3-3-3 Coordination between private companies and state companies

Coordination of fields handled by state companies and private companies is not always clear, but according to P.T. Krakatau Steel, it is as follows: Namely, capital-intensive, low-profit-margin steel upstream sectors, mainly flat rolled steels, are under state-owned steel mills while low-capital, higher-profit-margin fields are left to private companies. This includes fabricator, pipe making, galvanizing, tinplating, sheet forming, bar and wire. It is true, but as mentioned above, P.T. Krakatau Steel has under it as semi-state companies tinplate mill and pipe mill which are joint venture companies with private capitals in part.

As regards distribution of steel products in Indonesia, high percentages of shipment between regions are accounted for by coastal ships connecting an island to another, and the freights of coastal shipping is very high. For example, the freights of GI sheet from Jakarta to Ujung Pandang is Rp19160 or about US$20 (in 1984) and this calls for special consideration in selecting a site for a steel mill, in particular in relation with markets for its products.

3-4. Present condition of steel industry in Indonesia

In Indonesia, there are, in addition to P.T. Krakatau Steel which is a state-owned integrated steel company based on DR process and the successor of the Trikora project as mentioned before, 11 small electric furnace steel companies and about 60 steel rolling and reprocessing companies at present. However, in 1960s, only a few rolling and re-processing companies were known to exist and the progress of the steel industry in Indonesia took place mainly after 1970s.

3-4-1 Outline of steel companies by type of operation

(1) Integrated steel company based on DR process

P.T. Krakatau Steel is the only state-owned integrated steel company based on DR process in Indonesia and its annual production capacity at the end of 1986 is 2 million tons of sponge iron (DR 4 units), 1.5 million tons of crude steel, 230,000 tons of bars and sections, 220,000 tons of wire rods and one million tons of hot rolled coil/sheet. Following completion of the first facilities of bar and section mills (150,000 t/y of bars and 80,000 t/y of sections) in 1977, all facilities under the first phase construction including 2 units of DR equipment of HyL process (1 million t/y), 4 units of 65-t electric arc furnaces (500,000 t/y), 2 units of 4-strand continuous billet casters and a wire rod mill (220,000 t/y) were completed by 1979 and put into operation. In succession, the second phase expansion project was undertaken and in 1983, in addition to 2 units of DR equipment (1 million t/y), 4 units of 130-t electric furnaces (1 million t/y), 2 units of single strand continuous slab casters and a hot strip mill (1 million t/y) were added to form the present production organization. The 1986 production was 1.3 million tons of sponge iron, 1.1 million tons of crude steel, 450,000 tons of billet, 650,000 tons of slab and 630,000 tons of hot coil, and the operating rate in terms of crude steel rose from 53% in 1985 to 73%. As a result, the company reported profit for the first time since its establishment. Incidentally, there is a spirally welded pipe mill in the compound, which is managed as a separate company (Krakatau Hoogovens International Pipe Industries).

(2) Electric furnace steel companies

Electric furnace steel companies were mostly established around 1975 and 1976, and at present, 11 companies are known. Their aggregate crude steel production capacity is

estimated to be 870,000 t/y (including P.T. Budidharma Jakarta, an open hearth furnace steel company).

The largest of those companies is P.T. Ispat Indo, a joint venture with an Indian company owning 80% and Indonesian 20%, its wire rod mill started operation in 1978 and electric arc furnaces in 1981 with annual capacity of 300,000 tons of crude steel. The second largest is P.T. Tosan Prima established in 1981 whose capacity is 250,000 t/y of crude steel, and the company is the only electric furnace steel company specialized in the production of billets only without any rolling facilities though it has a plan to install them. There is P.T. Budidharma Jakarta established in 1976 and its capacity is 90,000 t/y of crude steel, but all the other companies are small-scaled mills with annual capacity of about 30,000 tons or so.

(3) Bar rolling companies

Those companies do not have steelmaking furnaces and either produce bars using billets purchased or reroll scrap into bars. They number about 22 and their aggregate capacity is 1,000,000 tons of bars a year. Billets are provided by import excepting some part supplied by P.T. Karakatau Steel and P.T. Tosan Prima. The rerollers use scrap obtained mainly from shipbreakers.

(4) Galvanized steel sheet makers

There are 15 companies producing GI sheet using imported cold rolled sheet and their total capacity is estimated to be 550,000 tons a year. In Indonesia, GI sheet is mostly used as roofing.

(5) Plate maker

P.T. Jaya Pari Steel is the only company to produce plate and started operation in 1982. It has annual capaci-

ty of about 110,000 tons and is located in Surabaya.

(6) Welded pipe makers

There are estimated to be 16 companies with aggregate capacity of about 470,000 tons a year. The only spiral-welded pipe maker, Krakatau Hoogovens International Pipe Industries Ltd. was established as a joint venture with P.T. Krakatau Steel owning 67% and Hoogovens in Netherlands and International Pipe Industries in Philippines owning 16.5% each. It began operation in 1974 with annual capacity of 60,000 tons. The others include, among others, P.T. Bakrie & Brothers (started up in 1960 and capacity of 27,000 t/y), the oldest pipe maker in Indonesia and its subsidiary, P.T. Bakrie Pipe Industries (capacity of 60,000 t/y), which is the largest pipe maker and began operation in 1981. Materials used by those pipe makers are mostly imported hot coils, but cold rolled sheet is used in some cases.

(7) Tinplate maker

Tinplate maker in Indonesia is only one, P.T. Pelat Timah Nusantara, and P.T. Krakatau Steel is one of its shareholders. It was said that the company started up only recently in September 1985 and produced 20,000 tons of tinplate. Its annual capacity is 100,000 tons. At present the country imports more than 100,000 tons of tinplate every year, and if the company begins full operation, the import can be substituted by the domestic products.

Table 2-3-2 Number of Companies by Type of Operation and Capacity by Kind of Products

(Unit: 1,000 tons)

Type of Operation	No.	Name of Major Companies	Rated Capacity						
			Crude Steel	Products					
				H.R. Coil	Plate	Bar & Section	GI Sheet	Tin Plate	Pipe
Integrated steel mill:	1	Krakatau Steel	1,500	*1 1,000	*1	450			*2
E.F. steel mills:	11	Ispat Indo Tosan Prima Murni Budidharma Jakarta and others	870			540			
Rolling & processing mills:									
Bar & section rolling mills: (incl. re-rollers)	22	Jakarta Kyoei Steel Baja Indonesia Tobusco and others				1,000			
Plate rolling mill:	1	Jaya Pari Steel			110				
GI sheet mills:	15	Fumira Keris Mas Sukses Sermani Steel and others					550		
Tin plate mills:	1	Pelat Timah Nusantara						100	
Pipe mills:	16	Bakrie Pipe Industries Krakatau Hoogovens Industrial Pipe and others							*2 470
Total	67		2,370	1,000	110	1,990	550	100	470

Notes: *1 Thickness of products which can be produced on hot strip mill of P.T. Krakatau Steel (constructed in February 1983) ranges 2.0 - 25.0 mm.

*2 A subsidiary of P.T. Krakatau Steel, Krakatau Hoogovens International Pipe Industries Ltd., is included.

*3 Excluding cold rolling mill because of operation in February 1987.

Table 2-3-3 Facilities of Major Steel Mills (DR Integrated Steel Mill & E.F. Steel Mills)

	P.T. Krakatau Steel	Annual Capacity (ton)
Ironmaking	(DR units) HyL-I (Start-up: Nov., 1978) HyL-II (July 1979) HyL-III (Apr., 1983) HyL-IV (June 1983)	 500,000 500,000 500,000 500,000
Steelmaking	(Electric furnaces) No.1 shop 65t/ch x 4 ('78) No.2 shop 130t/ch x 4 ('83) 4-str. billet c.c. x 2 ('78) 1-str. slab c.c. x 2 ('83)	 500,000 1,000,000 500,000 1,000,000
Rolling & processing	(Bar & section mill) Bar & section mill x 1 ('77) Wire rod mill x 1 ('79) (Strip mill) Hot strip mill x 1 (Feb., '83) (Processing lines) Spiral-welded pipe, mill x 3 *1 ('74) Galvanizing line x 2 Wire drawing line x 1 Wide flange beam mill (Sep., '85) Tinning line *3 (Sep., '85)	 230,000 220,000 1,000,000 50,000 10,000 30,000 60,000 10,000
Under plan	Cold strip mill x 1 (Feb. 87) *2 Seamless pipe mill*4 Pellet plant	850,000 350,000 3,000,000
Product mix	Wire rod, bar, section, rail, H.R. sheet, plate, spiral-welded pipe, wire, galv. wire, tin plate etc.	

	P.T. Ispat Indo	Annual Capacity (ton)
Steelmaking	(E.F.) 80t/ch x 1 ('81) (C.C.) 4-str. billet c.c. x 1 ('81)	300,000 300,000
Rolling	(Bar mill) Wire rod & bar mill x 1 ('78)	150,000
Under plan	Section mill x 1	200,000
Product mix	Bar, wire rod	

	P.T. Tosan Prima Murni	Annual Capacity (ton)
	(E.F.) 25t/ch x 2 ('76) 25t/ch x 1 ('84) (C.C.) Billet c.c. x 2 ('78 & '84)	150,000 100,000
	Bar mill x 1	150,000
	Ingot, billet	

	P.T.Budidharma Jakarta	Annual Capacity (ton)
	(O.H.F.) 50t/ch x 3	90,000
	(Bar mill) Bar mill	120,000
	Bar, rebar, section	

	P.T. Pulogadung Steel Mfg. Co. Ltd.	Annual Capacity (ton)
Steelmaking	(E.F.) 15t/ch x 1	36,000
Rolling	(Bar mill) Bar mill x 2	45,000
Under plan		
Product mix	Round bar	

	P.T. Gunung Gahapi	Annual Capacity (ton)
	(E.F.) 15t/ch x 2 (C.C.) Billet c.c. x 2	30,000 30,000
	(Bar & rod mill) Bar & rod mill	30,000
	Round bar, flat bar, wire rod	

	P.T. Hanil Jaya Metal Works	Annual Capacity (ton)
	(E.F.) 5t/ch x 3 Cupola x 2	30,000
	(Bar & section mill) Bar & Section mill	40,000

Notes: ( ) shows year or month of start-up or completion.
*1 Managed as a separate company "Krakatau Hoogovens International Pipe Industries Ltd."
*2*3 Planned to be operated by separate companies as joint ventures with private companies
*4 Being studied

Table 2-3-3 Facilities of Major Steel Mills (DR Integrated Steel Mill & E.F. Steel Mills)
(Cont'd)

	P.T. Toyogiri Iron	Annual Capacity (ton)	P.T. Inti General Yaja Steel	Annual capacity (ton)	P.T. Djatim Utama Steel Mfg.	Annual Capacity (ton)	P.T. Master Steel Mfg. Co.	Annual Capacity (ton)
Steelmaking	(E.F.) 10t/ch x 1 ('76)	30,000	(E.F.) 10t/ch x 2	E 30,000	(E.F.) 1t/ch x 1 6t/ch x 1 10t/ch x 1	} 25,000	(E.F.) 8t/ch x 2	24,000
Rolling	(Bar mill) Bar mill	60,000	(Bar mill) Bar mill	15,000	(Bar mill) Bar mill	18,000	(Bar mill) Bar mill	40,000
Under plan								
Product mix			Reber		Round bar, angle, wire nail		Rebar, light section	
	P.T. Industry Baja Growth Sumatera	Annual Capacity (ton)						
steelmaking	(E.F.) n.a.	E 20,000						
Rolling	(Bar mill) Bar mill	24,000						
Under plan								
Product mix								

3-4-2 Steel production capacity by region

Indonesian steel industry is concentrated in Jawa area and of 5.07 million tons of the total capacity to produce finished rolled steels, more than 90% of the facilities is in operation in Jawa area. Though there are G.I. sheet facilities in Sumatera, Sulawesi and Kalimantan areas besides Jawa area, the production facilities for other products can be found only in Jawa area.

Table 2-3-4 Production Capacity by Region

(Unit: 1,000 t/y)

	Jawa	Sumatera	Kali-mantan	Sulawesi	Total
Bar	1,110	92	--	44	1,246
Section	312	--	--	--	312
Wire rod	350	78	--	--	428
Sub-total	1,772	170	--	44	1,986
Plate & HR sheet	1,114	--	--	--	1,114
CR sheet	850	--	--	--	850
G.I. sheet	366	122	18	48	554
Tinplate	100	--	--	--	100
Sub-total	2,430	122	18	48	2,618
Seamless pipe	--	--	--	--	--
ERW pipe	436.4	22.2	--	8.4	467
Sub-total	436.4	22.2	--	8.4	467
(Total)	(4,638.4)	(314.2)	(18)	(100.4)	(5,071)

Note: Cold rolling mill was put into operation in Feb. 1987

Table 2-3-5 Production Capacity of Certain Steel Products by Region and by Company

(Licensed capacity: Unit: 1,000 t)

Region	Wire rod	Plated sheet	Wire rope	(Section H, I)	Wire	Rebar	Tinplate
Jawa	P.T. Krakatau Steel (220) P.T. Jakarta Kyoei Steel (12) P.T. Maxifero (18) P.T. Ispat Indo (100)	P.T. Super Steel Indah (24)	P.T. Bripindo Utama (10) P.T. Wonosari Jaya (8)	P.T. Daya Raya (150) P.T. Alim Jaya Steel (102) P.T. Cigading Habeam Center (60)	P.T. Kawat Mas (1.08) P.T. T.M.S. (36) P.T. Pulung Copper (3)	P.T. Pulogadung St. (58.5) P.T. The Master St. (40) P.T. Budidharma St. (127) P.T. Toyogiri St. (30) P.T. Maxifero Ind. (30) P.T. Tobu Ind. St. (85) P.T. Jkt. Kyoei St. (98) P.T. Air Baya Indon. (10) P.T. Inter Works St. (18) P.T. Muara Pluit (10.75) P.T. Ancol Iron Fac. (7.5) P.T. Iro Steel (80) P.T. San Iron Trad (36) P.T. National Union St. (10.8) P.T. Waja Wuhan (10) P.T. Krakatau Steel (235) P.T. Inti General (40) P.T. Hanil Jaya (30) P.T. Jatim Utama St. (20) P.T. Waru Jaya (12) P.T. Birawa Steel (12) P.T. Aneka Lg. Medaeng (4) P.T. Ispat Indo (80) P.T. Jaya Pari St. (25)	P.T. Pelat Timah Nusantara (100)
Capacity sub-total	(350)	(24)	(18)	(312)	(40.08)	(1,109.55)	(100)
Sumatera	P.T. Gunung Gahapi (6) P.T. Gunung Sakti (72)					P.T. Gunung Gahapi (30) P.T. Growth Sumatera (24) P.T. Piramid Agung (18) P.T. Sumatera Steel (20)	
Capacity sub-total	(78)	(0)	(0)	(0)	(0)	(92)	(0)
Sulawesi						P.T. Serniwa Steel (28.8) P.T. Bara Waja (15)	
Capacity sub-total	(0)	(0)	(0)	(0)	(0)	(43.8)	(0)
Kalimantan							
Capacity sub-total	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Total	(428)	(24)	(18)	(312)	(40.08)	(1,245.35)	(100)

Source: Ministry of Industry

Table 2-3-5 Production Capacity of Certain Steel Products by Region and by Company (Cont'd)

