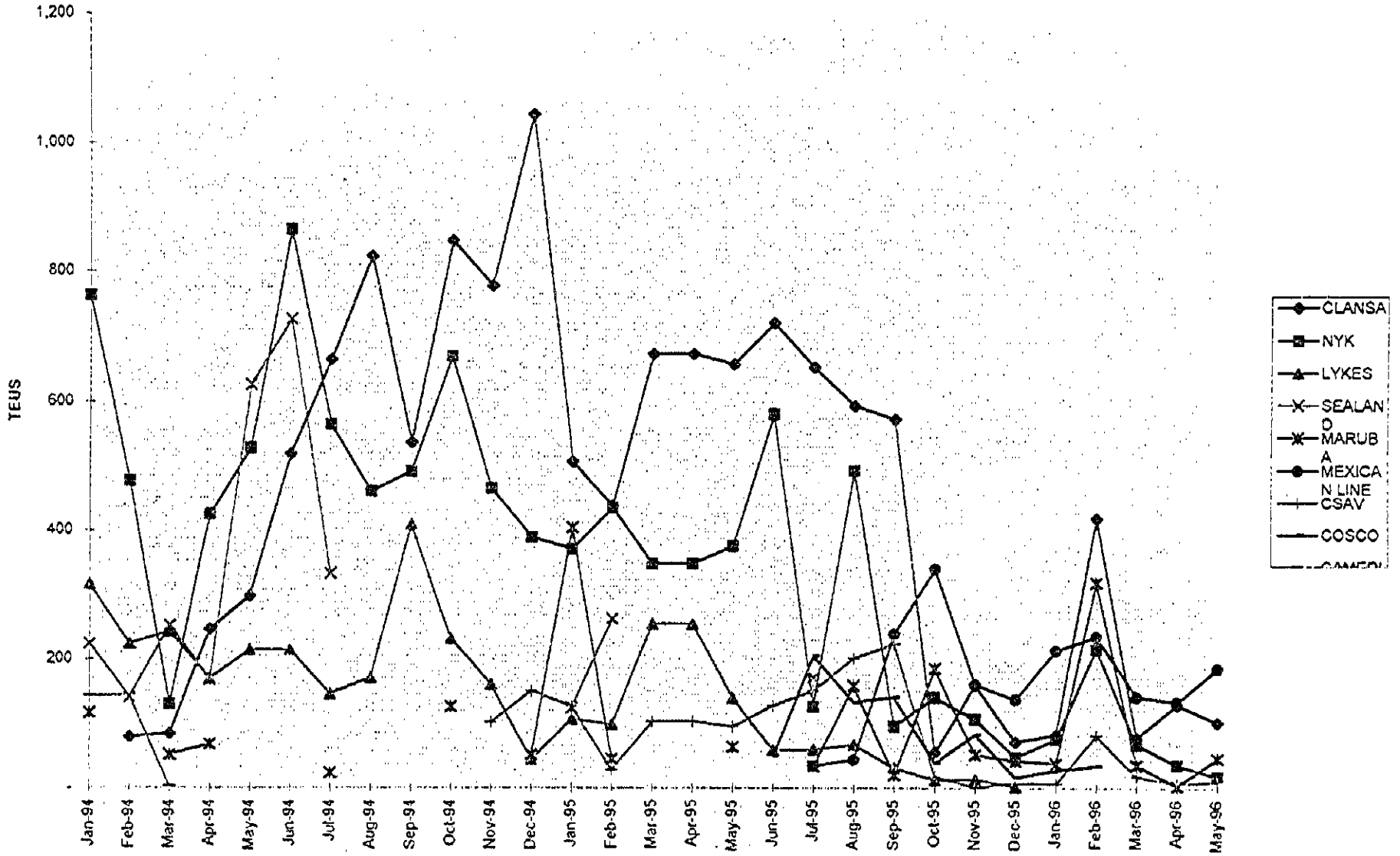


Figure AI-10 Number of Containers Carried by Major Shipping to/from Free Zone in Colon (monthly)

Table AI-3(1) Number of Containers Carried by Shipping Company to/from Free Zone in Colon (monthly)

Shipping line \ month	Jan-94	Feb-94	Mar-94	Apr-94	May-94	Jun-94	Jul-94	Aug-94	Sep-94	Oct-94	Nov-94	Dec-94
CLANSA		81	86	247	299	519	666	824	537	849	779	1,048
NYK	763	477	131	425	528	865	564	461	492	671	466	389
LYKES	317	224	243	170	214	214	147	171	409	232	161	45
SEALAND	224	142	253	168	626	728	333					
MARUBA	118		53	69			24			128		53
MEXICAN LINE											104	151
CSAV												
COSCO												
CAMERICA	144	145	2									10
CCNI								209				
KENMOST							151					
NANJING						18						
HAPAG				34								
ECUADORI				28								
POL-AMER												
LASER			14									
FRENCH												
NEDLLOYD												
COLUMBUS												
ASA												
CGM												
CIA GENERALE MAR												
TOTAL	1,566	1,069	782	1,141	1,667	2,344	1,885	1,665	1,438	1,880	1,510	1,696

Table AI-3(2) Number of Containers Carried by Shipping Company to/from Free Zone in Colon (monthly)

Shipping line \ month	Jan-95	Feb-95	Mar-95	Apr-95	May-95	Jun-95	Jul-95	Aug-95	Sep-95	Oct-95	Nov-95	Dec-95
CLANSA	508	439	675	675	659	728	654	594	573	56	162	73
NYK	370	436	348	348	375	581	128	494	98	142	109	49
LYKES	109	100	255	255	141	60	61	68	32	12	14	2
SEALAND	126	263					172					
MARUBA	404	46			65		35	160	21	186	58	43
MEXICAN LINE							35	45	239	340	161	139
CSAV	128	29	105	105	97	130	152	201	223	18	1	8
COSCO						51	205	135	143	40	85	17
CAMERICA												
CCNI	1	1	1	1	1		32	29	28	1	4	3
KENMOST												
NANJING												
HAPAG								3	8			13
ECUADORI												
POL-AMER												
LASER								18	1			6
FRENCH												
NEDLLOYD								1				5
COLUMBUS		1								7		
ASA												
CGM												2
CIA GENERALE MAR									2			
TOTAL	1,646	1,315	1,384	1,384	1,338	1,545	1,474	1,748	1,368	802	589	360

Table AI-3(3) Number of Containers Carried by Shipping Company to/from Free Zone in Colon (monthly)

Shipping line \ month	Jan-96	Feb-96	Mar-96	Apr-96	May-96	TOTAL	Accumulated %
CLANSA	84	419	80	131	104	12,544	34%
NYK	77	216	69	36	18	10,126	62%
LYKES						3,656	72%
SEALAND						3,035	80%
MARUBA	39	319	36	3	47	1,902	85%
MEXICAN LINE	213	235	143	135	185	1,870	91%
CSAV	7	83	18	7	10	1,577	95%
COSCO	28	35				739	97%
CAMERICA						291	98%
CCNI	1	111	7		49	280	98%
KENMOST						209	99%
NANJING						151	99%
HAPAG			37			79	100%
ECUADORI						34	100%
POL-AMER						28	100%
LASER						25	100%
FRENCH						14	100%
NEDLLOYD			3			9	100%
COLUMBUS						8	100%
ASA		2				2	100%
CGM						2	100%
CIA GENERALE MAR						2	100%
TOTAL	449	1,420	393	312	413	36,583	