Region	Sheet (Shearing & slitting)	H.R. sheet	C.R. sheet	G.I. sheet	Color-coated sheet	Welded pipe	Licensed Capacity Total
Jawa	P.T. Sarana Steel Corp. (24) P.T. Pulogadung Steel (15) P.T. Super Steel Indah (24) P.T. Aneka Jkt. Iron St. (9.6) P.T. Logam Seloka Kencana (15) P.T. Lautan Berlian Sakti (1.2) P.T. Jaya Pari Steel (14)	P.T. Krakatau Steel (1,000) P.T. Jaya Pari Steel (114)	P.T. Cold Rolling Mill Indonesia (850)	P.T. Keris Mas Sukses(25.2) CV. wira Mustika Indah (15) P.T. TB. Mas Inti Mulia (48) P.T. Semarang Makmur (46) P.T. Fumira (60) P.T. Amien Steel (35) P.T. Tumbak Mas Jaya (48) P.T. kalisco (25)	P.T. Super Steel Indah (24) P.T. Keris Mas Sukses (25) P.T. Fumira (15)	P.T. K.H.I. (60) P.T. Indespi (30) P.T. Bakrie & Brother (27) P.T. Bakrie Pipe Ind. (60) P.T. Pabrik Pipa Indon. (15) P.T. Sinar Tanggerang (5) P.T. Bumi Kaya St. (28) P.T. Super Tata Raya (50) P.T. Aneka Jkt. (20) P.T. Inastu (27) P.T. Jasa Karya (6) P.T. Spindo (36) P.T. Rajin (13.2) P.T. Pipaemas (7.2) P.T. Alim Steel (4) P.T. Raja Besi (24) P.T. I.S.T.W. (24)	
Capacity sub-total	(102.8)	(1,114)	(850)	(302.2)	(64)	(436.4)	(4,730.51)
Sumatera	P.T. Ahli Teknik (12)			P.T. Ind. Baja Garuda (24) P.T. Intan Nasional(18) C.V. Wira Mustika Indah (25) P.T. Gandus steel (6) P.T. Polyguna Nusantara(41)	P.T. Polyguna Nusantara(8)	P.T. Cemara Indah (3.6) P.T. Ahli Teknik (9) NV. Johan Trading (9.6)	
Capacity sub-total	(12)	(0)	(0)	(114)	(8)	(22.2)	(326.2)
Sulawesi				P.T. Sermani steel (36) P.T. Witikco (12)		P.T. Ginco (4.8) P.T. suspimco (3.6)	
Capacity sub-total	(0)	(0)	(0)	(48)	(0)	(8.4)	(100.2)
Kalimantan				P.T. Kalisco(18)			
Capacity sub-total	(0)	(0)	(0)	(18)	(0)	(0)	(18)
Total	(114.8)	(1,114)	(850)	(482.2)	(72)	(467)	(5,174.91)

Chapter Ⅲ. STEEL MARKET

Chapter III. STEEL MARKET

1. Current Situation and Short- and Medium-Range Outlook of World Steel Demand and Supply

1-1. Current situation and outlook of world steel demand

After the oil crisis in 1973, steel consumption in the world remained sluggish reflecting effect of increased oil prices on the world economy.

The short-range outlook of world steel consumption prepared by International Iron and Steel Institute (IISI) which is known as the most authoritative outlook of this kind at present shows, as in Table 3-1-1, that the forecasted consumption in 1987 will be almost the same level of 1980.

This study was made by IISI comprehensively on the basis of the outlook which each member country makes twice a year.

According to the IISI outlook, those regions whose consumption in 1987 will be lower than 1980 are Western Europe, Latin America, Middle East and Oceania while the regions whose consumption in 1987 will be higher than 1980 are Asia and non-market economy countries. This shows that the effect of the oil crisis which took place in early 1970s on the world economy will persist to the second half of 1980s and that the world economy is not fully recovered. In particular, the effect on European countries and U.S.A. has been most severe and the steel consumption of those areas has been hit doubly by slowdown in economic growth and decrease in steel consumption per unit of GDP or steel intensity. Evolution of steel intensity in main regions is shown in Table 3-1-2.

Table 3-1-1 Apparent Steel Consumption by Countries in the World (1980-1987)

(million metric tons, crude steel equivalent)

COUNTRY	1980	1981	1982	1983	1984	1985	1986[E]	1987[F]
Belgium & Luxembourg	3.9	3.7	3.6	3.6	4.3	3.7	4.0	3.7
Denmark	1.5	1.5	1.6	1.5	1.6	1.6	1.6	1.6
France	19.8	18.0	17.2	15.3	15.1	14.7	14.7	14.6
F.R. of Germany	35.4	33.8	28.3	30.6	31.6	32.1	31.6	30.5
Greece	2.0	1.6	1.5	2.0	1.5	1.6	1.6	1.6
Ireland	0.5	0.6	0.6	0.4	0.5	0.5	0.5E	0.5E
Italy	25.6	21.2	20.6	19.2	20.7	21.1	21.5	21.0
Netherlands	4.6	4.0	3.8	3.4	4.0	4.4	4.3	4.2
Portugal	1.5	1.5	1.6	1.2	1.2	1.1	1.3	1.5
Spain	8.7	8.4	8.3	8.1	7.4	6.9	8.1	8.5
United Kingdom	14.9	14.7	14.6	14.1	14.4	13.9	14.3	14.3
Total EEC (12)	118.4	109.0	101.7	99.5	102.3	101.6	103.5	102.0
Austria	3.1	3.0	2.6	2.6	2.6	2.8	2.7	2.8
Finland	2.2	1.9	2.1	1.9	2.0	2.0	1.9	1.9
Norway	1.7	1.3	1.7	1.3	1.4	1.5	1.6	1.5
Sweden	3.9	3.6	3.5	3.6	3.8	3.5	3.7	3.6
Switzerland	2.2	2.6	2.1	2.0	2.3	2.4	2.0	2.0
Turkey	3.1	3.3	3.6	4.2	4.8	4.9	5.3	5.6
Yugoslavia	5.7	5.0	5.2	5.3	5.0	5.1	5.3E	5.3E
Total Western Europe	140.3	129.7	122.5	120.4	124.2	123.8	126.0	124.7
United States	118.4	128.2	92.2	95.9	114.7	109.3	97.6	94.5
Canada	13.8	14.4	10.2	11.1	13.3	13.4	12.5	12.5
Total North America	132.2	142.6	102.4	107.0	128.0	122.7	110.1	107.0
Argentina	3.7	2.6	2.8	2.8	2.8	2.0	2.7	3.0
Brazil	14.6	12.9	12.1	9.8	12.2	12.7	14.8	16.0
Chile	0.8	0.8	0.4	0.5	0.6	0.7	0.7	0.7E
Mexico	11.4	12.5	9.0	6.5	7.7	7.7	6.6	7.1
Venezuela	3.1	3.0	3.1	1.6	2.2	2.0	2.8	2.6
Others	3.2	3.7	3.4	2.7	2.8	3.1	3.5E	3.5E
Total Latin America	36.8	35.5	30.8	23.9	28.3	28.2	31.1	32.9
Egypt	1.6	2.3	2.6	2.7	2.8	2.6	2.7E	2.8E
Nigeria	3.3E	5.0	1.4	0.8	0.6	1.9	1.8	2.0
South Africa	6.4	6.6	5.8	5.3	5.7	5.1	5.2	5.2
Tunisia	0.2	0.3	0.6	0.6	0.6	0.5	0.5E	0.5E
Zimbabwe	0.3	0.3	0.3	0.4	0.4	0.6	0.6E	0.6E
Other Africa	5.3	5.7	4.3	4.3	4.6	4.6	4.5E	4.5E
Total Africa	17.1	20.2	15.0	14.1	14.7	15.3	15.3	15.6
Iran	4.5E	3.5E	4.9E	6.4E	5.0E	5.0E	5.0E	5.0E
Israel	0.3	0.6	0.6	0.5	1.1	0.9	0.9	1.0
Qatar	0.3	0.1	0.3	0.2	0.1	0.1	0.1	0.1
Other Middle East	10.8	10.6	12.4	12.8	11.8	11.4	10.0E	9.0E
Total Middle East	15.9	14.8	18.2	19.9	18.0	17.4	16.0	15.1
Japan	78.8	72.3	70.0	66.3	73.9	74.0	71.0	68.8
India	10.2	14.0	13.9	12.2	12.5	14.4	15.3	16.3
Indonesia	2.9	3.0	2.7	2.4	2.4	2.2	2.5E	2.5E
Republic of Korea	6.1	7.5	7.6	8.6	10.1	10.9	11.5	12.9
Philippines	1.4	1.3	1.9	1.6	0.9	0.8	0.8E	0.8E
Singapore	1.9	2.5	2.7	3.0	2.3	2.0	2.1	1.6
Taiwan (Rep. of China)	6.3	5.6	5.1	5.8	6.1	6.0	7.7	7.3
Other Asia	11.6	9.1	10.1	11.5	12.7	14.4	15.0E	15.0E
Total Asia	119.2	115.3	114.0	111.4	120.9	124.7	126.0	125.2
Australia	6.4	6.6	5.6	5.0	5.9	5.8	5.9	6.1
New Zealand	0.7	0.8	0.9	0.8	0.9	0.9	0.7	0.7E
Total Oceania	7.1	7.4	6.5	5.8	6.8	6.7	6.6	6.8
Total Western World	468.6	465.5	409.4	402.5	440.9	438.8	431.1	427.3
USSR, Eastern Europe, Cuba (Comecon)	209.6E	205.1E	203.8E	208.5E	210.4E	211.3E	218.0E	220.0E
China, DPR Korea & others	49.5E	45.3E	48.1E	57.0E	63.9E	79.0E	80.5E	81.7E
TOTAL WORLD	727.7	715.9	661.3	668.0	715.2	729.1	729.6	729.0
Balancing Items	−11.7	−8.1	−15.9	−4.3	−5.0	−9.6	−15.1	
WORLD CRUDE STEEL PRODUCTION	716.0	707.8	645.4	663.7	710.2	719.5	714.5	

Footnote: The approach adopted for the Short Range Outlook is to allow each country to choose the most appropriate method of estimating apparent steel consumption in crude steel equivalents. The methods therefore vary between countries and in particular some countries use constant yield coefficients over time whilst others adjust for improvements in yields from, for example, the introduction of continuous casting.

E = Secretariat Estimate Source: IISI

Developing countries showed a bright or dark condition in 1970s depending on whether a country is an oil-producing or not, but entering 1980s when oil prices are showing a declining trend clearly, the adverse effect was also felt by oil-producing countries. As a result, steel consumption of Middle East countries as a whole has also been stagnant.

Table 3-1-2 Evolution of steel intensity of GDP in all regions of the world from 1960 to 1980

Region	Steel intensity in kg/$ (Apparent steel consumption in crude steel equivalents per GDP in constant 1975 US dollars)			Index 1960=100		Growth rates (percentage /year)	
	1960	1970	1980	1970	1980	1960-1970	1970-1980
EEC	0.1040	0.1017	0.0647	98	62	-0.2	-4.4
CMEA	0.2830	0.2572	0.2129	91	75	-1.0	-1.9
Other Europe	0.0715	0.0916	0.0704	128	98	+2.5	-2.6
United States	0.0975	0.0935	0.0634	96	65	-0.4	-3.8
Japan	0.1344	0.1757	0.1153	131	86	+2.7	-4.1
Other industrialized countries	0.0843	0.0938	0.0761	111	90	+1.1	-2.1
Industrialized countries excluding CMEA	0.0989	0.1053	0.0722	106	73	+0.6	-3.7
Industrialized countries	0.1218	0.1269	0.0955	104	78	+0.4	-2.8
Developing countries	0.0548	0.0617	0.0781	113	143	+1.2	+2.4
World	0.1131	0.1179	0.0926	104	82	+0.4	-2.4

Source: UN/ECE, The evolution of the specific consumption of Steel, 1984, P28

In the meantime, as a medium-range outlook of world steel consumption, there is an outlook up to 1995 prepared also by IISI, which is considered as the only reliable one at present. According to this outlook, steel consumption in the world is expected to increase by 5.1% from 1985 to 1995, namely from 723 million tons estimated for 1985 to

760 million tons in 1995. Among the regions, industrialized countries' consumption in 1995 will be 7% below that in 1985 whereas steel consumption in non-market economy countries and developing countries in 1995 will show increase of 9% and 36%, respectively, over that in 1985.

1-2. Steel production capacity in the world

In this medium-range outlook, IISI also forecasted steelmaking capacity in 1990. The capacity of industrialized countries will be about 440 million tons and that of market economy developing countries about 110 million tons. This means that these will be about 550 million tons of steel production capacity in the market economy countries as a whole in 1990 as against about 430 million tons of consumption and that there will still exist supply capacity far exceeding consumption even in 1990.

Table 3-1-3 Outlook of Apparent Steel Consumption in the World up to 1995

(Unit: million tons)

Year		1977-1983 Average	1985	1990 out-look	1995 out-look	1995/1985 %	Steelmaking Capacity		
							1980	1985	1990 fore-cast
Market economy block:	Developed Countries	353 (50.0)	332 (45.9)	312 (42.7)	308 (40.6)	92.8	535	475	442
	Developing Countries	96 (13.7)	101 (14.0)	118 (16.2)	137 (18.0)	135.6	60	86	110
	Sub-total	449 (63.7)	433 (59.9)	430 (58.9)	445 (58.6)	102.8	595	561	552
Non-market economy block:	COMECON China & N. Korea	256 (36.3)	290 (40.1)	300 (41.1)	315 (41.4)	108.6	---	---	---
World Total		705 (100.0)	723 (100.0)	730 (100.0)	760 (100.0)	105.1	---	---	---

Source: Lenhard J. Holschuh, Secretary General's Report to the Twentieth IISI Annual Conference, October 1986

Table 3-1-4 Crude steelmaking capacity and apparent crude steel consumption

(Unit: million tons)

	1985		1990		Change Capa. & Consum.	
	Capacity	Consumption	Capacity	Consumption	Capacity	Consumption
Non-OECD	417	396	457	423	+40	+27
market economy countries	115	106	142	123	+27	+17
non-market economy countries	302	290	315	300	+13	+10
O E C D	518	327	453	307	-65	-20
World Total	935	723	910	730	-25	+7

Source: OECD Press Release Press/A(87)21 April 1987

OECD also announced a forecast of the world steelmaking capacity and steel consumption in 1990. This forecast says that as of 1985 there was about 210 million tons of excess capacity in the world and that in 1990 there will still be an excess capacity of nearly 200 million tons because the world steel demand will not increase as expected and also because expantion of steelmaking capacity in many non-OECD countries will continue.

However, many industrialized countries are engaged in the programmes of restructuring of their steel industry and steel production capacity shows trend not to be expanded quantitatively and effective production capacity is rather decreasing. For example, EC countries plan curtailment of production capacity of crude steel by about 27 million tons.

Table 3-1-5 ECSC General Objectives Steel 1990

(Unit: million tons)

	Production high assumption	MPP Dec. 86	Rate of utilization	MPP required (1)	Surpluses (1)		MPP 1980
					Tonnage	%	
I. CRUDE STEEL	119.6	167.4	71.4%	140.7	26.7	15.9%	204.8
II. HOT ROLLED PRODUCTS							
Wide and narrow strip	53.0	71.9	73.7%	66.3	5.6	7.8%	82.5
Reversing-mill plate	7.6	14.2	53.5%	9.5	4.7	33.3%	19.5
Hot flat products, total	60.6	86.1	70.4%	75.8	10.3	12.0%	102.0
Heavy sections	7.4	12.1	61.2%	9.3	2.8	23.1%	16.1
Light sections	15.8	27.2	58.0%	19.8	7.4	27.2%	35.1
Wire rod (not incl. reinforcing bar in coils)	11.2	15.1	74.2%	14.0	1.1	7.3%	18.7
Long products, total	34.4	54.4	63.2%	43.0	11.4	20.9%	69.9
Hot-rolled products, total	95.0	140.5	67.6%	118.8	21.7	15.4%	172.0
III. OTHER FINISHED PRODUCTS							
Cold sheet	30.5	43.3	70.4%	38.1	5.2	12.0%	44.9
Coated sheet	13.3	18.5	71.9%	16.6	1.9	10.3%	15.5

Note: Both MPP required and surpluses have been calculated on the basis of a utilization rate of 85% in respect of crude steel and 80% in respect of rolled products.