APPENDIX II BOREHOLE LOGS

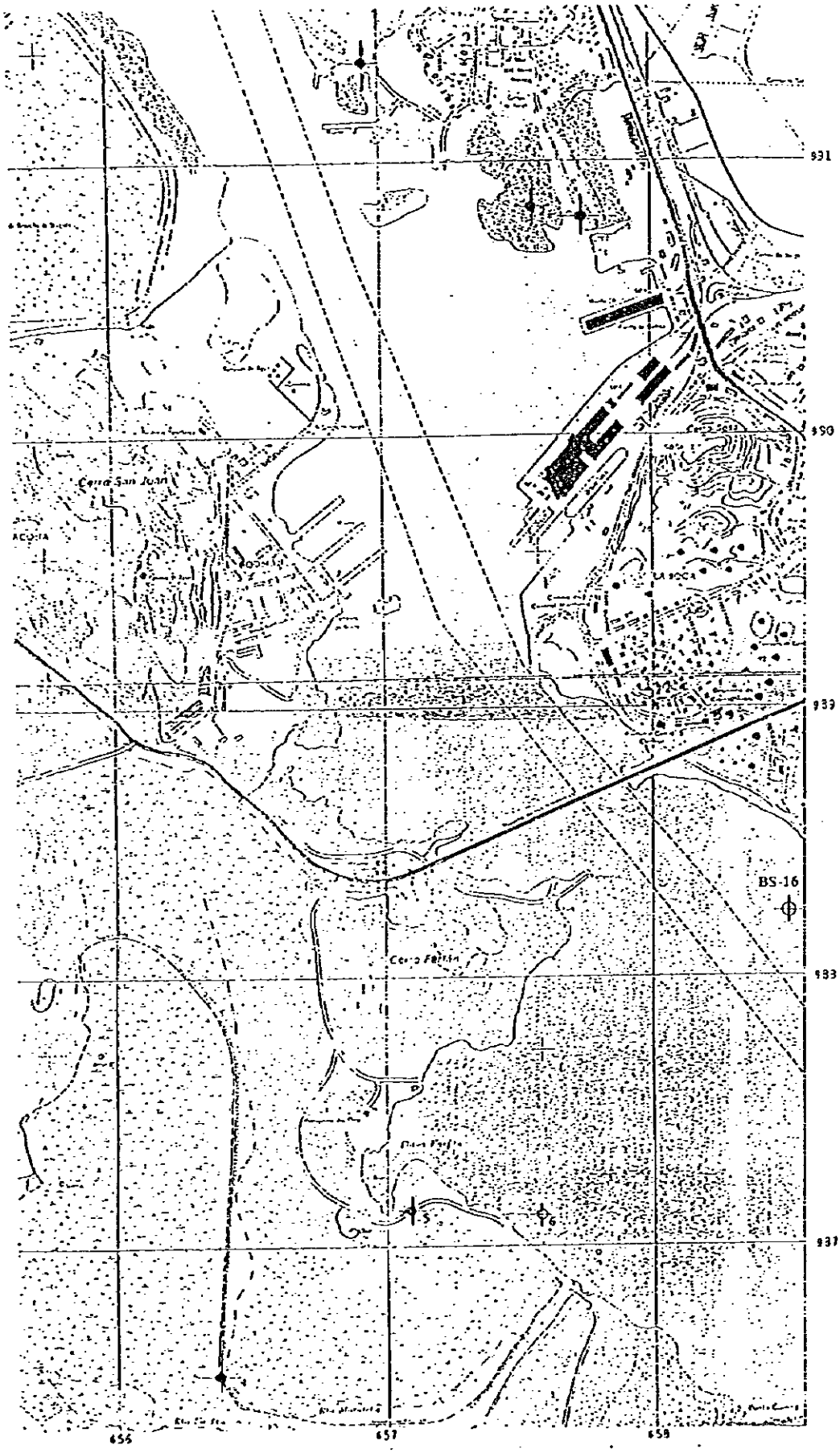


Figure A II-1 Location of Borehole Exploration

TECNILAB, S.A.
LABORATORIO DE SUELOS Y MATERIALES
MIEMBRO DEL GRUPO TECNIPAN

BOREHOLE PROFILE

JOB No. 4-171 HOLE No. 1 SHEET 1 OF 2 DRILL TYPE MECHANICAL

PROJECT DEVELOPMENT OF THE PORT OF BALBOA

LOCATION WALKER STREET, DIABLO

CLIENT PACIFIC CONSULTANTS INTERNATIONAL DATE November 19, 1996

Metres DEPTH *	Metres ELEV.	SYMBOL	DESCRIPTION OF MATERIAL VISUAL ELEV. +3.9377 (MSL)	SAMPLE No.	TYPE OF SAMPLE	STANDARD PENETRATION TEST N Blows	STANDARD PENETRATION TEST P cm.	STANDARD PENETRATION TEST q_u Kg/cm²	RECOVERY %	WATER CONTENT %	REMARKS
											0.00
0.10			TOPSOIL								
0.30											
0.60			DARK BROWN CLAYEY SILT FILL, FIRM, MEDIUM PLASTICITY	1	D	5 5 5	15 15 15	1.16	88.8	47.6	
1.50			OCHRE WITH WHITE SPOTS SILTY CLAY FILL, MEDIUM FIRM TO FIRM, MEDIUM PLASTICITY, MEDIUM WATER CONTENT, CL	2	D	2 2 2	15 15 15	0.50	100.0	35.7	
2.40											C TCB
3.00			GRAY ORGANIC CLAY, SOFT TO VERY SOFT WITH DEPTH; MEDIUM PLASTICITY; HIGH WATER CONTENT	3	D	9 3 1	15 15 15	0.50	100.0	55.4	
4.50				4	D	HW	45	0.20	44.4	86.9	
4.90			OH	1	UD		60		83.3		
6.00				5	D	3 6 6	15 15 15	1.48	22.2	60.2	
6.20			GRAY WITH WHITE SPOTS (SHELLS) ORGANIC CLAY WITH SAND AND SHELLS, FIRM, MEDIUM PLASTICITY, HIGH WATER CONTENT								
7.00											
7.50			GRAY SILTY SAND WITH SHELLS AND GRANULAR MATERIAL, MEDIUM DENSE, LOW PLASTICITY, LOW WATER CONTENT	6	D	11 9 8	15 15 15	2.26	77.7	23.9	7.50
8.00											
9.00			GRAYISH GRAY CLAY, VERY DENSE, HIGH PLASTICITY, LOW WATER CONTENT	7	D	75	12	+10.0	100.0	24.0	TCB
10.00			CH								10.00

NOMENCLATURE:

GWT - GROUNDWATER TABLE
D - DISTURBED
UD - UNDISTURBED
R - ROCK
N - NUMBER
P - PENETRATION
q_u - UNCONFINED COMPRESSION
RQD - ROCK QUALITY DESIGNATION (%)
HW - HAMMER WEIGHT
C - CASING
DTB - CORE BARREL
FB - FISHTAIL BIT
TB - 3 CONE BIT
CB - CARBIDE BIT
DB - DIAMOND BIT

REMARKS:

W.T.= 3.90 AFTER 24 HOURS

W.T. IS AFFECTED BY THE TIDE

Figure AII-2 Borehole No.1-1

TECNILAB, S.A.
LABORATORIO DE SUELOS Y MATERIALES
MIEMBRO DEL GRUPO TECNIPAN

BOREHOLE PROFILE

JOB No. 4-171 HOLE No. 1 SHEET 2 OF 2 DRILL TYPE MECHANICAL
PROJECT DEVELOPMENT OF THE PORT OF BALBOA
LOCATION WALKER STREET, DIABLO
CLIENT PACIFIC CONSULTANTS INTERNATIONAL DATE November 19, 1996

Metres DEPTH *	Metres ELEV.	SYMBOL	DESCRIPTION OF MATERIAL VISUAL	SAMPLE No.	TYPE OF SAMPLE	STANDARD PENETRATION TEST N Blows	STANDARD PENETRATION TEST P cm	STANDARD PENETRATION TEST q_u Kg/cm²	RECOVERY %	WATER CONTENT %	REMARKS
10.07		XX	SAME MATERIAL DESCRIBED ABOVE	8	D	75	7	+10.0	100.0	22.5	10.00
				1	R		80		71.2		
10.87			CREAM WITH GRAY STREAKS SOUND ROCK, SOFT, HIGH WATER CONTENT	9	D	50	4	+10.0	100.0	23.4	DT8 CB
11.31								74.2			
				2	R		100		100.0		
11.91				10	D	50	7	+10.0	100.0	28.1	
11.98											11.98
			END OF BORING								

NOMENCLATURE:
GWT - GROUNDWATER TABLE
D - DISTURBED
UD - UNDISTURBED
R - ROCK
N - NUMBER
P - PENETRATION
q_u - UNCONFINED COMPRESSION
RQD - ROCK QUALITY DESIGNATION IN
HW - HAMMER WEIGHT
C - CASING
DTB - CORE BARREL
FB - FISHTAIL BIT
TB - 3 CONE BIT
CB - CARBIDE BIT
DB - DIAMOND BIT

REMARKS:

Figure AII-3 Borehole No.1-2

TECNILAB, S.A.
LABORATORIO DE SUELOS Y MATERIALES
MIEMBRO DEL GRUPO TECNIPAN

BOREHOLE PROFILE

JOB No. 4-171 HOLE No. 2 SHEET 1 OF 2 DRILL TYPE MECHANICAL

PROJECT DEVELOPMENT OF THE PORT OF BALBOA

LOCATION ROOSEAU STREET, DIABLO

CLIENT PACIFIC CONSULTANTS INTERNATIONAL DATE November 21, 1996

Metres DEPTH *	Metres ELEV.	SYMBOL	DESCRIPTION OF MATERIAL VISUAL ELEV. +4.0924 (MSL)	SAMPLE No.	TYPE OF SAMPLE	STANDARD PENETRATION TEST N Blows	STANDARD PENETRATION TEST P cm	STANDARD PENETRATION TEST q_u Kg/cm²	RECOVERY %	WATER CONTENT %	REMARKS
0.08			TOPSOIL								0.00
0.60			FILL; LIGHT TO DARK BROWN MIXTURE OF SILTY SAND, ORGANIC CLAY AND RUBBLE; MEDIUM DENSE TO VERY SOFT; MEDIUM TO LOW PLASTICITY, LOW TO MEDIUM WATER CONTENT	1	D	11 8 6	15 15 15	1.80	44.4	14.9	
1.50				2	D	1 1 1	15 15 15	0.25	15.5	23.7	
3.00				3	D	8 3 7	15 15 15	1.16	33.3	41.1	C TCB
4.00											
4.50			GRAY ORGANIC CLAY; VERY SOFT TO SOFT WITH DEPTH; MEDIUM PLASTICITY; HIGH WATER CONTENT OH	4	D	1 1 2	15 15 15	0.37	44.4	56.2	
5.60				1	UD		60		50.0		
6.00				5	D	HW	45	0.20	77.7	91.5	
7.50				6	D	1 2 2	15 15 15	0.50	100.0	79.9	7.50
7.85											
8.00			GRAY WITH WHITE SPOTS (SHELLS) ORGANIC CLAY WITH SAND AND SHELLS, SOFT, MEDIUM TO HIGH PLASTICITY, MEDIUM WATER CONTENT OH	2	UD		60		100.0		
9.00				7	D	2 2 2	15 15 15	0.50	88.8	35.5	TCB
10.00											10.00

NOMENCLATURE:

GWT - GROUNDWATER TABLE
D - DISTURBED
UD - UNDISTURBED
R - ROCK
N - NUMBER
P - PENETRATION
q_u - UNCONFINED COMPRESSION
RQD - ROCK QUALITY DESIGNATION (%)
HW - HAMMER WEIGHT
C - CASING
DTB - CORE BARREL
FB - FISHTAIL BIT
TB - 3-CONE BIT
CB - CARBIDE BIT
DB - DIAMOND BIT

REMARKS:

W.T.= 2.40 m. AFTER 24 HOURS

W.T. IS AFFECTED BY THE TIDE

Figure AII-4 Borehole No.2-1

TECNILAB, S.A.
LABORATORIO DE SUELOS Y MATERIALES
MIEMBRO DEL GRUPO TECNIPAN

BOREHOLE PROFILE

JOB No. 4-171 HOLE No. 2 SHEET 2 OF 2 DRILL TYPE MECHANICAL

PROJECT DEVELOPMENT OF THE PORT OF BALBOA

LOCATION ROOSEAU STREET, DIABLO

CLIENT PACIFIC CONSULTANTS INTERNATIONAL DATE November 21, 1996

Metres DEPTH *	Metres ELEV.	SYMBOL	DESCRIPTION OF MATERIAL VISUAL	SAMPLE No.	TYPE OF SAMPLE	STANDARD PENETRATION TEST N Blows	STANDARD PENETRATION TEST P cm.	STANDARD PENETRATION TEST q_u Kg/cm²	RECOVERY %	WATER CONTENT %	REMARKS
10.00											10.00
10.50				8	D	19 15 25	15 15 15	5.00	22.2	29.8	
12.00			LIGHT OCHRE CLAY WITH SAND; DENSE TO VERY DENSE WITH DEPTH; MEDIUM PLASTICITY; MEDIUM TO LOW WATER CONTENT	9	D	11 13 22	15 15 15	4.50	100.0	41.3	TCB
13.50			CH	10	D	75	10	+10.0	100.0	26.4	
15.00				11	D	50	5	+10.0	100.0	21.3	15.00
15.30											
15.75			GRAY SOUND ROCK, HARD, LOW WATER CONTENT	1	R		100	57.1	54.0		DTB
16.05				12	D	50	5	+10.0	100.0	15.2	CB
16.10											16.10
			END OF BORING								

NOMENCLATURE:
GWT - GROUNDWATER TABLE
D - DISTURBED
UD - UNDISTURBED
R - ROCK
N - NUMBER
P - PENETRATION
q_u - UNCONFINED COMPRESSION
RQD - ROCK QUALITY DESIGNATION %
HW - HAMMER WEIGHT
C - CASING
DTB - DOREL BARREL
FB - FISHTAIL BIT
TB - 3-CONE BIT
CB - CARBIDE BIT
DB - DIAMOND BIT

REMARKS:

Figure AII-5 Borehole No.2-2

TECNILAB, S.A.
LABORATORIO DE SUELOS Y MATERIALES
MIEMBRO DEL GRUPO TECNIPAN

BOREHOLE PROFILE

JOB No. 4-171 HOLE No. 3 SHEET 1 OF 3 DRILL TYPE MECHANICAL

PROJECT DEVELOPMENT OF THE PORT OF BALBOA

LOCATION END ROOSEAU STREET, DIABLO

CLIENT PACIFIC CONSULTANTS INTERNATIONAL DATE November 23, 1996

Metres DEPTH	Metres ELEV.	SYMBOL	DESCRIPTION OF MATERIAL VISUAL ELEV. +3.5808 (MSL)	SAMPLE No.	TYPE OF SAMPLE	STANDARD PENETRATION TEST N (Blows)	STANDARD PENETRATION TEST P (cm)	STANDARD PENETRATION TEST q_u Kg/cm²	RECOVERY %	WATER CONTENT %	REMARKS
											0.00
0.08			TOPSOIL								
0.60			FILL; MIXTURE OF LIGHT BROWN HARDPAN SILT AND REDDISH BROWN SILTY CLAY, MEDIUM DENSE, MEDIUM TO LOW PLASTICITY, LOW TO MEDIUM WATER CONTENT	1	D	6 14 8	15 15 15	2.91	66.6	16.8	
1.50				2	D	4 2 10	15 15 15	1.48	17.7	29.2	
3.00				3	D	6 9 12	15 15 15	2.78	22.2	36.5	C TCB
4.10											
4.50			FILL: GRAY HARDPAN SILT WITH CLAY, MEDIUM DENSE, MEDIUM TO LOW PLASTICITY, MEDIUM WATER CONTENT	4	D	8 7 4	15 15 15	1.32	22.2	34.6	
6.00				5	D	9 7 8	15 15 15	2.00	66.6	27.1	
6.60											
7.50			GRAY WITH WHITE SPOTS (SHELLS) ORGANIC CLAY WITH SAND AND SHELLS, HARD, MEDIUM PLASTICITY, HIGH WATER CONTENT OH	6	D	30 16 16	15 15 15	4.20	66.6	74.0	7.50
8.00											
9.00			GRAY ORGANIC CLAY, VERY SOFT TO MEDIUM FIRM WITH DEPTH, MEDIUM PLASTICITY, HIGH WATER CONTENT OH	1	UD		60		50.0		TCB
				7	D	2 3 2	15 15 15	0.50	88.8	58.9	
10.00											10.00

NOMENCLATURE:
GWT - GROUNDWATER TABLE
D - DISTURBED
UD - UNDISTURBED
R - ROCK
N - NUMBER
P - PENETRATION
q_u - UNCONFINED COMPRESSION
RQD - ROCK QUALITY DESIGNATION IN
HW - HAMMER WEIGHT
C - CASING
CTB - CORE BARREL
FB - FISHTAIL BIT
TB - 3-CONE BIT
CB - CARBIDE BIT
DB - DIAMOND BIT

REMARKS:
W.T.= 2.50 m. AFTER 24 HOURS
W.T. IS AFFECTED BY THE TIDE

Figure AII-6 Borehole No.3-1

TECNILAB, S.A.
LABORATORIO DE SUELOS Y MATERIALES
MIEMBRO DEL GRUPO TECNIPAN

BOREHOLE PROFILE

JOB No. 4-171 HOLE No. 3 SHEET 2 OF 3 DRILL TYPE MECHANICAL
PROJECT DEVELOPMENT OF THE PORT OF BALBOA
LOCATION END ROOSEAU STREET, DIABLO
CLIENT PACIFIC CONSULTANTS INTERNATIONAL DATE November 23, 1996