Source: Report from the Commission to the Council on the General Objectives Steel 1990, October 1986 P III/7 Table 7

In the meantime, in developing countries also, because of a big increase of construction cost and decrease of steel demand, steel mill construction projects planned in 1960s were mostly deferred. On the other hand, as the world steel demand is forecasted to show growth, though small, in the long run, it is possible that construction of steel mills becomes necessary again depending on pattern of stabilization and progress of the world economy. At any rate, it will take much time and be not before 1990 that such condition appears.

2. Steel Demand and Supply Condition in Indonesia

2-1. Characteristics of steel demand and supply

After hitting the peak of 3.25 million tons in 1981 and 1982, apparent crude steel consumption of Indonesia decreased gradually to 2.41 million tons in 1985. It is estimated, however, that, with increase in domestic steel production and steel import, the apparent crude steel consumption in 1986 showed growth over the preceding year for the first time in five years. As a result, the self-supply ratio (production/consumption) in terms of crude steel showed a steady rise in last few years and it is believed that it reached about 50% in 1985 and 1986.

In recent years, in line with the expansion project of P.T. Krakatau Steel, crude steel production in Indonesia is showing a steady increase and in 1983 when the 2nd stage expansion was completed, the national steel production increased by 60% as compared with that in the preceding year and it reached one million tons in 1984 and 1.2 million tons in 1985 and 1.5 million tons in 1986.

The apparent steel consumption showed a big increase in 1980 thanks to a very favorable economic condition resulting from the oil boom and stayed at a high level for some following years. But recently the domestic economy stagnated as a result of sharp drop of crude oil prices and the apparent steel consumption fell below the level in 1980. Consequently increased supply of rolled steels was partly directed to export, which showed notable increase in 1985 and 1986.

2-2. Production of rolled steels by kind of products

2-2-1. Outline

In Indonesia, about 60 steel rollers and processors are producing rolled steels from imported base sheets (hot and cold rolled) or rerolling materials and the 1983 production of rolled steels was 1.64 million tons. In 1984 when hot strip mill of P.T. Krakatau Steel was started up, the production of rolled steels based on imported semi-finished products or base sheets decreased and it is considered that the production was about same as that in the preceding year. As the production at P.T. Krakatau Steel showed a smooth increase in 1985 and 1986, the national production of rolled steels is believed to have exceeded the 1983 level considerably. However, the production of rolled steels still exceeds that of crude steel, which means that the upstream and downstream are not yet balanced.

By kind of products, in 1983, non-flat products accounted for 61% of the total, including 720,000 tons (share 44%) of bar and section and 280,000 tons (17%) of wire rod. Flat products accounted for 24%, most of which was G.I. sheet of 330,000 tons (20%).

Before 1982, flat products except G.I. sheet were not produced in Indonesia. Production of hot rolled sheets and plates was begun in 1983 when the hot strip mill of P.T. Krakatau Steel and plate mill of P.T. Jaya Pari Steel were put into operation. The production of flat products at P.T. Krakatau Steel alone reached 240,000 tons in 1984, 360,000 tons in 1985 and it was 630,000 tons in 1986. Therefore it is believed that the composition of rolled steels changed considerably and that the share of flat products exceeded that of non-flat recently.

In the field of tubular products, 250,000 tons (share 15%) of welded steel pipe was produced in 1983. The pro-

duction of welded pipe was 240-260,000 tons in 1984 and 1985, but none of seamless steel pipe is domestically produced and the demand is met entirely by import. Incidentally tinplate production facilities with annual capacity of 100,000 tons began operation in September 1985 and produced about 20,000 tons of tinplate. The production in 1986 is planned to be 115,000 tons.

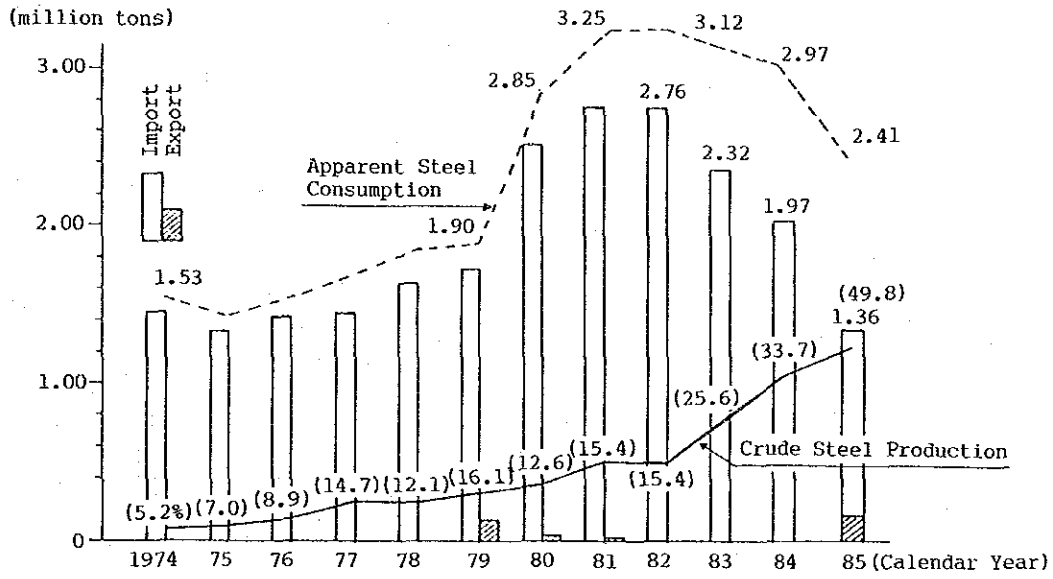


Fig. 3-2-1 Change of Demand and Supply Balance in Crude Steel

Sources: Production from IISI and export and import from customs clearance statistics of Indonesia.

Note 1: Apparent steel consumption (ASC) in terms of crude steel is calculated by following formula:

ASC = Crude steel production + Import - Export

when import and export are converted into crude steel basis. conversion rate for rolled steels to crude steel is 1.30 and that for ingot and semis 1.0.

2: Figures in parentheses show self-supply ratio. (Production/ASC x 100)%

2-2-2. Present condition and production of non-flat products

Production of bar, section and wire rod in Indonesia already exceeds one million tons a year. Bars are almost 100% reinforcing bar, or re-bar, and main sizes are 10ϕ - 13ϕ for plain bar and D10 - D25 for deformed bar. Production of sections is not much yet and mainly angles, L40 - L120, are produced. Wire rod is mainly of mild steel and mostly in sizes, 5.5ϕ - 12.0ϕ.

Present condition and production of non-flat products are shown in Table 3-2-1 and Table 3-2-2.

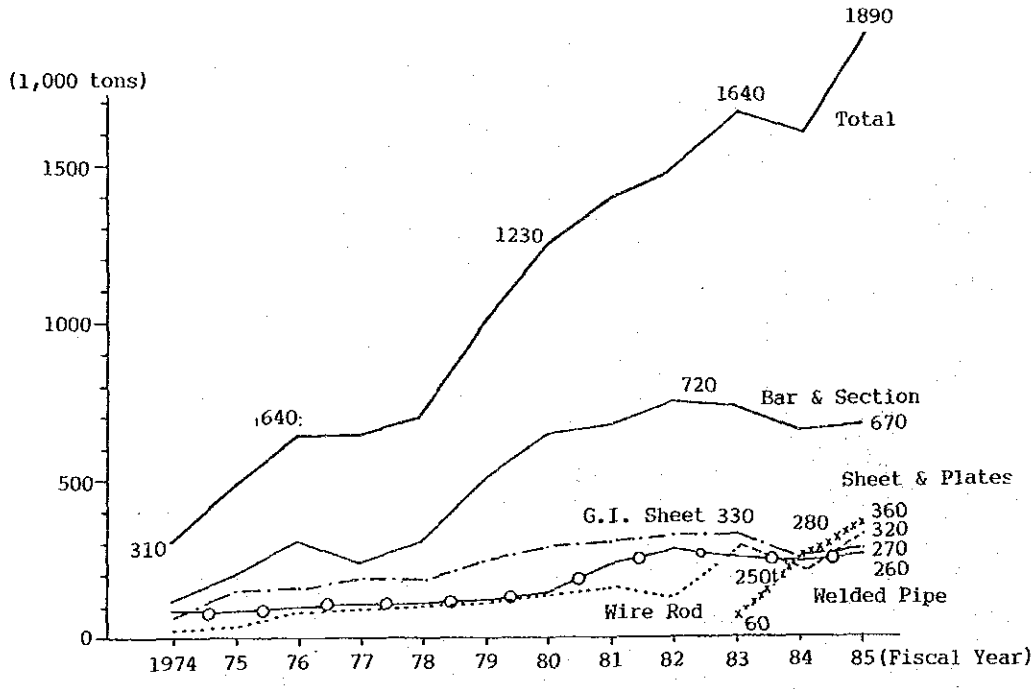


Fig. 3-2-2 Change of Production of Rolled Steels by Kind

Source: Annex to the address of the President on August 16, 1983.
Indonesia Financial Statistics, Bank of Indonesia

Note 1: Fiscal year basis (April 1 to March 31)

Table 3-2-1 Current Situation on Hot Rolled Non-flat Steel Products in Indonesia

Classification	Items		Contents	
Bar	General Feature on Type of Products	∘ Steel Grade :	∘ Steel Bars for Concrete Reinforcement (Corresponding to JIS SR24, SD30 and SD40) ∘ Re-rolled Bars for Concrete Reinforcement (Akin to JIS SRD34, SRD39)	Note ∘ Almost all products are estimated to be reinforcing bars.
		∘ Size Range :	∘ Plain Bars, 5.5 to 32 mm Dia. (Majority : 10 to 13 mm Dia.) ∘ Deformed Bars, D10 to D32 mm Dia. (Majority : D10 to D25 mm Dia.)	∘ No mill, so far visited, is producing carbon steel bars for machine structural use. ∘ Production amounts of deformed and plain bars are estimated to be more or less same.

Information Given from Companies at the Time of Survey	Bar Manufacturers	Name of Company (Location)	Type of Products (Note, P: Plain Bars, D: Deformed Bars)		Remarks
			Steel Grade	Size (mm Dia.)	
		Pulogadung Steel (Jakarta)	∘ Rebars: JIS SR24, SD30 Partially ASTM Grade 60	P: 10 to 32 (Majority: 10 to 12) D: D10 to D32 (Majority: D16 to D25)	∘ Production rate of deformed bars represents around 60% of all.
		Budidaharma (Jakarta)	∘ Rebars: JIS SR24, SD30	P: 10 to 25 D: D10 to D25	∘ Rolling materials of cast billets have been supplied from Tosan Prima, since 50 ton open hearth furnace was shut down.
		Tobe Steel (Jakarta)	∘ Rebars: JIS SR24	P: 8 to 16 (Majority: 8 to 12)	∘ Billet supplier to Tobe Steel has been P.T.K.S. ∘ Production rates of 8, 10 and 12 mm dia. bars represent around 30% of all, respectively.
		Jakarta Kyoei (Jakarta)	∘ Rebars: JIS SR24, SD30, SD40	P: 5.5 to 13 (Majority: 8) D: D10 to D13	∘ Cast billets have been supplied from Tosan Prima as well as in Budidaharma ∘ Plain bars represent major part of production.
		Krakatau Steel (Cilegon)	∘ Rebars: JIS SR24, SD30, SD40	P: 10 to 32 D: D10 to D32	∘ Production rate of D10 to D25 mm dia. deformed bars represents 70% and over in total bar production.
		Sumatera Steel (Palembang)	∘ Rebars: Re-rolled bars	P: 7 to 25 (Majority: 9 to 12)	∘ Steel plates from scraped ships are used as raw materials for rolling.
		Growth Sumatera (Medan)	∘ Rebars: Re-rolled Bars Billet-Bars	P: 8 to 25 D: Up to D25	∘ Plain bars are major products. ∘ Re-rolling mill was planned to be shut down as of July, 1985.
		Gunung Gahapi (Medan)	∘ Rebars: Re-rolled Bars Billet-Bars (Akin to JIS SR, SD)	P: 6.5 to 25 D:	

Classification	Items		Contents			
			Name of Company (Location)	Type of Products (Note, P: Plain Bars, D: Deformed Bars) Steel Grade	Size (mm Dia.)	Remarks
Bar (Cont'd)	Information Given from Companies at the Time of Survey (Cont'd)	Bar Manufacturers (Cont'd)	Serniwa Steel (U. Pandang)	∘ Rebars: Re-rolled Bars	P: 8 to 19	∘ Some amounts of small sized angles are being produced. ∘ Steel plates from scraped ships are for rolling materials
			Jaya Pari (Surabaya)	∘ Rebars: Re-rolled Bard	P: 8 to 12	∘ Trimmed steels in heavy plate mill are utilized for raw materials.
			Inti General Yaja (Semarang)	∘ Rebars:	P: 12 to 25	∘ Angles of 30 x 30 to 50 x 50 are being produced.
		Customers (Civil & Building)	General steel bars for heavy construction in Indonesia are as follows: ∘ Steel Grade : JIS SD30, SD40 ∘ Size Range : D10 to D25			Note ∘ Small sized plain bars are generally used for light construction. ∘ Less quality assurance seems to be necessary for plain bars, compared with deformed bars.
Wire Rod	General Feature on Type of Products		∘ Steel Grade : Low Carbon Wire Rods (Corresponding to JIS SWRM 6 to 25) High Carbon wire Rods (Corresponding to JIS SWRH 42A, B to 72A, B) Wire Rods for Core Wire of Cored Electrode (Corresponding to JIS SWRY 11 and 12) ∘ Size Range : 5.5 to 12.0 mm Dia. (Majority : 5.5 to 8.0 mm Dia.)			Note ∘ Some of wire rods for core wire of electrode seem to be applied to cold heading and forging, also. ∘ Low carbon wire rods represent major part of total production.
	Information Given from Companies at the Time of Survey	Wire Rod Manufacturers	Name of Company (Location)	Type of Products Steel Grade	Size (mm Dia.)	Remarks
			Jakarta Kyoei (Jakarta)	∘ Low Carbon Wire Rods: AISI 1010	5.5, 6.0 and 8.0 (Majority: 6.0)	
			Ispat Indo (Surabaya)	∘ Low Carbon Wire Rods ∘ High Carbon Wire Rods	5.5 to 16.0	∘ Ispat Indo is the only company which has a wire rod mill installed block mill in finishing train and capable of supplying directly patented wire rods.
			Gunung Sakti (Medan)	∘ Low Carbon Wire Rods: AISI 1006 to 1010	5.5 only	
			Krakatau Steel (Cilegon)	∘ Low Carbon Wire Rods: AISI 1006 to 1025 ∘ Wire Rods for Core : JIS ∘ Wire of Electrode : SWRY 11	5.5 to 12.0 (Major; 6.0	∘ Billets for rolling of wire rods for electrode are imported from Australia. ∘ Small sized wire rods of 5.5 to 6.5 mm dia. represent approx. 60% in total production.