Metres DEPTH *	Metres ELEV.	SYMBOL	DESCRIPTION OF MATERIAL VISUAL	SAMPLE No.	TYPE OF SAMPLE	STANDARD PENETRATION TEST N (Blows)	STANDARD PENETRATION TEST P cm.	STANDARD PENETRATION TEST q_u Kg/cm²	RECOVERY %	WATER CONTENT %	REMARKS
10.00											10.00
10.50				8	D	1 1 1	15 15 15	0.25	100.0	75.2	
11.00				2	UD		60		75.0		
			GRAY ORGANIC CLAY, VERY SOFT TO MEDIUM FIRM WITH DEPTH, MEDIUM PLASTICITY, HIGH WATER CONTENT								
12.00				9	D	1 1 1	15 15 15	0.25	77.7	86.6	
			OH								
13.50				10	D	1 2 3	15 15 15	0.50	84.4	110.0	
15.00				11	D	15 11 14	15 15 15	3.30	84.4	83.0	TCB
15.80											
16.50				12	D	14 21 28	15 15 15	5.45	95.5	36.5	
			DARK BROWN WITH GRAY STREAKS CLAYEY SILT, DENSE TO VERY DENSE WITH DEPTH; MEDIUM TO LOW PLASTICITY; LOW WATER CONTENT								
18.00				13	D	24 34 52	15 15 15	6.55	95.5	28.2	
			ML								
19.50				14	D	50 52	15 10	+10.0	100.0	23.0	19.50 DTB CB 20.00
20.00											

NOMENCLATURE:
GWT - GROUNDWATER TABLE
D - DISTURBED
UD - UNDISTURBED
R - ROCK
N - NUMBER
P - PENETRATION
q_u - UNCONFINED COMPRESSION
RQD - ROCK QUALITY DESIGNATION IN
HW - HAMMER WEIGHT
C - CASING
DTB - CORE BARREL
FB - FISHTAIL BIT
TB - 3-CONE BIT
CB - CARBIDE BIT
DB - DIAMOND BIT

REMARKS:

Figure AII-7 Borehole No. 3-2

TECNILAB, S.A.
LABORATORIO DE SUELOS Y MATERIALES
MIEMBRO DEL GRUPO TECNIPAN

BOREHOLE PROFILE

JOB No. 4-171 HOLE No. 3 SHEET 3 OF 3 DRILL TYPE MECHANICAL
PROJECT DEVELOPMENT OF THE PORT OF BALBOA
LOCATION END ROOSEAU STREET, DIABLO
CLIENT PACIFIC CONSULTANTS INTERNATIONAL DATE November 23, 1996

Metres DEPTH *	ELEV.	SYMBOL	DESCRIPTION OF MATERIAL VISUAL	SAMPLE No.	TYPE OF SAMPLE	STANDARD PENETRATION TEST N Blows	P cm	q_u Kg/cm²	RECOVERY %	WATER CONTENT %	REMARKS
20.00			SAME MATERIAL DESCRIBED ABOVE	1	R		100		15.0		DTB 20.00
20.75				15	D	68	15	+10.0	100.0	21.6	CB
20.90			END OF BORING								20.90

NOMENCLATURE:
GWT - GROUNDWATER TABLE
D - DISTURBED
UD - UNDISTURBED
R - ROCK
N - NUMBER
P - PENETRATION
q_u - UNCONFINED COMPRESSION
RQD - ROCK QUALITY DESIGNATION IN
HW - HAMMER WEIGHT
C - CASING
DTB - CORE BARREL
FB - FISHTAIL BIT
TB - 3-CONE BIT
CB - CARBIDE BIT
DB - DIAMOND BIT

REMARKS:

Figure AII-8 Borehole No.3-3

TECNILAB, S.A.
LABORATORIO DE SUELOS Y MATERIALES
MIEMBRO DEL GRUPO TECNIPAN

BOREHOLE PROFILE

JOB No. 4-171 HOLE No. 4 SHEET 1 OF 2 DRILL TYPE MECHANICAL

PROJECT DEVELOPMENT OF THE PORT OF BALBOA

LOCATION STREET ALONGSIDE MATUTELA RIVER, FARFAN

CLIENT PACIFIC CONSULTANTS INTERNATIONAL DATE November 28, 1996

Metres DEPTH *	ELEV.	SYMBOL	DESCRIPTION OF MATERIAL	SAMPLE No.	TYPE OF SAMPLE	STANDARD PENETRATION TEST N Blows	P cm.	q_u Kg/cm²	RECOVERY %	WATER CONTENT %	REMARKS
0.00			VISUAL ELEV. +5.3673 (MSL)								0.00
0.60			FILL: OCHRE WITH GRAY AND PURPLE SPOTS HARDPAN SILT WITH CLAY, MEDIUM DENSE TO DENSE, LOW PLASTICITY, MEDIUM WATER CONTENT	1	D	7 17 23	15 15 15	5.00	77.7	20.5	
1.50				2	D	12 10 7	15 15 15	2.26	88.8	9.0	C TCB
3.00				3	D	7 10 11	15 15 15	2.78	N.R.	-	
3.80											
4.50			GRAY WITH REO SPOTS SILTY CLAY WITH GRANULAR MATERIAL, VERY FIRM, MEDIUM PLASTICITY, LOW WATER CONTENT	4	D	9 14 6	15 15 15	2.65	11.1	17.2	
5.60											
6.00				5	D	5 3 3	15 15 15	0.67	100.0	85.2	6.00
6.80			GRAY ORGANIC SILT, MEDIUM FIRM TO SOFT WITH DEPTH; LOW PLASICITY; HIGH WATER CONTENT	1	UD		60		63.3		
7.50				6	D	1 2 2	15 15 15	0.50	100.0	83.3	
			OL								TCB
9.00				7	D	1 1 1	15 15 15	0.25	88.8	79.4	
10.00											10.00

NOMENCLATURE:

GWT - GROUNDWATER TABLE
D - DISTURBED
UD - UNDISTURBED
R - ROCK
N - NUMBER
P - PENETRATION
q_u - UNCONFINED COMPRESSION
RQD - ROCK QUALITY DESIGNATION IN
HW - HAMMER WEIGHT
C - CASING
CB - CORE BARREL
FB - FISHTAIL BIT
TB - TRICONE BIT
CB - CARBIDE BIT
DB - DIAMOND BIT

REMARKS:

W.T. = 3.40 m. AFTER 24 HOURS

Figure AII-9 Borehole No.4-1

TECNILAB, S.A.
LABORATORIO DE SUELOS Y MATERIALES
MIEMBRO DEL GRUPO TECNIPAN

BOREHOLE PROFILE

JOB No. 4-171 HOLE No. 4 SHEET 2 OF 2 DRILL TYPE MECHANICAL
PROJECT DEVELOPMENT OF THE PORT OF BALBOA
LOCATION STREET ALONGSIDE MATUTELA RIVER, FARFAN
CLIENT PACIFIC CONSULTANTS INTERNATIONAL DATE November 28, 1996

Metres DEPTH *	ELEV.	SYMBOL	DESCRIPTION OF MATERIAL VISUAL	SAMPLE No.	TYPE OF SAMPLE	STANDARD PENETRATION TEST N (blows)	P cm.	q_u Kg/cm²	RECOVERY %	WATER CONTENT %	REMARKS
10.00											10.00
10.50			SAME MATERIAL DESCRIBED ABOVE	8	D	1 1 4	15 15 15	0.50	66.6	80.0	
11.30											
12.00			DARK BROWN WITH GRAY SPOTS CLAYEY SILT WITH FRAGMENTS OF GRAVEL, DENSE TO VERY DENSE, MEDIUM PLASTICITY, MEDIUM TO LOW WATER CONTENT	9	D	14 16 14	15 15 15	4.00	N.R.	-	
13.50			MH	10	D	26 13 22	15 15 15	4.50	100.0	38.6	TC8
15.00				11	D	21 43 50	15 15 15	6.69	95.5	28.7	
16.00											
16.50			GRAY FRACTURED ROCK WITH LITTLE OXIDATION, ANDESITIC AGGLOMERATE, VERY HARD, LOW WATER CONTENT	12	D	50	5	+10.0	100.0	11.8	16.50
				1	R		150		26.6		DTB CB
18.05				13	D	50	5	+10.0	100.0	18.8	
18.60				2	R		50	40.0			18.60
			END OF BORING								

NOMENCLATURE:
GWT - GROUNDWATER TABLE
D - DISTURBED
UD - UNDISTURBED
R - ROCK
N - NUMBER
P - PENETRATION
q_u - UNCONFINED COMPRESSION
RQD - ROCK QUALITY DESIGNATION %
HW - HAMMER WEIGHT
C - CASING
CTB - CORE BARREL
FB - FISHTAIL BIT
TB - 3 CONE BIT
CB - CARBIDE BIT
DB - DIAMOND BIT

REMARKS:

Figure AII-10 Borehole No.4-2

TECNILAB, S.A.
LABORATORIO DE SUELOS Y MATERIALES
MIEMBRO DEL GRUPO TECNIPAN

BOREHOLE PROFILE

JOB No. 4-171 HOLE No. 5 SHEET 1 OF 2 DRILL TYPE MECHANICAL

PROJECT DEVELOPMENT OF THE PORT OF BALBOA

LOCATION Km. 1+00 TOWARDS VERACRUZ, FARFAN

CLIENT PACIFIC CONSULTANTS INTERNATIONAL DATE November 30, 1996

Metres DEPTH	Metres ELEV.	SYMBOL	DESCRIPTION OF MATERIAL	SAMPLE No.	TYPE OF SAMPLE	STANDARD PENETRATION TEST N Blows	STANDARD PENETRATION TEST P cm.	STANDARD PENETRATION TEST q_u Kg/cm²	RECOVERY %	WATER CONTENT %	REMARKS
*			VISUAL ELEV. +6.0568 (MSL)								0.00
0.10			TOPSOIL								
0.60			FILL: OCHRE CLAYEY SILT, HARD, MEDIUM PLASTICITY, MEDIUM WATER CONTENT; FROM 3.0 TO 3.40 m. A BOULDER WAS ENCOUNTERED	1	D	19 15 24	15 15 15	4.90	88.8	22.2	
1.50				2	D	50	13	+10.0	38.4	12.8	
				1	R		40		62.5		C TC8
3.40			FILL: LIGHT BROWN HARDPAN SILT, FIRM								
4.80											
6.00			CREAM WITH WHITE SPOTS WELL GRADED SAND, COARSE TO MEDIUM GRAINED, MEDIUM DENSE TO DENSE, LOW WATER CONTENT, NONPLASTIC	3	D	11 12 13	15 15 15	3.30	55.5	16.5	
			SW								7.50
											TC8
9.00				4	D	22 28 17	15 15 15	5.25	66.6	14.2	
9.80											
10.00			DESCRIPTION ON FOLLOWING PAGE								10.00

NOMENCLATURE:

GWT - GROUNDWATER TABLE
D - DISTURBED
UD - UNDISTURBED
R - ROCK
N - NUMBER
P - PENETRATION
q_u - UNCONFINED COMPRESSION
RQD - ROCK QUALITY DESIGNATION IN
HW - HAMMER WEIGHT
C - CASING
DTB - COREL BARREL
FB - FISHTAIL BIT
TB - 3 CONE BIT
CB - CARBIDE BIT
DB - DIAMOND BIT

REMARKS:

W.T.= 4.50 m. AFTER 24 HOURS

Figure AII-11 Borehole No.5-1

TECNILAB, S.A.
LABORATORIO DE SUELOS Y MATERIALES
MIEMBRO DEL GRUPO TECNIPAN

BOREHOLE PROFILE

JOB No. 4-171 HOLE No. 5 SHEET 2 OF 2 DRILL TYPE MECHANICAL

PROJECT DEVELOPMENT OF THE PORT OF BALBOA

LOCATION Km. 1+00 TOWARDS VERACRUZ, FARFAN

CLIENT PACIFIC CONSULTANTS INTERNATIONAL DATE November 30, 1996

Metres DEPTH *	Metres ELEV.	SYMBOL	DESCRIPTION OF MATERIAL VISUAL	SAMPLE No.	TYPE OF SAMPLE	STANDARD PENETRATION TEST N (Blows)	STANDARD PENETRATION TEST P cm	STANDARD PENETRATION TEST q_u Kg/cm²	RECOVERY %	WATER CONTENT %	REMARKS
10.00											10.00
10.50				5	D	50	15	+10.0	N.R.	-	
			OCHRE WITH GRAY STREAKS CLAYEY SAND, VERY DENSE, MEDIUM TO LOW PLASTICITY, MEDIUM WATER CONTENT								
12.00				6	D	43 50	15 15	+10.0	83.3	29.2	TCB
13.50			SC	7	D	50	12	+10.0	N.R.	-	
14.90											14.90
15.00			GRAY ANDESITIC BASALT, SOUND ROCK, VERY HARD	8	D	50	2	+10.0	N.R.	-	DTB
				2	R		50		40.0		CB
15.52				9	D	50	-	+10.0	N.R.	-	15.52
			END OF BORING								

NOMENCLATURE:

GWT - GROUNDWATER TABLE
D - DISTURBED
UD - UNDISTURBED
R - ROCK
N - NUMBER
P - PENETRATION
q_u - UNCONFINED COMPRESSION
ROD - ROCK QUALITY DESIGNATION (%)
HW - HAMMER WEIGHT
C - CASING
DTB - CORE BARREL
FB - FISHTAIL BIT
TB - 3 CONE BIT
CB - CARBIDE BIT
DB - DIAMOND BIT

REMARKS:

Figure AII-12 Borehole No.5-2

TECNILAB, S.A.
LABORATORIO DE SUELOS Y MATERIALES
MIEMBRO DEL GRUPO TECNIPAN

BOREHOLE PROFILE

JOB No. 4-171 HOLE No. 6 SHEET 1 OF 2 DRILL TYPE MECHANICAL
PROJECT DEVELOPMENT OF THE PORT OF BALBOA
LOCATION FARFAN BEACH
CLIENT PACIFIC CONSULTANTS INTERNATIONAL DATE December 14, 1996

Metres DEPTH *	ELEV.	SYMBOL	DESCRIPTION OF MATERIAL	SAMPLE No.	TYPE OF SAMPLE	STANDARD PENETRATION TEST N Blows	P cm.	q_u Kg/cm²	RECOVERY %	WATER CONTENT %	REMARKS
0.00			VISUAL ELEV. -1.74 (MSL)								0.00
1.50			CREAM SAND AND GRAY ORGANIC CLAY, LOOSE TO MEDIUM DENSE, MEDIUM TO LOW PLASTICITY, MEDIUM TO LOW WATER CONTENT	1	D	4 4 3	15 15 15	0.84	77.7	21.6	C TCB
3.00			SC	2	D	17 8 5	15 15 15	1.64	15.5	13.4	
4.50				3	D	2 1 2	15 15 15	0.37	11.1	23.4	
5.80											6.00
6.00			OCHRE CLAYEY SILT, VERY DENSE, MEDIUM TO LOW PLASTICITY, LOW WATER CONTENT	4	D	22 55	15 15	+10.0	56.5	24.4	
7.50			ML	5	D	50	10	+10.0	80.0	19.8	TCB
9.00				6	D	50	-	+10.0	N.R.	-	
10.00											10.00

NOMENCLATURE:
GWT - GROUNDWATER TABLE
D - DISTURBED
UD - UNDISTURBED
R - ROCK
N - NUMBER
P - PENETRATION
q_u - UNCONFINED COMPRESSION
RQD - ROCK QUALITY DESIGNATION %
HW - HAMMER WEIGHT
C - CASING
CTB - COREL BARREL
FB - FISHTAIL BIT
TB - 3 CONE BIT
CB - CARBIDE BIT
DB - DIAMOND BIT

REMARKS:
N.T. IS AFFECTED BY CHANGE OF TIDES

Figure AII-13 Borehole No.6-1

TECNILAB, S.A.
LABORATORIO DE SUELOS Y MATERIALES
MIEMBRO DEL GRUPO TECNIPAN

BOREHOLE PROFILE

JOB No. 4-171 HOLE No. 6 SHEET 2 OF 2 DRILL TYPE MECHANICAL

PROJECT DEVELOPMENT OF THE PORT OF BALBOA

LOCATION FARFAN BEACH

CLIENT PACIFIC CONSULTANTS INTERNATIONAL DATE December 14, 1996

Metres DEPTH *	Metres ELEV.	SYMBOL	DESCRIPTION OF MATERIAL VISUAL	SAMPLE No.	TYPE OF SAMPLE	STANDARD PENETRATION TEST N Blows	STANDARD PENETRATION TEST P cm.	STANDARD PENETRATION TEST q_u Kg/cm²	RECOVERY %	WATER CONTENT %	REMARKS
10.00											10.00
10.50			GRAYISH BROWN WEATHERED ROCK, HARD, MEDIUM WATER CONTENT	7	D	50	7	+10.0	100.0	24.3	TC8
11.70											11.70
				8	D	50	-	+10.0	N.R.	-	
			DARK GRAY SOUND ROCK, HARD; OXIDATION AT THE JOINTS	1	R		50		76.0		DTB
											CB
12.94				2	R		100	347.5	40.0		
13.20											13.20
			END OF BORING								

NOMENCLATURE:

GWT - GROUNDWATER TABLE
D - DISTURBED
UD - UNDISTURBED
R - ROCK
N - NUMBER
P - PENETRATION
q_u - UNCONFINED COMPRESSION
RQD - ROCK QUALITY DESIGNATION (%)
HW - HAMMER WEIGHT
C - CASING
OTB - COPEL BARREL
FB - FISHTAIL BIT
TB - TRICONE BIT
CB - CARBIDE BIT
DB - DIAMOND BIT

REMARKS:

Figure AII-14 Borehole No.6-2

ENGINEERING AND CONSTRUCTION BUREAU

INSPECTORS GEOLOGICAL FIELD LOG

Pacific Side Sewage Collection and Disposal Job No. 753-53-003

Hole No.: BS-16 Inspector: Robert E. Stewart Date Completed 5/7/55

Latitude: 8°56'+3522 Longitude: 79°33'+4941 Driller: [illegible]

Ground Elevation: -7.3 Recovery: 16% Sheet No: 1 of 1

Elevation	Depth	Columnar Section	Description of Material	Drilling Characteristics	Recovery
0.00	0.00		Precise level datum Water at high tide, dry at low tide.		
	-7.3		TOP OF PACIFIC MUCK		
			Sand, silt, and clay, OH-1, weak, low plasticity, low dry strength, consists of carbonaceous fine sand, silt and clay with calcareous shell debris; Color, dark grey to black.	Drills easily with no water, the weight of the drill tools causing penetration.	
			TOP OF WEATHERED ROCK		
	-25.0		Clay and silt, OH-3-5, weak, low plasticity, low dry strength, consists of saprolitic silt and clay derived from an andesite intrusive, small joint blocks still contain partially weathered andesite centers; Color, dark brown at top grading to mottled buff and brown at the base.	Drills easily with water, but core washes and grinds up badly.	2.4
	-29.8		TOP OF SOUND ROCK		0.6
			ANDESITE RH-3, strong, closely jointed with abundant weathering along joints, consists of a very fine grained porphyritic andesite; Color, mottled dark grey and buff.	Drills easily with water but core recovered in fragmental condition because of close jointing.	
	-36.9		BOTTOM OF HOLE		2.8
			Note: -7.3 – -25.0 Pacific Muck -25.0 – -29.8 Saprolitic Andesite -2918 – -36.9 Andesite Piles may be driven to 29.8 ft.		

Source: PCC

Figure AII-15 Borehole BS-16

APPENDIX III SIMULATION ON THE OPERATION OF THE CONTAINER TERMINAL

1. As shown in Figure APP-II-1, computer simulation (Witness) was introduced to verify the possible annual throughputs to be handled at the proposed Diablo Container Terminal (frontage:700m x depth:350m). Consequently, it is reported that 600,000 TEUs could be handled when the depth of the terminal is 350 meters, however, a depth of 500 meters is required when handling volume increases to 800,000 TEUs.

2. Simulation is composed of following several assumptions ;

Nature of the ship	Calling frequency	Discharge/Load (TEU)
Mother (A)	Weekly	1,800/1,800
	Second Week	+ 10%/+ 10%
	Fourth Week	- 10%/- 10%
Feeder (B)	Weekly	900/900
	Same as Mother Boat	
Feeder (C)	Weekly	900/900
	Same as Mother Boat	
Mother/Land-Bridge (D)	Weekly (base	390/390)
	First Week	+ 20%/+20%
	Second Week	- 20%/- 20%
Feeder (E)	Weekly (base	390/390)
	Same as Mother/L.B. (D)	
Local (F)	Weekly	450/450
Local (G)	Weekly	450/450

Basic pattern of ship's entry

	1st day	2	3	4	5	6	7
Berth (1)	A(56 hrs)			B(29 hrs)		B(29 hrs)	
Berth (2)		F(16 hrs)	D(35 hrs)		G(16 hrs)		E(35 hrs)

Delay of the ship is also taken account.

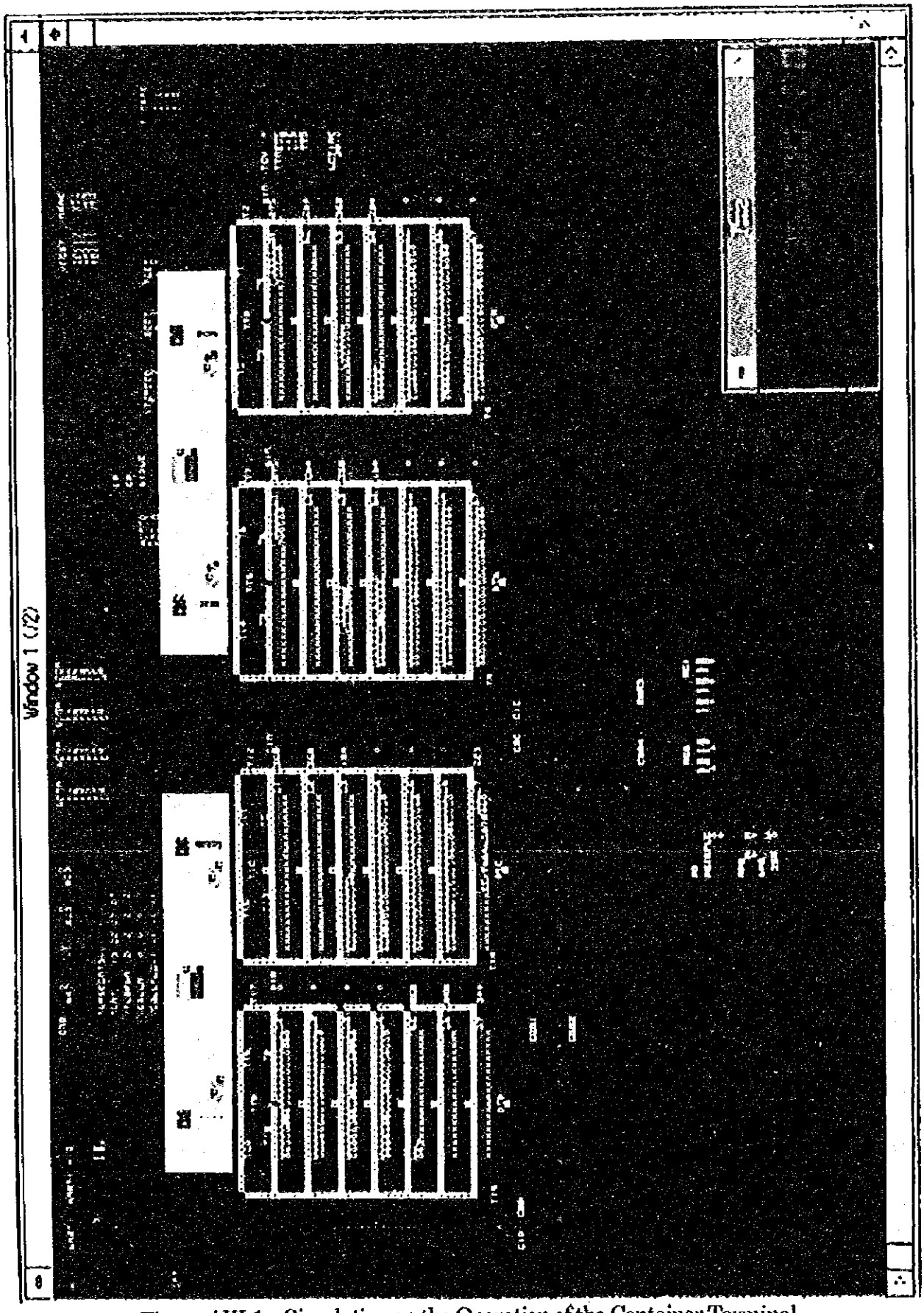


Figure AIII-1 Simulation on the Operation of the Container Terminal

APPENDIX IV COST COMPARISON OF SHORT-TERM DEVELOPMENT PLANS BETWEEN JICA AND HIT

1. In order to justify the short-term development plan recommended by the JICA Study Team, it is compared with that of HIT(see the attached figure).

2. As HIT's plan will demolish a part of Pier No. 15, and all of Pier No. 16 and No. 18, the cost of the urgent measures allocated for repairing these piers should be deducted. It is assumed for the comparison that HIT's plan can save 40% of the cost of the urgent measures.

3. Regarding the second stage of the short-term development, it is assumed that HIT will extend the face-line of the berth straight almost to the north from that of the first stage development. This is due to the convenience of ship berthing.

4. As the existing small boat berths, namely Pier No. 17 and No. 19, will be demolished in HIT's plan, new ones are to be built as replacements. On the contrary, in case of the recommended plan, all the existing piers can be utilized.

5. As a result of the cost comparison, the recommended plan is more economical by about US$ 19 million. This is due to the large reclamation volume in the first stage development and rock encountered along the face-line of the berth in the second stage, both of which are involved in HIT's plan. The summary is tabulated below and the cost estimate is shown in the attached table.