Classification	Items		Contents			
			Name of Company (Location)	Type of Products	Raw Material: Steel Grade	Raw Material: Size (mm Dia.)	Remarks
Wire Rod (Cont's)	Information at the Time of Survey (Cont'd)	Customer (Wire Drawing) Companies	I.W.W.I. (Jakarta)	∘ Iron Wires for Nail Manufacturing ∘ High Carbon Wires ∘ Carbon Steel Wires for Cold Heading/Forging	∘ Low Carbon Wire rods ∘ High Carbon Wire Rods ∘ Carbon Steel Wire Rods for Cold Heading/Forging	5.5 to 12.0 5.5 to 10.0 5.5 to 32.0	∘ Carbon steel wire rods of 13 to 32 mm dia. for cold heading and forging have been imported from Japan. ∘ Directly patented high carbon wire rods, supplied by Ispat Indo, permit wire drawing without heat treatment in advance.
			Universal Metal (Jakarta)	∘ Iron Wires for Nail Manufacturing ∘ Galvanized Iron Wires	∘ Low Carbon Wire Rods	5.5 to 8.0	∘ All of wire rods are procured by domestic manufactures.
			Intan Pertiwi (Jakarta)	∘ Welding Electrodes for Mild Steels	∘ Wire Rods for Core Wire of Cored Electrode	6.0	∘ Major supplier of wire rods is P.T.K.S.
Section	General Feature on Type of Products		∘ Steel Grade: Structural Steels for General Use (Corresponding to JIS SS41, SS50) ∘ Size Range : Angles 30 x 30 to 120 x 120 Channels 50 x 25 to 140 x 60 I-beams Up to 140 x 66				Note ∘ No exclusive section mill other than P.T.K.S. was found during site survey. ∘ Small sized angles are produced in some bar mills, however, the production seems to be low.
	Information Given from Companies at the Time of Survey	Section Manufacturers	Name of Company (Location)	Type of Products: Steel Grade	Type of Products: Size (mm Dia.)		Remarks
			Krakatau Steel (Cilegon)	Structural Steels for General Use : JIS SS41 AISI 1020 (Estimated)	Angles : 40x40 to 120x120 Channels: 80x45 to 140x60 I-beams : 100x50 to 140x66		∘ Recently, P.T.K.S. started production of a few sizes of flat bars.
		Customers (Civil & Building)	No Detail Information				∘ According to local civil engineers' opinion, SRC structure has been increasingly employed in place of RC structure. ∘ From the view point above, it is predictable that the demand of large sized H section steels will increase.

Table 3-2-2 Steel Bar/Section Production in Indonesia

No.	Region	Name of Company (Location)	Type of Product	Production Capacity (Ton)		Actual Production (Ton)		Remarks
				Licensed	Installed	1983 FY	1984 FY	
1	West Jawa	P.T. Master Steel (Jakarta)	Rebar, Angle, Channel	40,000	40,000	16,220	17,572	
2		P.T. Pulogadung Steel (Jakarta)	Rebar P: 8φ - 32φ D: D10 - D32	50,000	60,000	26,117	32,012	
3		P.T. Toyogiri Steel (Bekasi)	Rebar P: 8φ - 12φ	30,000	40,000	8,161	7,200	
4		P.T. Baja Wuhan (Jakarta)	Flat Bar Rebar, Angle	10,000	14,400	5,894	1,479	
5		P.T. Industri Anchol Iron Fact. (Jakarta)	Rebar Flat Bar, Angle	7,500	10,000	6,780	5,723	
6		P.T. San Iron Trad. Co. (Jakarta)	Rebar Angle	80,000	15,000			
7		P.T. National Union Steel (Bekasi)	Rebar, Angle	10,800	32,000	2,825	6,756	
8		P.T. Budidharma (Jakarta)	Rebar P: 10φ - 25φ D: D10 - D25	127,000	127,000	110,130	94,173	◦ Billet supplier : P.T. Tosan Prima
9		P.T. Sarana Nuscaco Baja (Jakarta)	Rebar P: 8φ - 25φ Angle	25,000	25,000	11,999	9,420	
10		P.T. Tobu Indonesia Steel (Jakarta)	Rebar P: 8φ - 16φ	85,000	80,000	90,796	82,584	◦ Billet supplier : P.T. Krakatau Steel

No.	Region	Name of Company (Location)	Type of Product	Production Capacity (Ton)		Actual Production (Ton)		Remarks
				Licensed	Installed	1983 FY	1984 BY	
11	West Jawa (Cont's)	P.T. Jakarta Kyoei Steel (Jakarta)	Rebar P: 5.5ϕ - 13ϕ D: D10 - D13	98,000	130,000	85,213	73,238	∘ Billet supplier : P.T. Tosan Prima
12		P.T. Interworld Steel (Jakarta)	Angle, Channel Flat Bar	18,000	30,000	21,900	15,995	
13		P.T. Air Baja Indonesia (Jakarta)	Rebar Flat Bar, Angle	54,000	60,000	28,639	31,842	
14		P.T. Muara Pluit (Jakarta)	Flat Bar Rebar	30,000	30,000	3,705	4,500	
15		P.T. Neo Union Steel (Jakarta)	Rebar Angle	18,000	15,000	---	---	
16		P.T. Maxifero (Tangerang)	Rebar	22,000	60,000	24,045	20,150	
17		P.T. Super Tata Raya (Tangerang)		15,000	20,000	---		
18		P.T. Krakatau Steel (Cilegon)	Rebar P: 10ϕ - 32ϕ D: D10 - D32 Angle 40 - 120 Channel I80-I140 I-beam I80-I140	235,000	195,000	106,008	73,731	∘ Installed Prod. Capa. Bar Mill : 150,000 T/Y Section Mill : 45,000 T/Y
19		P.T. Pembangunan Inti Steel (Cilegon)		40,000	30,000			
	West Jawa Total					Approx. 548,000	Approx. 476,000	

No.	Region	Name of Company (Location)	Type of Product	Production Capacity (Ton)		Actual Production (Ton)		Remarks
				Licensed	Installed	1983 FY	1984 FY	
20	Central Jawa	P.T. Nidari Kencono (Yogyakarta)		60,000	60,000			
21		P.T. Inti General Yaja (Semarang)	Rebar P: 12ϕ - 25ϕ Angle 30 - 50	40,000	40,000	24,115	26,860	
	Central Jawa Total			100,000	100,000	Approx. 24,000	Approx. 27,000	
22	East Jawa	P.T. Aneka logam Madaeng (Sidoarjo)	Rebar	4,800	6,000	---	---	
23		P.T. Birawa Steel (Surabaya)	Rebar Strip	36,000	36,000	5,450	4,610	
24		P.T. Waru Jaya (Sidoarjo)	Rebar Strip	12,000	13,500	3,230	1,480	
25		P.T. Hanil Jaya Steel (Surabaya)	Rebar P: 8ϕ - 25ϕ Angle, Flat Bar	40,000	48,000	47,370	44,156	
26		P.T. Jatim Utama Steel (Surabaya)	Rebar P: 8ϕ - 12ϕ	20,000	20,000	18,561	21,570	
27		P.T. Jaya Pari Steel (Surabaya)	Rebar P: 8ϕ - 12ϕ	25,000	23,000	---	---	∘ Re-rolling mill ∘ Cold formed light section steels are also manufactured in another line within the plant.
	East Jawa Total			138,000	147,000	Approx. 75,000	Approx. 72,000	

No.	Region	Name of Company (Location)	Type of Product	Production Capacity (Ton)		Actual Production (Ton)		Remarks
				Licensed	Installed	1983 FY	1984 FY	
28	North Sumatera	P.T. Pyramid Iron Factory (Medan)	Rebar Angle, Flat Bar	18,000	18,000	12,409	4,850	
29		P.T. Growth Sumatera (Medan)	Rebar P: 8φ - 25φ Angle, Flat Bar	24,000	24,000	2,400	9,387	
30		P.T. Gunung Gahapi (Medan)	Rebar P: 6.5φ - 25φ Angle	30,000	30,000	22,500	17,728	
	North Sumatera Total			72,000	72,000	Approx. 37,000	Approx. 32,000	
31	South Sumatera	P.T. Sumatera Steel (Palembang)	Rebar P: 7φ - 25φ	20,000	23,000	13,638	13,486	Two re-rolling mills
	South Sumatera Total			20,000	23,000	Approx. 14,000	Approx. 13,000	
32	South Sulawesi	P.T. Serniwa Steel (Ujung Pandang)	Rebar P: 8φ - 19φ Angle, Flat Bar	28,800	36,000	16,804	12,116	Two re-rolling mills
33		P.T. Bara Waja (Ujung Pandang)	Rebar	15,000	20,000	9,390	5,681	
	South Sulawesi Total			44,000	56,000	Approx. 26,000	Approx. 18,000	
	Total					Approx. 724,000	Approx. 638,000	

2-3. Apparent steel consumption of rolled steels by kind

Statistics of production of rolled steels is on a fiscal year basis while that of import was on a calendar year basis, and so it may not be proper to calculate apparent steel consumption in terms of rolled steels by kind based on those statistics. But they were used as it is in order to grasp overall picture of weight and change of consumption of each kind of rolled steels. In addition, as materials for domestic production of galvanized sheet and welded pipe, imported hot rolled and cold rolled sheet are used and apparent consumption of steel sheet was calculated by deducting the tonnage consumed (estimated yield as 95%) in those processings from the tonnage imported.

Change of apparent consumption of rolled steels by kind is as shown in Fig. 3-2-3. Though the consumption of all kinds of rolled steels decreased in 1983, 1984 and 1985, the consumption mainly of bar and section, plate and welded pipe showed increase since 1979 reflecting growth of demand from construction. Weight of each type of rolled steels in the total consumption in 1985 was about 47% for long products, about 34% for flat products and about 17% for tubular products. The highest was 770,000 tons of bar and section (weight being 34%), followed by 290,000 tons of wire rod (13%) and 280,000 tons each of G.I. sheet and welded pipe (12%).

2-4. Consumption of rolled steels by demand sector

By demand sectors, construction accounted for about 65% of the total consumption of rolled steels, the highest, of which building accounted for 34% and civil engineering 25%. The manufacturing sector accounted for 24%, secondary processing sector such as wire and nail 9% and container sector which uses mainly tinplate 6%, but other sectors such as machinery, automotive and shipbuilding sectors ac-

counted for only about 2%.

Recently the consumption of rolled steels as a whole shows a decrease, but as there is no noticeable change in the consumption by kind of product, it is believed that the weight in the consumption by sector does not show any big change.

Table 3-2-3 Weight of Steel Consumption by Demand Sector (1983)

(Unit: %)

Construction:		Manufacturing (Cont'd):	
Sub-total	65.4	Elec. & ind. machinery	2.0
of which;		Home & office appliances	2.5
Building	34.1	Containers	5.6
Civil eng.	24.6	Secondary processing	8.8
Manufacturing:		Others	10.7
Sub-total	23.9	Total	100.0
of which:			
Shipbuilding	1.5		
Automotive	2.5		

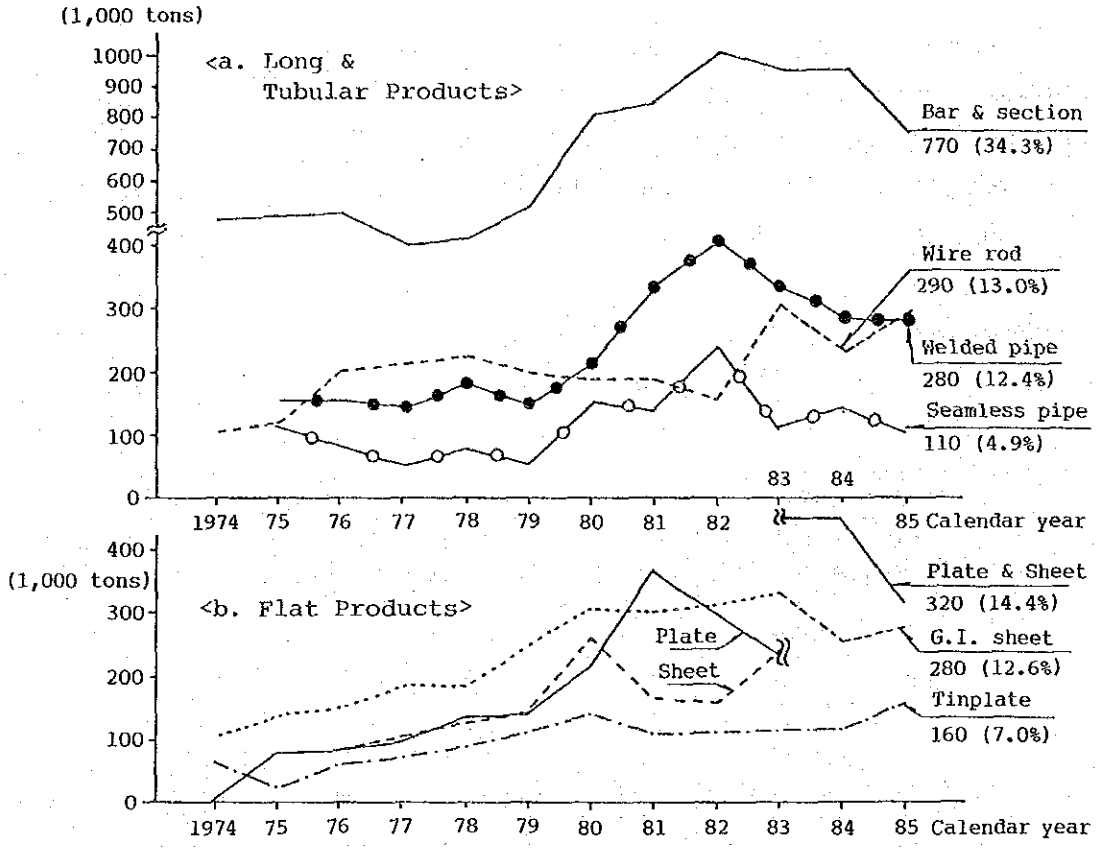


Fig. 3-2-3 Change of Apparent Consumption of Rolled Steels by Kind

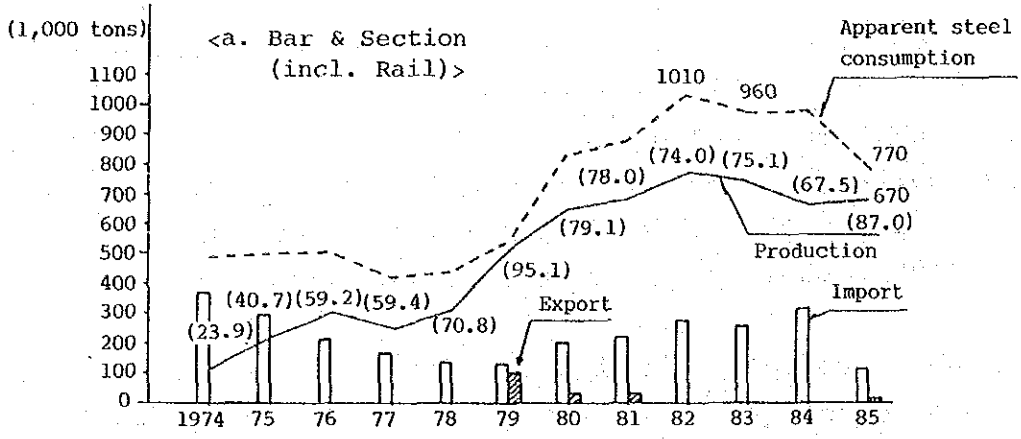
Sources: Annex to the address of the President. Indonesia Financial Statistics.

Note 1: ASC: Production + Import - Export (in terms of steel products).
2: Export and import on calendar year basis; production on fiscal year basis.
3: Sheet shown on final consumption basis, that is, import minus consumption for processing such as G.I. sheet and welded pipe.
4: Seamless pipe not produced domestically, and so import = consumption. This is true also to sheet and plate prior to 1983 when their domestic production began.
5: ( ) shows weight of each product in 1985.

2-5. Demand and supply balance of rolled steels by kind

Demand and supply balance and self-supply ratio of four kinds of rolled steels, bar and section, wire rod, G.I. sheet and welded pipe which are produced in Indonesia for years are shown in Fig. 3-2-4. As regards other products, hot rolled sheet and plate are domestically produced from 1983, their self-supply ratio is over 100% temporarily.

The product, of which self-supply ratio is the highest, is G.I. sheet and with almost no import, the ratio has been about 100%. Production of wire rod has shown a rapid increase in recent years while its import decreased, and the self-supply ratio has increased from a little less than 30% in 1974 to 80-90% in 1980s, indicating a fast substitution of import. Self-supply ratio of bar and section is about 75% and that of welded pipe about 70%. Though some fluctuation is observed from year to year, the both show a fairly stable trend. In 1985, however, due to decrease of demand and increase of production, the self-supply ratio rose considerably.



Sources: Production from Annex to the address of the President.
Export & import from customs clearance statistics of Indonesia

Note 1: Export and import on calendar year basis; production on fiscal year basis.

2: Figures in parentheses are self-supply ratio. (Production/ASC x 100) %

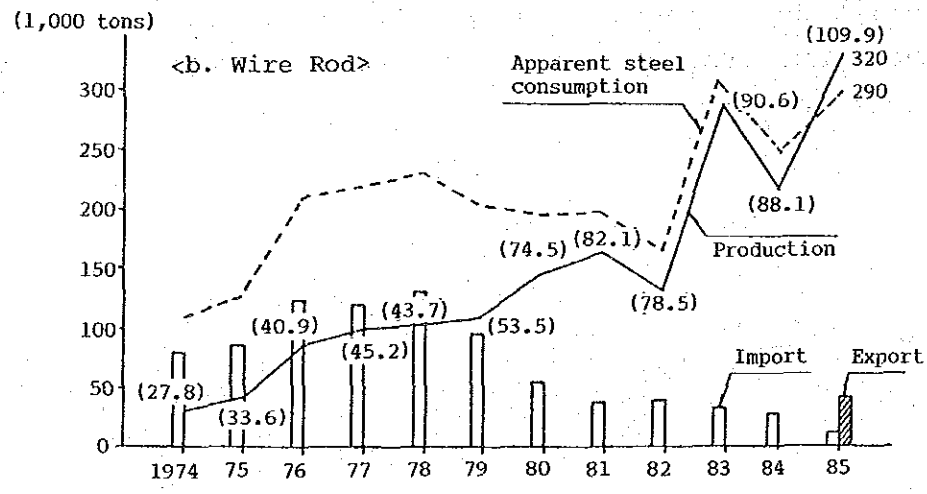
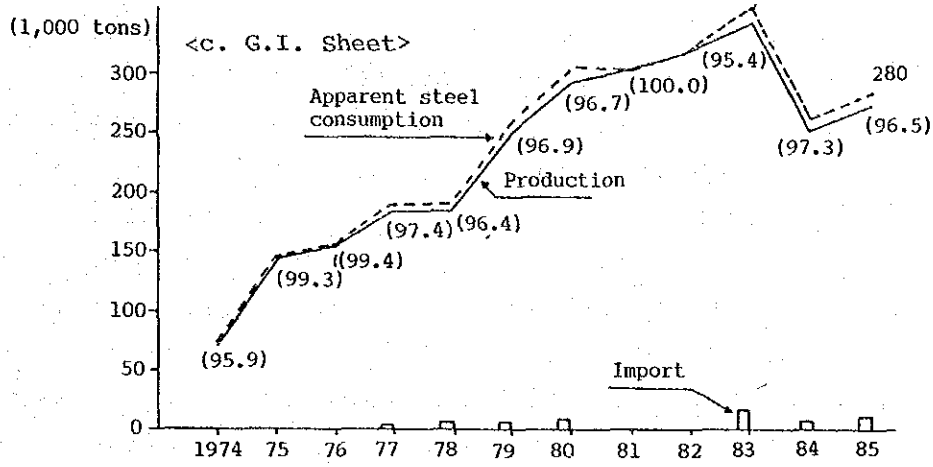
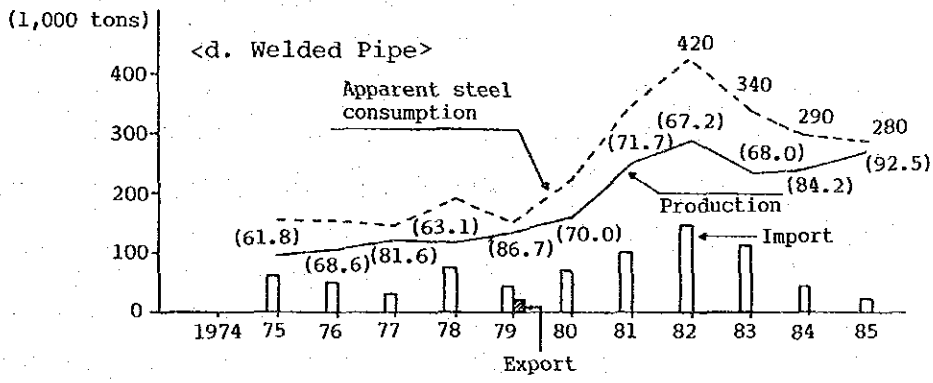


Fig. 3-2-4 Change of Demand and Supply Balance of Major Products


(1,000 tons)
<c. G.I. Sheet>
Apparent steel consumption
Production
Import
300
250
200
150
100
50
0
(95.9)
(99.3)
(99.4)
(97.4)
(96.4)
(96.9)
(96.7)
(100.0)
(95.4)
(97.3)
280
(96.5)
1974 75 76 77 78 79 80 81 82 83 84 85


(1,000 tons)
<d. Welded Pipe>
Apparent steel consumption
Production
Import
Export
400
300
200
100
0
(61.8)
(68.6)
(81.6)
(63.1)
(86.7)
(70.0)
(71.7)
(67.2)
420
340
290
(68.0)
280
(84.2)
(92.5)
1974 75 76 77 78 79 80 81 82 83 84 85

2-6. Regional patterns of steel consumption

There are almost no statistical data available which are necessary for calculation of steel consumption by regions in Indonesia and such calculation has to be made practically by estimation. In particular, no statistics are available concerning movement of steel among regions in the domestic steel distribution. Consequently, the Step I study was conducted as follows: Namely, first, personal interviews with local government and trading company officials and related industrial officials about per capita steel consumption in respective regions were conducted and then steel consumption in respective regions was estimated by its correlation with forecast of population in the regions made by the Indonesian Government. The result was reviewed historically as well as internationally referring to cross-sectional data on steel consumption in different countries and modified where it was considered necessary. As a result, apparent steel consumption--ASC crude steel equivalent by region was obtained as shown in Table 3-2-4.

Steel consumption by region and by kind of product in Indonesia is characterized by the fact that the consumption pattern by kind of product in Jawa area is relatively varied with demand sectors extending from construction, major one, to manufacturing and others while the consumption pattern in the other areas has characteristics particular to respective areas.

Product pattern for Kalimantan is characterized by big demand for steel pipe because of progress of development of coal, oil and natural gas and by some demand for products for construction in a broad sense such as long products and plate. In Sulawesi, demand for G.I. sheet is increasing. Steel demand in Sumatera has increased for a variety of products along with progress of regional development in the North, but is mainly for long products consumed in construc-

tion sector.

Incidentally one of the characteristics of steel consumption in Indonesia is regional difference in population which enjoy so-called iron culture. For example, compared to Jawa Island, a major part of population in Kalimantan and Sumatera leads daily life without enjoying the iron culture. It should be kept in mind that the average ASC/capita by region includes such population enjoying less iron culture which in turn means that there are population locally, which consume steel far exceeding the average. Attention should also be given to the fact that consumption is concentrated on the regions where development projects are planned or under way.

Table 3-2-4 Steel Consumption by Region

Region	1983				
	Population		ASC		
	(1,000)	%	ASC/ Capita (kg)	ASC (1,000M.T)	%
SUMATERA	30,929	19.6	18.2	564.0	16.0
JAWA	96,893	61.3	28.1	2,726.3	77.3
NUSA TENGGARA	8,996	5.7	1.2	10.6	0.3
KALIMANTAN	7,350	4.6	13.0	95.6	2.7
SULAWESI	11,112	7.0	11.1	123.4	3.5
MALUKU + IRIAN JAYA	2,803	1.8	2.5	7.1	0.2
TOTAL	158,083	100.0	22.3	3,527.0	100.0

Source 1: STATISTIK INDONESIA 1983 BIRO PUSAT STATISTIK
2: Verbal description from various authorities concerned and trading firms
3: Estimated figures from this report

3. Steel Export and Import

3-1. Outline

Indonesian import of rolled steels was about one million tons up to 1979, but it increased suddenly to 1,581,000 tons in 1980 (a 39.6% increase as compared to that a year ago) and hit the highest figures ever of 1,949,000 tons in 1982. But from the following year, the import decreased from year to year and it was 1,015,000 tons in 1985 (a 28.7% decrease from the preceding year).

In addition to finished rolled steels, Indonesia imports ingots and semi-finished products, mainly billet, used by non-integrated steel rolling mills. The quantity of such import peaked at about 500,000 tons in 1981, but since, it showed a decreasing trend, 220,000 tons in 1982, 158,000 tons, in 1983, 119,000 tons in 1984 and 42,000 tons in 1985.

On the other hand, export of rolled steels was 115,000 tons in 1979 and about 10-20,000 tons in 1980 and 1981 and mainly small section was exported. Recently, however, with start-up of the hot strip mill of P.T. Krakatau Steel, 100-200,000 tons of rolled steels, mainly hot coil and wire rod and bar, are exported a year.

3-2. Import of rolled steels by kind

Of steel import in 1985, flat rolled steels accounted for 75.3%, the highest, and pipes and long products 12.8% and 11.9, respectively.

The reason why the import of flat rolled steels is high is that there were no domestic facilities to produce plate and sheet until a hot strip mill was put into operation at P.T. Krakatau Steel in February 1983. Particularly, there was a strong demand for hot rolled sheet, plate

and cold rolled sheet to be supplied as materials to welded pipe makers and G.I. sheet makers in Indonesia. Steel sheet import in 1983 was 766,000 tons, which accounted for 46% of imported rolled steels. It should be noted that since the start-up of the hot strip mill, import of sheet decreased and was 148,000 tons (share 14.5%) in 1985. Contrariwise, import of plate in the same year was 427,000 tons (42.0%), the highest in the past.

Of long products imported, section was 62,000 tons in 1985 followed by bars (42,000 tons) and wire rod (11,000 tons), but their import is decreasing in recent years.

Of import of pipes, seamless pipe was 110,000 tons in 1985, accounting for 10.8%, which was about 20% less than that in the preceding year. Other pipes were 21,000 tons, accounting for 2.0% of the total import.

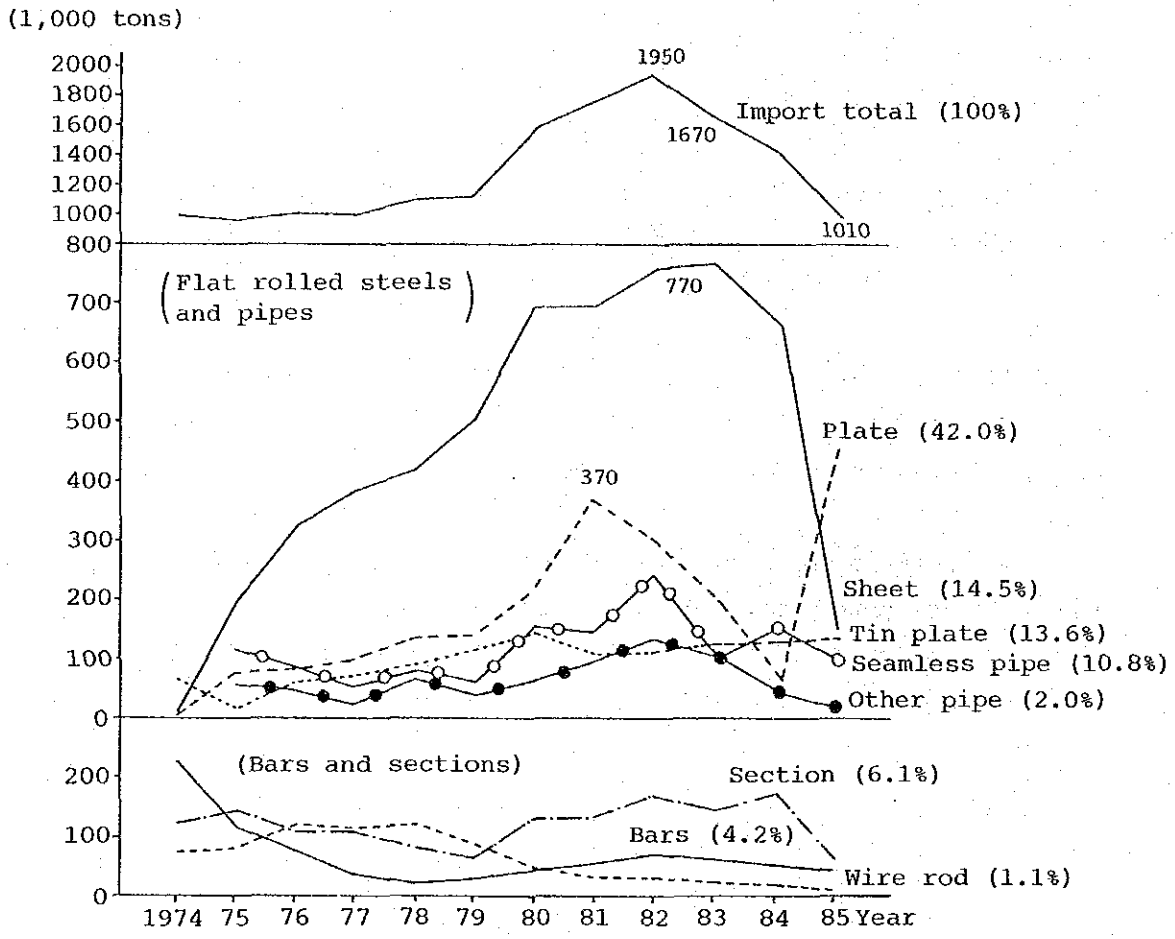


Fig. 3-3-1 Import of rolled steel products by major kind

Source: Customs clearance statistics of Indonesia

Note: Figure in parentheses shows share of each product in the total import in 1985. (%)

Table 3-3-1 Import of Ingots and Semi-finished Products

(Unit: 1,000 t)

	Ingots & Semis	(Billet)		Ingots & Semis	(Billet)
1974	166		1980	468	467*
1975	76	33	1981	497	483
1976	120	99	1982	220	207
1977	164	95*	1983	158	129
1978	199	190*	1984	119	57
1979	267	247*	1985	42	16

Source: Customs clearance statistics of Indonesia

Note: The above figures are not included in the total of rolled steel products.