Table A IV-1 Summary of Cost Comparison

(Unit = Million US$)

	Urgent Measures	CT 1st Stage	CT 2nd Stage	Small Boat Berths	Total
Recommended Plan	58.4	66.7	58.8	0	184
HIT's Plan	40.4	75.5	81.7	5.7	203

Note: CT : Container Terminal

6. In addition, HIT, as a private company, would come into operation based on favorable terms of the contract. Based on the contract, the cost of the improvement of basic infrastructures such as road improvement will be borne by the government. The government might also have to cover the expense of demolishing PCC facilities behind the existing piers necessary for the yard expansion, which would be beneficial to HIT.

7. That is, HIT might make a move to handle cargoes including containers at a minimum investment by utilizing the existing facilities as much and as long as possible instead of developing the Diablo container terminal. However, this type of action is typical of private companies which seek to relieve the financial load. The benefits of utilizing the existing facilities would be more that offset by various other troubles including long-term financial condition.

8. For example, PCC is firstly required to relocate the related functions to Corozal timely in a very short term after coordination with HIT. However, the availability of facilities there also depend on the political decision of the US base. The facilities might not be available for a long time. In such a case, HIT won't be able to handle the rapidly increasing number of containers, which means that some of those containers will be diverted elsewhere. On the other hand, the danger of losing containers is much less at Diablo-site.

9. From the planning point of view, HIT will be obliged to handle a lot of containers in the terminal together with conventional cargoes. Naturally, this dual operation will have a negative effect on the cargo handling productivity. This problem could be avoided if the new terminal were constructed at Diablo. In addition, the capacity of the existing facilities will be saturated simply from handling conventional cargoes by the target year of the Master Plan. Sooner or later, HIT has to develop a full container terminal at Diablo.

10. An early decision concerning the construction of a new full container terminal at Diablo would attract many shipping companies and consignees from all over the world. HIT, the port of Balboa and the government (APN) could reap great rewards.

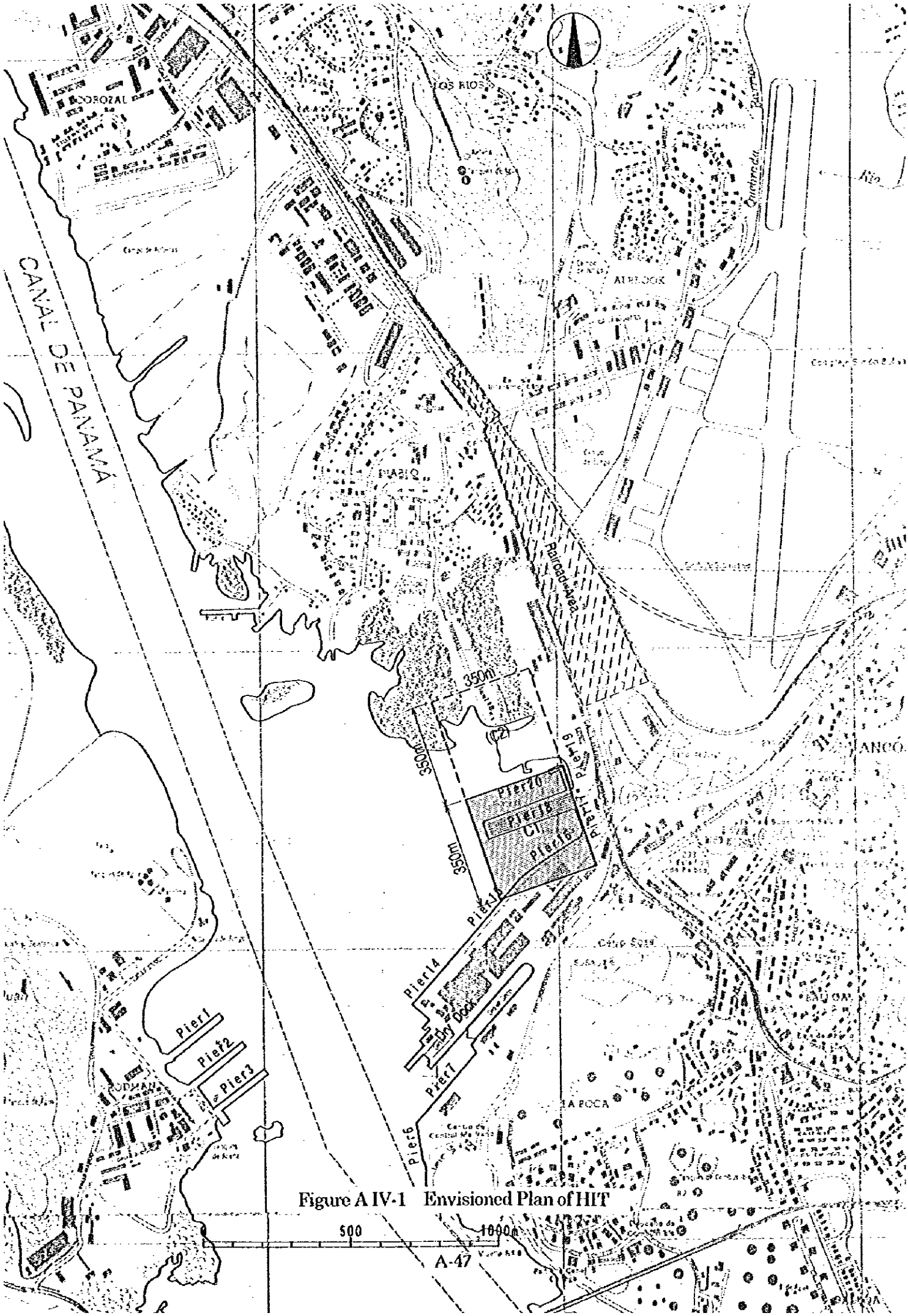


Figure A IV-1 Envisioned Plan of HIT

Table A IV-2 Cost Comparison between Alternative D5 and HIT's Plan

Item No.	Description of Work	Unit	Quantity	Unit Rate	Total Amount	Remarks
				(US$)	(US$)	
A	Alternative D5					
1	Urgent Measures					
1.1	Improvement of Piers	l.s.	1	45,000,000	45,000,000	
1.2	Equipment					
	a. Panamax Container Quay-side Cranes	each	2	4,500,000	9,000,000	
	b. Transfer Crane	each	3	1,000,000	3,000,000	
	c. Reach Stackers	each	1	350,000	350,000	
	d. Top Lifters	each	3	70,000	210,000	
	e. Trailers	each	10	60,000	600,000	
	f. Chassis	each	12	20,000	240,000	
	Equipment Total				13,400,000	
	Urgent Measures Total				58,400,000	
2	Container Terminal 1st Stage					
2.1	Dredging (-12m)	cu.m.	850,000	2.0	1,700,000	
2.2	Reclamation	cu.m.	350,000	6	2,100,000	
2.3	-14m Quay	l.m.	350	67,500	23,625,000	
2.4	Pavement	sq.m.	110,000	150	16,500,000	
2.5	Building	sq.m	6,500	200	1,300,000	
2.6	Electrical Works	l.s.	1	1,600,000	1,600,000	
2.7	Utilities Works	l.s.	1	800,000	800,000	
2.8	Access Road(incl. bridge)	l.m.	520	2,400	1,248,000	
2.9	Miscellaneous Works	l.s.	1	4,890,000	4,890,000	
	Sub-Total				53,763,000	
2.10	Post-Panamax Container Quay-side Crane	each	2	5,000,000	10,000,000	
2.11	Transfer Cranes	each	3	1,000,000	3,000,000	
	Sub-Total				13,000,000	
	Container Terminal 1st Stage Total				66,763,000	
3	Container Terminals 2nd Stage					
3.1	Reclamation	cu.m.	820,000	6	4,920,000	
3.2	-14m Quay	l.m.	350	67,500	23,625,000	
3.3	Pavement	sq.m.	123,000	150	18,450,000	
3.4	Electrical Works	l.s.	1	400,000	400,000	
3.5	Utilities Works	l.s.	1	200,000	200,000	
3.6	Access Road	l.m.	350	2,000	700,000	
3.7	Miscellaneous Works	l.s.	1	4,830,000	4,830,000	
	Sub-Total				53,125,000	
3.10	Post-Panamax Container Quay-side Crane	each	1	5,000,000	5,000,000	
3.11	Transfer & Reinstall of Panamax Container Quay-side Crane	l.s.	1	750,000	750,000	
	Sub-Total				5,750,000	
	Container Terminal 2nd Stage Total				58,875,000	
	Alternative D5 Total				184,038,000	