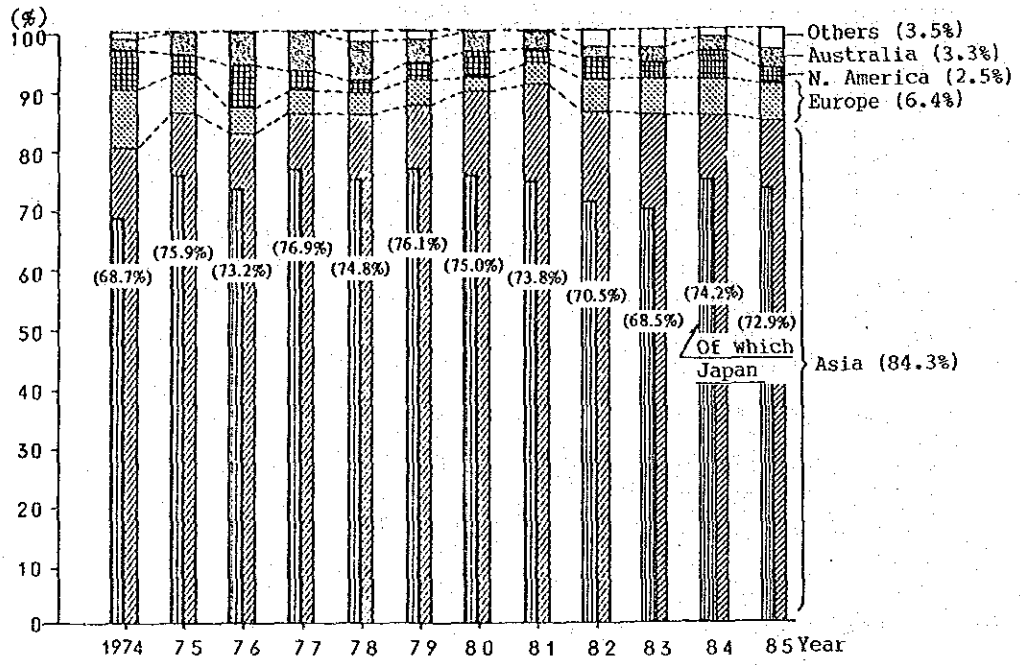
* The figures include slabs.

3-3. Import of rolled steels by exporting countries

Import from Japan has been the largest (72.9% in 1985), followed by South Korea (8.9%). Therefore, regionally also, the import from the Asia accounts for the largest part of import, 84.3%, and the shares of Europe and others are only 6.4% and 2-3%, respectively.

It was seen recently that the share of Japan declined after hitting the peak of 76.9% in 1977 while the share of countries in the southeast Asia other than Japan increased from around 10% in 1970s to 15-16% entering 1980s. Also, the share of the European countries, mainly EC, showed increase in 1983 and 1984.

Fig. 3-3-2 shares of Major Exporting Countires



Source: Customs clearance statistics of Indonesia

Note: Figures in parentheses show shares in the total import.
Most of imports from Europe are from EC and those from N. America are from U.S.

3-4. Rolled steel import from Japan

Indonesia was the 6th largest market for Japan's steel export in 1986, and the ranking almost remained the same as compared to the fifth in 1982 and the sixth in 1983. Steel import from Japan increased from 860,000 tons in 1979 to 1,370,000 tons in 1982, the highest, but in 1985 it decreased to 740,000 tons, a 30.0% decrease as compared to that in the preceding year and it still remained at the level of around 900,000 tons in 1986.

As in the total import, flat rolled steels accounted for 70% of the import from Japan, of which 20% was sheet. The decrease of import from Japan in 1985 resulted mainly from decrease of sheet (77% less than the preceding year), and sections (67%).

3-5. Steel products under import restriction

1) (Cooperative buying system by P.T. Krakatau Steel - PPBB)
   Ingot, slab, billet, scrap
   H.R. coil/sheet, plate
   Wire rod
2) (Cooperative buying system by P.T. Giwang Selogam)
   C.R. coil/sheet
   G.I. sheet, E.G. sheet, Al coated sheet, terne sheet
   Prepainted sheet
   Silicon steel sheet
   Stainless steel sheet
3) (Cooperative buying system by P.T. Kemasinti Nusabakti)
   Tinplate
   Tin-free steel sheet
   Tin mill black sheet
4) (Quota system) Importer: P.T. Dharma Niaga, P.T. Kerta Niaga
   Bar, shape
   Pipe (all pipes excepting seamless pipe of 4" dia. and over)
   Wire products

5) (Importer license system)

Part of wire products, pipe fittings

Consequently, steels presently not under import restriction are limited to seamless steel pipe with diameter of 4 inches and over and products of high carbon and alloy steel.

Table 3-3-2 Import of Raw Materials and Steel Products by Kind

(Unit: 1,000MT)

	Iron ore	Coal	Scrap	Pig iron, ferro alloy	Ingots, semi products	Coil for rerolling	Barsteel				Plates and sheets							Steel pipes & tubes		Total steel products	Uncoated wires/ Wire and wire products
							Wire rods	Bars	Shapes	Rails & Accessories	Heavy plates	Sheets	Hoop & strip	Electrical sheets	Tin plates	Galvanized sheet	Other coated sheet	Seamless pipes	Other pipes		
1970	•	—	0.2	1.3	—	—	—	153.8	—	7.4	—	—	5.4	—	27.4	0.8	141.5	80.9		417.2	55.7
71	←									N.			A.								→
72	—	—	3.8	—	—	—	—	242.9	—	19.7	—	—	10.9	—	42.2	1.5	242.6	121.4		681.2	95.0
73	←									N.			A.								→
74	•	0.3	12.7	9.5	165.6	22.2	77.6	225.9	122.0	18.7	8.8	16.0	38.3	1.2	65.9	2.5	245.4	139.7		1,149.8	130.6
1975	•	13.4	16.0	11.5	75.7	19.8	84.7	118.2	148.3	27.8	80.8	197.9	35.2	—	22.9	1.1	41.7	116.9	60.2	1,031.2	25.7
76	•	9.3	29.5	19.1	120.4	9.6	123.2	81.7	111.6	10.4	83.7	326.1	35.4	—	61.0	1.3	20.7	85.9	49.2	1,120.2	24.5
77	0.2	•	47.1	37.6	163.8	4.1	119.1	40.8	113.5	9.9	99.0	388.3	44.0	—	72.6	5.1	16.1	51.1	26.7	1,153.9	26.7
78	55.0	2.5	80.7	36.9	198.6	4.6	128.9	25.6	86.0	16.2	133.8	420.3	37.8	—	89.7	6.7	12.3	81.3	70.6	1,312.4	22.4
79	53.2	4.1	29.8	51.0	267.2	1.5	94.2	37.5	67.4	16.2	139.3	505.4	40.1	—	116.2	7.7	8.0	59.1	40.0	1,399.8	31.4
1980	285.0	4.5	39.0	51.1	468.2	1.6	52.4	49.6	132.4	6.8	218.2	693.8	37.5	—	146.8	9.6	8.8	156.6	66.5	2,048.8	33.2
81	701.6	—	62.7	81.1	496.6	2.4	35.2	57.5	135.9	10.4	365.2	694.6	46.4	—	110.9	—	46.3	145.0	97.0	2,243.6	52.1
82	121.0	0.2	226.9	97.5	220.5	1.9	35.3	73.1	173.1	15.4	301.2	757.1	35.4	—	114.7	—	59.0	242.7	139.7	2,169.0	43.2
83	128.0	0.7	257.9	105.0	157.5	1.0	29.0	65.4	147.2	27.6	207.3	766.0	24.4	3.1	119.1	16.2	35.9	114.5	108.4	1,822.6	40.7
84	182.4	0.1	243.1	125.6	118.9	2.0	27.9	62.7	176.6	72.7	69.9	657.6	16.7	3.0	114.6	7.0	31.6	137.1	45.4	1,543.7	37.7
85	132.6	16	190.9	105.4	42.3	1.2	10.9	42.3	61.7	5.8	426.7	147.6	9.4	4.3	137.4	10.3	27.5	109.6	20.7	1,057.7	24.7

Source: Biro pusat Statistik, Djakarta "Impor Menurut Djenis Barang Dan Negeri Asal"

Note: Prior to 1977, "Others" in "Steel pipes & tubes" include pipe fittings.

Table 3-3-3 Steel Import by Exporting Countries (1972-1985)

(Unit: 1,000 MT, %)

	Asia				Europe				North America				Latin America		Australia		Others		Total Import	
	Japan		Sub total		EC		Sub total		U.S.A.		Sub total									
	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%
1972	385.5	56.6	599.6	88.0	21.2	3.1	40.8	6.0	14.1	2.1	14.5	2.1	—		24.7	3.6	1.4	0.2	681.1	100.0
73								N.	A.											
74	676.5	68.7	749.0	80.7	96.0	9.8	98.7	10.0	65.7	6.7	65.8	6.7	1.0	0.1	21.3	2.2	3.2	0.3	984.2	100.0
1975	725.3	75.9	824.8	86.3	45.3	4.7	62.9	6.6	28.3	3.0	34.1	3.6	—	—	33.7	3.5	0.1	—	955.5	100.0
76	731.4	73.2	828.9	82.9	38.8	3.9	41.4	4.1	58.7	5.9	71.7	7.2	0.5	0.1	57.0	5.7	0.3	—	999.8	100.0
77	761.7	76.9	851.2	86.0	32.6	3.3	33.0	3.3	32.1	3.2	32.2	3.3	1.8	0.2	68.9	7.0	3.1	0.3	990.1	100.0
78	833.0	74.8	956.3	85.9	36.5	3.3	37.3	3.3	23.9	2.1	26.3	2.4	4.6	0.4	78.3	7.0	10.9	1.0	1,113.7	100.0
79	862.1	76.1	986.8	87.1	51.3	4.5	52.1	4.6	32.3	2.9	33.7	3.0	—	—	47.8	4.2	11.8	1.0	1,132.6	100.0
1980	1,185.0	75.0	1,411.2	89.3	38.6	2.4	41.6	2.6	63.9	4.0	65.1	4.1	1.8	0.1	53.1	3.4	8.0	0.5	1,580.6	100.0
81	1,289.0	73.8	1,580.2	90.5	58.3	3.3	63.8	3.7	41.8	2.4	42.7	2.4	—	—	45.2	2.6	15.1	0.9	1,747.0	100.0
82	1,373.0	70.5	1,676.5	86.0	64.4	3.3	104.7	5.4	67.1	3.4	81.7	4.2	11.6	0.6	39.7	2.0	34.3	1.8	1,948.6	100.0
83	1,140.2	68.5	1,417.4	85.1	81.4	4.9	102.6	6.2	40.7	2.4	51.3	3.1	11.5	0.7	39.5	2.4	42.5	2.6	1,665.1	100.0
84	1,056.7	74.2	1,215.4	85.3	79.2	5.6	90.8	6.4	45.7	3.2	68.4	4.8	13.1	0.9	30.0	2.1	7.1	0.5	1,424.8	100.0
1985	740.3	72.9	856.1	84.3	45.3	4.5	65.3	6.4	23.3	2.3	25.8	2.5	18.2	1.8	33.6	3.3	11.4	1.1	1,015.4	100.0

Source: Biro pusat Statistik, Djakarta "Impor Menurut Djenis Barang Dan Negeri Asal"

Note: E.C. prior to 1972 shows the total of 6 countries.

Chapter IV. OUTLOOK OF STEEL DEMAND

Chapter IV OUTLOOK OF STEEL DEMAND

1. Outlook of Steel Demand by Step I Mission

1-1. Outlook of demand for rolled steels in 1990 by kind and demand sector

In forecasting rolled steel demand in 1990 by kind and by demand sector, while taking into consideration economic policies and industrial policies incorporated in the fourth 5-year development plan of Indonesia which started in 1984 as reference, the so-called "Tsumiage" method was used, in which the demand in 1990 was estimated by making the best of the trend of production levels of relevant machinery and unit consumption of rolled steels based on various statistical data and other information collected during the studies in Indonesia.

The result of the forecasting work is as shown in Table 4-1-1.

(1) Demand forecast by demand sector

It is forecasted that the entire demand for rolled steels in 1990 will be 4,129,000 tons, an increase of 1,416,000 tons compared to 1983, meaning an annual growth rate of 6.2% during the period.

By demand sectors, building sector which is the largest is expected to show some growth in factory and plant buildings, but construction of office buildings in urban districts is considered to have run its course, and also there is no prospect of high growth in housings and schools. Therefore, the demand for rolled steels by this sector is forecasted to be 1,297,000 tons in 1990, with an annual growth rate being 5%.

Table 4-1-1 Demand Forecast for Rolled Steels in 1990 by Kind and by Demand Sector

(Unit: 1,000 tons, %)

Products \ Sectors	Construction				Manufacturing												Others	Grand total	Growth rate % 1990/1983
						Automotive													
	Building	Civil Eng.	Others	Total	Shipbuilding	4-wheel	2-wheel	Bicycle	Railway vehicle	Elec. machinery	Industrial machinery	Home, office appliances	Containers	Secondary products	Others	Total			
Bars	622	142	264	1,028	1	· ·			2		2	1				6		1,034	6.1
Sections	56	329	40	425	6				6		3					15		440	7.6
Wire rods		· ·		· ·										363		363	104	467	6.1
Heavy & medium plates	55	113		168	51	7			7	8	19					92	125	385	7.5
Hot rolled sheet	8	4		12		16	2	2			1		3			24	47	83	4.7
Cold rolled sheet	21			21		29	15	4		27	2	20	58			155	122	298	5.1
Galvanized sheet	440			440		8				9	1					18	21	479	5.1
Tinplate										18			152			170		170	5.2
Seamless tubes		194		194	1						1					2		196	8.2
Welded pipes	93	328		421	2	5	3	2			3	53				68	45	534	6.1
Total of ordinary steels	1,295	1,110	304	2,709	61	65	20	8	15	62	32	74	213	363		913	464	4,086	6.2
Total of special steels	2			2		21					6	13			1	41		43	3.4
Grand total	1,297	1,110	304	2,711	61	86	20	8	15	62	38	87	213	363	1	954	464	4,129	6.2
Growth rate, % 1990/1983	5.0	7.5	7.5	6.2	5.8	3.4	4.2	4.2	17.0	8.5	9.6	3.8	5.0	6.1	0.0	5.7	6.9	6.2	
Percentage, %	(31.4)	(26.9)	(7.4)	(65.7)	(1.5)	(2.1)	(0.5)	(0.2)	(0.4)	(1.5)	(0.9)	(2.1)	(5.1)	(8.8)	(. .)	(23.1)	(11.2)	(100.0)	

As the improvement of infrastructure forms one of the important policies of the nation, civil engineering is expected to consume 1,110,000 tons of rolled steels in 1990, showing an annual growth rate of 7.5% which is higher than the average growth rate of all demand for rolled steels. By type of project, waterworks, ports and power supply, among others, are expected to be strong. As a result, rolled steel demand by the construction sector including "others" is forecasted to be 2,711,000 tons in 1990, showing an annual growth rate of a little more than 6%.

As regards manufacturing sector, with the Government's policy to promote industrialization and increase the ratio of domestic production, high growth of rolled steel demand is expected at railway vehicle (an annual growth rate of 17%), industrial machinery (10%) and electric machinery (9%) though the demand will still remain small even in 1990. Secondary processed products have diversified demand fields, enjoying a relatively large demand, and because they are used mainly in construction, their demand is expected to increase to 363,000 tons in 1990, showing an annual growth rate of about 6% which is almost the same as that of the construction sector. Reflecting a stable trend of tin cans, container is forecasted to show an annual growth rate of 5% of rolled steel consumption, reaching 213,000 tons in 1990.

Forecast for shipbuilding and automotive sectors is as follows. Improvement of ships and expansion of maritime industry are of prime importance to the Republic of Indonesia which consists of a great number of islands. Though there is a considerable potential demand for new construction and repair of ships, rolled steel demand from shipbuilding is expected to show an annual growth rate of a little less than 6% because there are some limitations in capacities. In the automotive (4-wheel cars) sector, production (commercial cars) is expected to increase from

129,000 units in 1983 to 165,000 units in 1990 and the steel demand of the sector is expected to show a growth rate of 3.4% a year during the period, which is comparatively slower than other sectors. All other sectors are expected to show an increase in the steel demand at an annual rate of about 4% generally. Reflecting the above trend, the rolled steel demand by the manufacturing sector is forecasted to be 954,000 tons in 1990, an annual growth rate of a little lower than 6%.

In 1990, the construction sector will account for 66% of the total demand for rolled steels, the manufacturing sector 23% and others 11%, and the demand structure is expected to show a pattern similar to that in 1983. Thus the demand will continue to be heavily dependent on the construction sector in 1990.

(2) Demand forecast by kind of rolled steels .

The demand for special steels is expected to be 43,000 tons in 1990, an annual growth rate of 3%, as their main consuming sectors such as home and office appliances and automotive will grow at a slower pace than other sectors.

On the other hand, the demand for ordinary steels is forecasted to reach 4,086,000 tons in 1990, an annual growth of a little higher than 6%, thanks to the growth of construction sector.

As regards the demand by kind of rolled steels of ordinary steel, those which are expected to show a high growth are seamless tubes and pipes (an annual growth rate of 8%) reflecting the increased demand from oil exploitation and development, and shapes, heavy and medium plates showing an annual growth rate of about 7.5%. On the other hand, the four rolled steels of hot rolled sheet, cold rolled sheet, galvanized sheet and tinplate are forecasted

to show an annual growth rate of around 5%.

The demand of the products which is enjoying the large amount are bars, welded pipes and galvanized sheet and their demand in 1990 will be 1,034,000 tons, 534,000 tons and 479,000 tons, respectively. Their ranking will be the same as that in 1983.

From the above forecasts it results that long products will increase at an annual growth of 6.5% to 1,941,000 tons in 1990, flat products at the rate of 5.7% to 1,415,000 tons and tubulars at the rate of 6.7% to 730,000 tons, with the tubulars showing the highest growth rate. The demand structure will be 47% for long products, 35% for flat products and 18% for tubulars, and this pattern is almost same as that in 1983 excepting that one point percentage drop of flat products is offset by an increase of tubulars.

(3) Matters agreed with the Ministry of Industry

Step I mission's outlook of steel demand was prepared at the end of 1984 and the data available at the time were those of 1983 or earlier. Therefore, the slowdown of economy, drop of crude oil prices and rapid decrease of steel demand in the past two or three years were not taken into consideration. It was agreed between Indonesian Ministry of Industry and Step III mission that though the figure of 4,129,000 tons is given for 1990 in the outlook of steel demand prepared by Step I mission, it does not mean the demand will reach the level in that year but sometime in 1990s.

1-2. Forecast of crude steel demand in 1995 and 2000

The demand in 1990 was forecasted according to the so-called "Tsumiage" method where demand in each consuming sector is calculated by multiplying respective activity level by unit steel consumption and the demand in all consuming sectors is added up. Use of this Tsumiage method was considered unsuitable for forecasting steel demand in 1995 and 2000 because various factors involved such as activity level and unit steel consumption had to be set too arbitrary, and so the following methods were used for making the forecast.

(1) Forecast by macro-correlation method

Regression analysis was made about time-series of apparent steel consumption (crude steel) and macro-economic indicators such as GDP during the period from 1973 to 1983. To the regression formula thus obtained, forecasted GDP was substituted to forecast steel demand.

Table 4-1-2 Forecast of crude steel demand in 1995 and 2000 by macro-correlation method

	1995	2000	Remarks
GDP (in Rp. billion 1975 price)	21,363.9	26,623.3	Real annual growth rate 4.8% 1990-1995 Real annual growth rate 4.5% 1995-2000
Crude steel demand (in 1,000t)	6,892	8,968	

(2) Forecast by cross-section method

A general model of steel intensity curve (ASC/GDP - kg/US$) corresponding to the level of economic development (GDP per capita in 1975 US dollars) was prepared by observing steel consumption in selected developed and developing countries. Difference between the actual steel consumption in Indonesia and the consumption estimated from the general model formula was fixed as characteristics of Indonesian economy and the general model formula was revised accordingly so that the formula could be used as formula for forecasting steel demand in Indonesia.

Table 4-1-3 Forecast of crude steel demand in 1995 and 2000 by cross-section method

	1995	2000	Remarks
Population (Million persons)	198.4	215.9	Real annual growth rate
GDP (Million US$)	83,736	104,350	4.8% 1990-1995
Steel consumption (Crude steel, 1,000T)	6,968	8,896	4.5% 1995-2000

(3) Conclusion of the long-term demand forecast

From those consideration, it can be said that the both forecasting methods give almost same outlook and that the demand is expected to be about 6,968,000 tons in 1995 and about 8,896,000 tons in 2000.

(Note: As the demand figure forecasted for 1990 is now expected to be reached a few years later in 1990s, the outlook for 1995 and 2000 also will be reached the same number of years later.

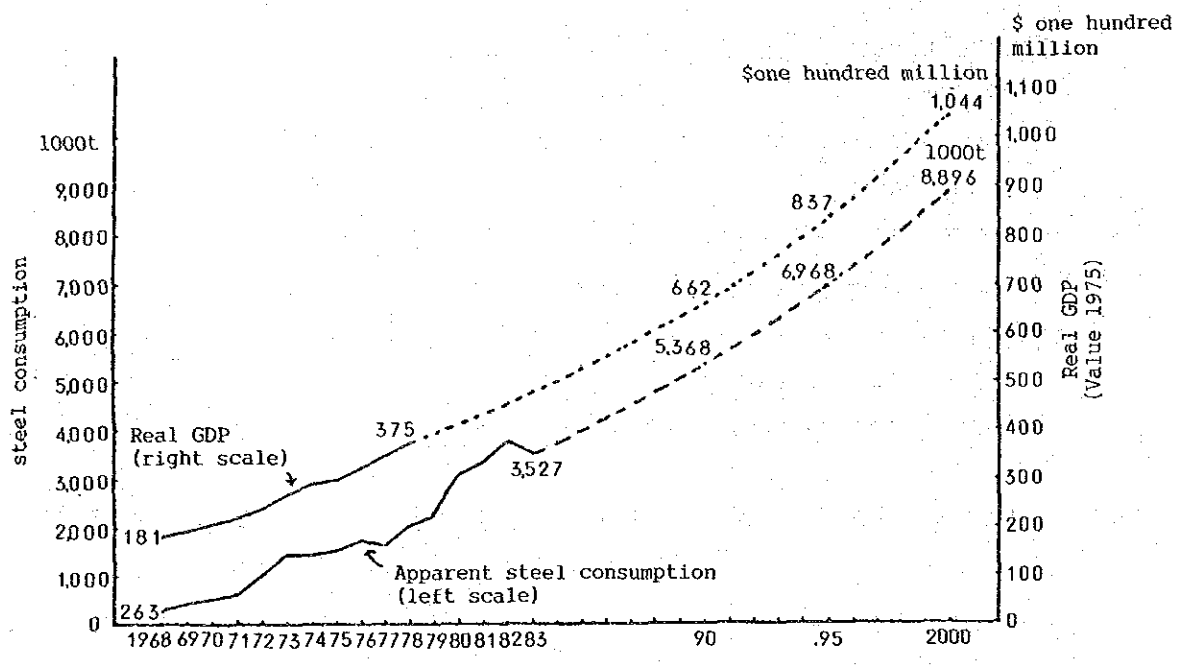


Fig. 4-1-1 Forecast of Crude Steel Consumption

2. Outlook of Steel Demand of Other Organizations

Informations about outlook of steel demand which Step III mission received from Ministry of Industry are two; one is the study by BSC and the other is the study of Arthur D. Little, Inc., a U.S. consultant company. The both studies were prepared after the study of Step I mission and are the latest data on the outlook of steel demand in Indonesia that took into consideration the recent slowdown of economy and drop of oil prices.

2-1. Outlook of steel demand by BSC

(1) The structure of the economy

The Indonesian economy is still heavily dependent on agriculture, oil and primary products. In 1985 agriculture accounted for 24% of GDP, oil and gas for 16% and manufacturing excluding LNG and oil refining for only 9%. GDP growth from 1971 to 1981 averaged 8%p.a but since 1982 has fallen to around 3%p.a. Manufacturing growth has fallen from 14%p.a 1971-81 to 5%p.a.

Table 4-2-1 % pa Growth at Constant Prices

	1971-1981	1982-1986
GDP	8	3
Agriculture	4	2
Mining, Oil & Gas	7	-1
Manufacturing	14	5
Construction	15	0

The construction industry growth was positive up to 1985 but in 1986 output is likely to decline by 10%.

Because of its structure, the economy has been very severely affected by the decline in prices for oil, agricultural products and other commodities. The deterioration in the terms of trade resulted in a balance of payments crisis in 1983 and again in 1986. The fall in oil prices has also severely reduced Government revenues, almost 70% of which come from oil and gas production.

Debt service charges, which in the past were of little concern, are becoming much more significant with the fall in foreign earnings from oil exports, and in 1986 will exceed 30% of exports.

(2) Economic prospects up to 1990

The depressed state of the economy, brought about largely by worsening terms of trade, is likely to be persistent. GDP growth could be constrained to about 1%p.a up to 1990, implying a sharp fall in income per head. Despite the 1986 devaluation, export industries (except perhaps textiles and plywood) will not provide much growth stimulus, because of their inefficiencies.

The longer term outlook beyond 1990 depends to a large extent on the outcome of the next few years, in particular the government policy responses. If government policy continues along past lines, of import substitution and protection, domestic industry and with it the construction industry will be restricted by sluggish domestic demand. Even with same recovery in oil and commodity prices and output, sufficient to prevent further falls in GDP per head, GDP growth is unlikely to exceed 2-3%p.a. With policy change to a more 'open' economy, growth could reach 4-5% p.a.

(3) The forecast of rolled steels by kind in 1990 and 1995

The forecast, in relation to 1985 actual and trend demand in 1990 and 1995 is as shown in Table 4-2-2.

Table 4-2-2 Indonesian Steel Demand

(Unit: Thousand Tons)

	1985		1990		1995	
	Actual	Trend	Low Case	High Case	Low Case	High Case
Rod & Rebar	887	917	733	745	844	993
Section & Bars	166	323	284	287	324	369
C R & Galv.	513	664	677	682	841	958
H R & Plate	168	342	309	312	370	429
Tinplate	137	142	150	151	186	209
Tubes	390	381	379	390	407	448
Total	2,261	2,768	2,531	2,567	2,972	3,404

2-2. Outlook of steel demand by A.D.L.

(1) Historic steel consumption patterns

Consumption of steel in Indonesia has increased rapidly in the recent past. Since 1975, consumption increased every year but two, until the slowdown of 1984 and 1985. (Fig. 4-2-1) Over the 15-year period shown in Figure 4-2-1 steel consumption has grown at an annual rate of 15% per year, which is a very robust growth rate by any standards. In fact, consumption doubled between 1970 and 1973, and again between 1973 and 1979. However, growth slowed in the latter part of the period and consumption actually declined after 1983.

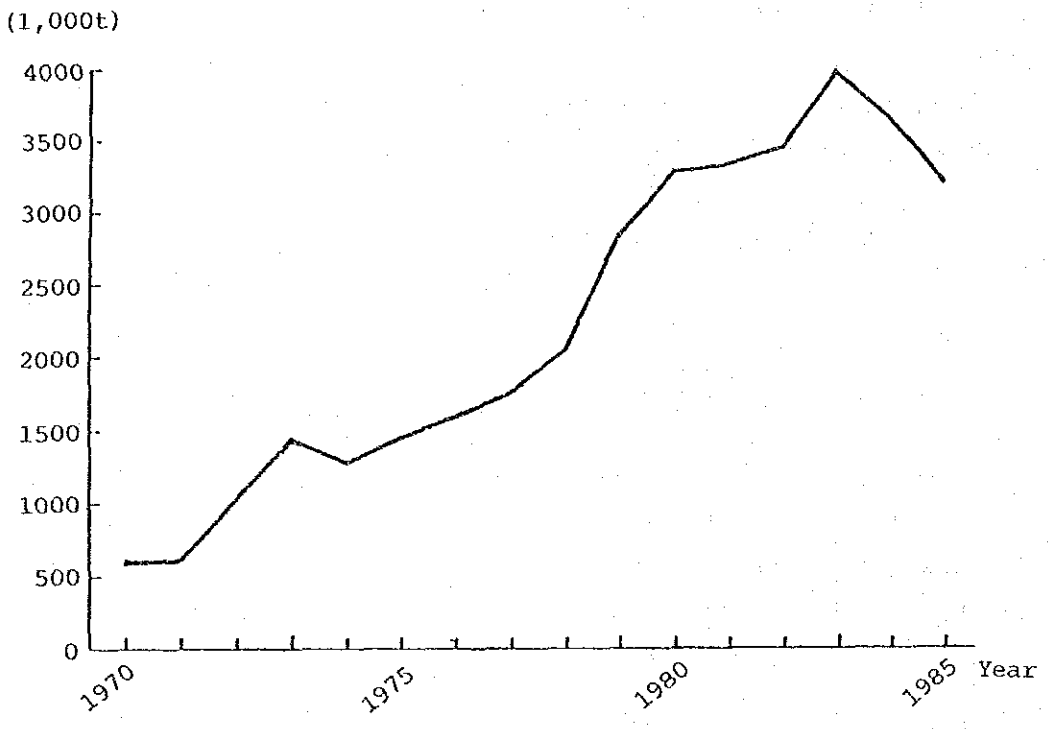


Fig. 4-2-1 Apparent Domestic Consumption of Steel in Indonesia - 1970-85

Source: International Iron and Steel Institute, Steel Statistical Yearbook. 1980 & 1985

(2) Sectors consuming steel mill products

Steel consumption in Indonesia is heavily oriented towards capital investment, particularly construction. The country has undergone rapid development over the past 15 years, and the majority of steel consumption has supported this effort. Steel is currently consumed by the industrial sectors indicated and in the proportions shown in Table 4-2-3. The consumption percentage data from Table 4-2-3 is shown in Fig. 4-2-2.