Item No.	Description of Work	Unit	Quantity	Unit Rate	Total Amount	Remarks
				(US$)	(US$)	
B	HIT's Plan					
1	Urgent Measures					
1.1	Improvement of Piers	l.s.	1	27,000,000	27,000,000	60% of Alt. D5.
1.2	Equipment					
	a. Panamax Container Quay-side Cranes	each	2	4,500,000	9,000,000	
	b. Transfer Crane	each	3	1,000,000	3,000,000	
	c. Reach Stackers	each	1	350,000	350,000	
	d. Top Lifters	each	3	70,000	210,000	
	e. Trailers	each	10	60,000	600,000	
	f. Chassis	each	12	20,000	240,000	
	Equipment Sub-Total				13,400,000	
	Urgent Measures Total				40,400,000	
2	Container Terminal 1st Stage					
2.1	Dredging (-12m)	cu.m.	0	2.0	0	
2.2	Demolition (Pier No. 18 Shed)	sq.m.	15,000	80.0	1,200,000	
2.3	Demolition (Pier No.15 (part), No.16, No.17, No.18)	sq.m.	56,000	40.0	2,240,000	
2.4	Reclamation	cu.m.	1,720,000	6	10,320,000	
2.5	-14m Quay	l.m.	350	67,500	23,625,000	
2.6	Pavement	sq.m.	110,000	150	16,500,000	
2.7	Building	sq.m	6,500	200	1,300,000	
2.8	Electrical Works	l.s.	1	1,600,000	1,600,000	
2.9	Utilities Works	l.s.	1	800,000	800,000	
2.10	Miscellanies Works	l.s.	1	4,890,000	4,890,000	
	Sub-Total				62,475,000	
2.11	Post-Panamax Container Quay-side Crane	each	2	5,000,000	10,000,000	
2.12	Transfer Cranes	each	3	1,000,000	3,000,000	
	Sub-Total				13,000,000	
	Container Terminal 1st Stage Total				75,475,000	
3	Container Terminals 2nd Stage					
3.1	Dredging	cu.m.	612,000	2	1,224,000	
3.2	Rock Dredging	cu.m.	108,000	200	21,600,000	
3.3	Reclamation	cu.m.	460,000	6	2,760,000	
3.4	-14m Quay	l.m.	350	67,500	23,625,000	
3.5	Pavement	sq.m.	123,000	150	18,450,000	
3.6	Electrical Works	l.s.	1	1,200,000	1,200,000	
3.7	Utilities Works	l.s.	1	200,000	200,000	
3.8	Miscellaneous Works	l.s.	1	6,910,000	6,910,000	
	Sub-Total				75,969,000	
3.9	Post-Panamax Container Quay-side Crane	each	1	5,000,000	5,000,000	
3.10	Transfer & Reinstall of Panamax Container Quay-side Crane	l.s.	1	750,000	750,000	
	Sub-Total				5,750,000	
	Container Terminal 2nd Stage Total				81,719,000	
4	Small Boat Berths					
4.1	-4.5 m Quay	l.m.	180	30,000	5,400,000	
4.2	Electrical/Utilities/Miscellaneous Works	l.s.	1	270,000	270,000	
	Small Boat Berths Total				5,670,000	
	HIT's Plan Total				203,264,000	

APPENDIX V WORKING PAPER FOR MODERNIZATION OR PRIVATIZATION OF APN

1. Objectives of private participation to port administration are to improve efficiency of service through commercial incentive, minimizing government or political interference, eliminating redundant government employee, and introducing immediate capital for development from international market.

2. Several proposals have been submitted to the Government of Panama through the Ministry of Commerce. Some proposes one specific area or terminal for exclusive concession and other proposes entire port management contract by the private sector.

3. Results of Manzanillo terminal has been so successful that a substantial part of container lines has shifted from APN terminal at Cristobal. MIT has invested a initial sum of approximately $120 million for its terminal including access channel dredging, quay wall, yard, gantry cranes and other equipment. With this highly sophisticated terminal with slim work force, MIT seems to be competitive with other Caribbean hub ports.

4. There exist so many different kinds and types of port management system in the world. General trend in the world, in recent decade, is more for private sector participation in the port operation. Many port authorities in one group of countries, including USA and Japan, retain ownership and development planning initiative but let operation of the port to private sectors. Some of government or public owned authority, where the ports had their own labor for cargo handling operation, transformed to private companies or commercialized entities while retaining direct cargo operation system. Some of other ports contract out terminal operation to one private company and another group of ports contract out terminal operation to multiple private operators.

5. Advantages of one contract for whole port operation and management are simply eliminating port management procedure from government or political interference and avoiding labor problem as a part of the government employee while the government securing immediate cash revenue for concession fee. Port management through one private management contract, however, might create a monopolistic situation.

6. With regard to the form of the port authority itself, several alternatives may be considered. One is a single authority under the board of commissioners

through which the government retain power of control. This is same as the existing APN system. The authority can be also a private corporation where the government may become a significant share holder.

7. There exists a possibility to formulate multiple authorities in Panama. One authority will be responsible only for Cristobal area including Coco Solo and Manzanillo. The other one may control on Balboa. Other smaller ports in the country may be managed by separate authorities or controlled through respective municipal government.

(1) Alternative types of administration

8. Possible alternatives for privatization applicable for APN will be as followings.

a) Convert APN into a private company. The government of Panama provides existing assets thus holds majority of the share. All the employee will become share holders including workers.

b) A successful private bidder takes over entire APN with lump sum payment to the government. The new management company will not only mange and operate Balboa and Cristobal terminals which are under direct management of APN at present but also look after other terminals under concession including Coco Solo Norte, Manzanillo, dry docks at Balboa and oil terminals.

c) A part of Balboa such as the pier No. 14,15 and 16 and the pier No. 18 with adjacent area as well as other side of the anal such as the existing Cristobal piers and Telfer island may be given for separate concessions. APN will maintain its function as the landlord and the care taker. APN will also be responsible for all development planning and contract for the concessions.

d) Detach all the existing work force under APN. New private stevedore(s) will be introduced with concession. The workers for the new stevedores may not be limited to the existing workers. APN will maintain its function as the landlord and the care taker as in the case 3 above.

e) Liquidate APN and pay indemnification to all the workers, the clerks and the managers. Establish a new port authority with limited function as

mentioned in 3 above. All the operations will be licensed out to private stevedores or terminal operatosers or shipping companies with concession.

f) As a variation to the case 5 above, establish two separate port authorities. One of which is responsible for the Pacific ports including Balboa and another takes care of Atlantic ports including Cristobal, Coco Solo and Manzanillo.

(2) Evaluation of alternatives

9. At the evaluation of possible alternatives to the port administration system, following key factors have to be considered.

1) Government control

10. The government should retain the right of minimum control on the planning and usage of the port and waterfront from the view point of public interest. However, government or political interference must be avoided from the routine management of the port.

2) Mobilization of private finance

11. Introduction of private sector will open ample opportunities for private financing.

3) Avoidance of monopoly

12. Port operation by single operator may cause monopolistic situation. Similar effect will also be created by collusion of multiple operators or labor union(s).

4) Peaceful settlement of labor redundancy

13. In order to achieve ideal formation of work force, substantial number of reduction in the existing labor is unavoidable. If proper indemnification payment by APN is not made, a private investor will not dare to face with labor problem. Magnitude of reduction of man power and re-employment of APN workers are different in the cases.

5) Flexibility for future development

14. A private investor tends to avoid competitive situation. For that purpose, excessive area might be earmarked by a private operator without immediate use. This area, however, might be utilized effectively by (a) separate user(s) immediately.

6) Attraction to the private sector

15. A private investor is always profit oriented. If there is any possible risk for such profit opportunities by various restrictions, over competition and/or labor problem, the investor will stay away from involvement.

7) Availability of management skill

16. Experienced managers for a port terminal may be available from already developed port which is most likely from outside of the country.

8) Incentive for the workers

17. Incentive for the workers is related not only to the salary level but to the working environment and management.

18. Result of evaluation in relation to the types of administrations and factors to be considered may be indicated as in the following matrix form.

Table A V-1 Matrix for Evaluation of Administration Types vs. Factors Involved

Type of administration	Government control	Private finance	Avoid monopoly	Labor management	Attraction to private sector	Management skill	Incentive for workers
a	C	B	B	D	D	D	C
b	D	A	D	A	A	A	B
c	B	B	A	A	B	B	B
d	A	C	B	B	C	C	C
e	A	B	B	C	C	B	C
f	A	B	B	C	C	C	C

Where A is excellent, B is good, C is fair and D is poor.

JICA