Table 4-2-3 Sectors Consuming Steel Mill Products

Sector	Percent of Total	Typical Products Used
Heavy Construction	43	Rebar, sections, rod, sheet and plate, pipe
Light Construction	23	Rebar, galvanized sheet, rod, pipe
Engineering	3	HR sheet and plate, sections, rod
Shipbuilding	2	HR sheet and plate
Oil and Gas	10	Pipe and tube
Automotive	5	CR sheet, HR sheet
Furniture/Appliances	1	CR sheet
Packaging	2	Tin mill products
General Manufacturing	11	Pipe and tube, HR sheet, rod, tinplate
Total	100	

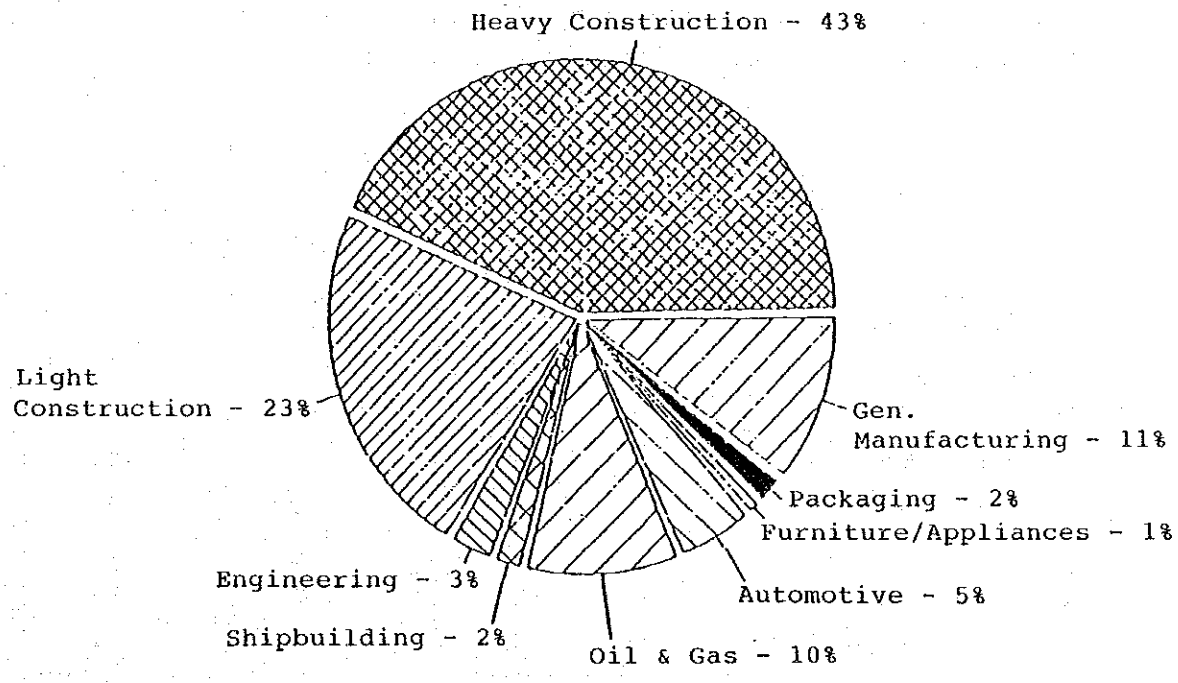


Fig. 4-2-2 Sectors Consuming Steel Mill Products

(3) Steel consumption by sector and by kind

Indonesia consumed a total of 2,283,000 tons of steel mill products in 1985, a 9% decrease from the estimated 2,510,000 tons consumed in 1984. It is evident that much of the 1985 decline in steel consumption resulted from products destined for the capital investment/construction and personal spending sectors of the economy: profiles and sections, hot rolled sheet, and plate and their products (cold rolled sheet, galvanized sheet, and tin plate). Products that did not suffer severe declines included concrete reinforcing bar (rebar), wire rod, and pipe and tube. The volumes for these products were buoyed by the continuation of light construction projects that involved the use of rebar and some wire rod, the broad base of industrial and consumer applications which demand wire products, and the petroleum industry which continued to exert healthy demand for tubular products throughout the year.

Steel consumption by kind and the matrix of steel products vs. market sectors in 1985 presented as Table 4-2-4 and Table 4-2-5.

Table 4-2-4 Estimated 1985 Steel Consumption

Products	1984 (000 tons)	1985 (000 tons)	% Change from 1984
Reinforcing Bar	635	618	-3%
Profiles and Sections	435	330	-24%
Wire Rod	270	251	-7%
Hot Rolled Sheet and Plate	200	244	22%
Pipe and Tube	400	400	0%
Cold Rolled Sheet	180	140	-22%
Galvanized Sheet	275	200	-27%
Tin Mill Products	115	100	-13%
Total	2,510	2,283	-9%

Table 4-2-5 Product/Market Distribution - Final Products Current Demand Levels (1985)
(000 tonnes)

Products / Markets	Rebar	Sections	Wire Rod	HR Sheet & Plate	Pipe & Tube	Cold Rolled	Galvanized	Tinplate	Total
Heavy Const.	468	275	89	70	55	--	30	--	987
Light Const.	150	30	97	19	45	--	160	--	501
Engineering	--	15	15	30	--	--	--	--	60
Shipbuilding	--	10	--	40	--	--	--	--	50
Oil & Gas	--	--	--	--	240	--	--	--	240
Automotive	--	--	--	25	*	100	*	--	125
Appliances/ Furniture	--	--	--	*	*	20	*	*	20
Cans	--	--	--	--	--	--	--	50	50
General Manufacturing	--	--	50	60	60	20	10	50	250
Total	618	330	251	244	400	140	200	100	2,283
% Sold via Distributors	90%	25%	5%	65%	33%	100%	100%	40%	

(4) Economic forecasts

Steel consumption is linked to the rate of economic activity in Indonesia, which is best measured by the nation's Gross National Product (GNP) growth rate, or that of its Gross Domestic Product (GDP). The GDP is the broadest measure of economic activity taking place within Indonesia, and is similar to the GNP, except that it ignores foreign activity being performed by Indonesians. A close approximation of the country's steel- intensive activities is measured by the Gross Capital Formation (GCF). Forecasts of Indonesian steel consumption were by first developing estimates of the GDP and GCF, and then estimating how each steel-consuming sector would behave with respect to these broader indicators. Then, steel consumption was estimated by calculating the growth rate for each end-market sector for each of the steel products consumed by that sector, and summing the total estimated volume of steel products demanded.

The late 1985 oil price declines will trigger oil market and price disruptions that will probably persist throughout the rest of the 1980s. As long as oil prices remain uncertain or depressed, exploration for and development of new reserves will decline. This will ultimately lead to conditions of shortage -- perhaps by the late 1980s. As oil shortages develop in the late 1980s, oil prices will bring a long-term rise. Until then, oil prices are expected to be unstable, with sharp swings, perhaps into the 1990s. At that time, however, oil shortages should bring relatively strong growth as new energy development projects rekindle economic activity.

Table 4-2-6 Economic Forecasts for Indonesia (1985-95)
(% per year of growth)

	1985-1990	1990-1995
Prior to oil price declines of late 1985		
Gross Domestic Product (GDP)	4.4%	5.0%
Gross Capital Formation (GCF)	5.0%	6.0%
Revised Forecasts*		
GDP (high-low cases)	2.2 - 0%	7.5 - 5%
GCF (high-low cases)	2.5 - 0%	9.0 - 6%

* Used in this report

(5) Development of steel consumption forecasts

Steel forecasts were developed by applying national GCF growth rates, developed in the prior page, to each end-market sector, and to the steel products consumed in each sector.

Table 4-2-7 Growth Forecasts - End-Market Sectors

	Indicated Growth: % per year			
	1985-1990		1990-1995	
	High	Low	High	Low
Gross domestic Product	2.2%	0%	7.5%	5%
Gross Capital Formation	2.5%	0%	9.0%	6%
Sector				
Heavy Construction	3.5%	1.0%	6.0%	3%
Light Construction	2.5	0	6.0	3
Engineering Industries	1.5	-1.0	9.0	6
Shipbuilding	2.5	0	6.0	3
Oil and Gas	-2.5	-5.0	11.0	8
Automotive	0.5	-2.0	10.0	7
Appliance and Furniture	3.5	1.0	10.0	7
Food and Beverage Packaging	0.5	-2.0	4.0	1
General Manufacturing	4.5	2.0	10.0	7

Table 4-2-8 Steel Products Demand Forecast -- Indonesia

(Unit: 1,000 ton)

Year / Product	1985	1990 (E)		1995 (E)	
		High	Low	High	Low
Rebar	618	726	642	971	744
Sections and Profiles	330	388	343	523	401
Wire Rod	251	294	260	414	317
Hot Rolled Sheet and Plate	244	283	250	412	316
Pipe and Tube	400	402	355	632	485
Cold Rolled Sheet	140	151	133	244	187
Galvanized Sheet	200	229	203	310	238
Tin Mill Products	100	114	100	163	125
Total	2,283	2,587	2,286	3,669	2,813
Overall Steel Growth Rates (% per year)		2.5%	0.0%	7.2%	4.2%

Chapter V. MAIN RAW MATERIALS FOR STEEL PRODUCTION

Chapter V. MAIN RAW MATERIALS FOR STEEL PRODUCTION

1. Availability of Iron Ore or Pellet Including Analysis of Component

1-1. General

The recommended process for this project is steelmaking process consisting of DR plants and electric arc furnaces using direct reduction iron produced by the DR plants and scrap. Therefore, the raw materials used in the DR plants should be decided on the basis of economy at both the DR plants and the EAFs which follow.

The most suited raw materials for direct reduction and electric steelmaking are selected according to the following criteria.

1) Chemical and physical properties of iron oxide
2) Reduction characteristics
3) Overall economic consideration at both DR and steelmaking processes including reduction of power consumption

(1) Chemical characteristics of iron oxide

Direct reduction processes convert the iron oxide ie iron ore pellet and briquette made by fine iron ore into highly metallized iron suitable for steelmaking.

The only and most important chemical change in the DR processes is to remove oxygen from iron oxide such as iron ore. As the above is done without melting and refining, most of impurities and gangue in the iron oxide remain in direct reduced iron (DRI). As a result of deoxidation of iron oxide, the content of impurities in DRI increases.

For the above reason, the iron content of iron oxide should be as high as possible and the contents of gangue and others as low as possible and the overall composition in DRI should be within the limits which acceptable use of DRI in the subsequent steelmaking processes. Since excessive gangue and tramp elements have particularly marked effect on the operation of electric furnace steelmaking, it is desirable to have iron oxide with least gangue and tramp elements to ensure lower power consumption and extension of life of refractories.

(2) Physical characteristics of iron oxide

Physical characteristics of iron oxide are more important than its chemical characteristics in DR processes. Namely, it is very important to have hot and cold strength, which minimizes physical degradation during and after reduction, and stable size range, which ensures supply of homogeneous materials to the DR furnace. In addition, it is desirable to have iron oxide which shows low clustering tendency in DR processes.

(3) Reduction characteristics of iron oxide

Since the reduction apparatus of iron oxide is governed by its reducibility during effective burden residence time in reduction zone of a DR furnace, it is necessary to have iron oxide with uniform and good reducibility. It is also desirable for iron oxide to have low fragmentation behavior regarding its thermal fragmentation occurring at early period of reduction and reduction fragmentation when hematite is reduced to magnetite.

(4) Overall economies of both DR and EAF

Factors such as the degree of metallization, gangue content, impurities and resistibility against chipping and degradation during transport and handling have great effect for the productivity of steelmaking processes at EAFs. Therefore, for DR/EAF process, the raw material ore is desirable to have following characteristics.

1) Gangue content is as low as possible, or ideally 2-3% max.
2) Basicity ratio ($CaO + MgO$ / $SiO_2 + Al_2O_3$) is high, but due to the above restriction, should be 0.5-0.8.
3) It should have uniform chemical and physical characteristics.
4) Of impurities, phosphorus and sulfur in particular should be 0.04% max. and 0.015% max., respectively.

(5) Conclusion

Summarizing the above, technological and economical consideration of the DR/EAF processes calls following characteristics for iron oxide.

- High Fe content
- High strength
- High reducibility
- Low fragmentation tendency
- Low clustering tendency
- Uniform size distribution

Suggested pellet specifications for MIDLEX process are given as follows;

SUGGESTED PELLET SPECIFICATIONS

CHEMISTRY	RANGE
%Fe	67.0 min.
%SiO_2 + Al_2O_3	2.0 max.
%P	0.02 max.
%S	0.015 max.
%Cu	0.010 max.
%TiO_2	0.150 max.
%SiO_2	1.0 max.
Moisture	2.0 max.
Basicity (CaO + MgO / SiO_2 + Al_2O_3)	0.5 min. - 0.8 max.
PHYSICAL	
% 9-16 mm	90.0 min.
% -6.3 mm	4.0 max.
Compression (kg)	250 min.
Tumble index (% +6.3 mm)	94.0 min.
(% -1 mm)	3.0 max.
% Porosity	20-30
Bulk density (kg/m^3)	2000 min.
LINDER (at 760 °C)	
% Metallization	92.0 min.
% Sulfur liberation	30.0 max.
% Fragmentation (-3.3 mm)	3.0 max.
Compression (kg)	50 min.
STATIC BED REDUCTION (at 815 °C)	
Bulk density (kg/m^3)	1500 min.
Tumble index (% +6.3 mm)	90 min.
Clustering tendency	0

1-2. Availability of iron oxide

(1) General

Though ideal conditions of iron oxide suitable for DR/EAF processes were enumerated in the preceding section, there are actually no sized iron ore nor pellet which satisfy the same condition. Consequently, the real condition calls for the plant of DR/EAF processes to consider use of any brand of iron oxide continuously and economically by selecting and blending them from market with a view of approaching as close as possible to the technical criteria. Such use of some brands of iron oxide by selecting and blending permits flexibility in coping with changes in international economy conditions and makes sure long-term and stable purchase of the materials and so is considered advantageous.

(2) Availability of pellet for DR

At present, the followings are listed as suppliers of DR grade pellet; LKAB, MPRD (Sweden), CVRD (Brazil), SAMARCO (Brazil) and others. In addition, pellets produced in the following countries may be available; India, Bahrain, Canada, Venezuela and others.

Typical chemical analysis and size distribution of some well-known brands are given in Table 5-1-1.

Table 5-1-1 Chemical Analysis and Size Distribution of Pellet of Selected Brands

	LKAB (Sweden)	CVRD (Brazil)	SAMARCO (Brazil)
Chemical analysis	Typical	Typical	Typical
T.Fe	67.3%	67.9%	67.7%
SiO_2 + Al_2O_3	1.2%	1.9%	2.1%
P	0.014%	0.018%	0.03%
S	0.006%	0.003%	0.004%
Physical properties		8-18 mm	
9 - 16 mm	95.5%	95.6%	85% min.
- 5 mm	0.8%	1.1%	3% max.
Metallization			94%

Presently those pellets are used at the following DR plants.

KRAKATAU	(Indonesia)
TRENGANU	(Malaysia)
SABAH	(Malaysia)
HADEED	(Saudi Arabia)
ANSDK	(Egypt)
SIDBEC	(Canada)

(3) Availability of lump (sized) ore for DR

It is theoretically possible to use 100% sized ore in the present DR processes. However, considering inferior fragmentation of produced DRI, stable operation and also economies of DR plant, it is recommended to limit use of sized ore to about 30%.

Typical brands of sized ore for DR are Mutuca (MBR. Brazil) and Ferteco (Brazil), and Mt. Newman and Hamersley in Australia are also high potential brands. Sized ore therefore seems to provide relatively wider range of selec-

tion than pellets in purchasing. In view of advantage of carrying the ore by ships from same port as pellets, use of sized ore from Brazil is recommended in this case.

Table 5-1-2 Chemical Analysis and Size Distribution Selected Sized Ore Brands

	MUTUCA (Brazil)	FERTECO (Brazil)
Chemical analysis	Typical	Typical
T.Fe	68.3%	67.0%
$SiO_2 + Al_2O_3$	1.7%	2.5% max.
P	0.04%	0.065% max.
S	0.006%	0.01% max.
Physical properties	Typical	
9 - 16 mm		-
- 5 mm	- 6 mm 2.7%	- 6 mm 5% max.
Metallization		-

(4) Demand and supply

Crude steel production in the western world is expected to increase gradually from the present level of 440 million tons a year to 500 million tons in 1995 and thereafter. The demand for pellet, therefore, is expected to increase from 120 million tons in 1987 to 160 million tons during the time catching up the supply capacity in present.

It is expected that pellet for DR will be in a tight supply from the first half of 1990s. But considering possibility of pellet suppliers to start production of pellet for DR, shift to sinters at BF process and also construction of new pellet plants reported on paper, it can be said that stable availability of pellet for DR is fully possible though its present users' market may change to more balanced market.

(5) Conclusion

Already in Indonesia, P.T. Krakatau Steel, steel works based on DR process ranking among the largest in the world, is in operation and purchases DR grade pellet from the three largest suppliers in the world and has adequate negotiating capability. Therefore, the present three typical brands of LKAB, CVRD and SAMARCO should be applied to the new steel works.

Also it is recommended that the new steel works should use about 30% of sized ore in addition to DR grade pellet.

By the above, it should be possible for Indonesia to be in a better position in purchasing negotiation than now and obtaining supply of raw materials advantageously.

2. Availability of Other Materials

2-1. Scrap

Demand and supply condition of scrap for the second steel works under this project is basically affected by the same background as that for P.T. Krakatau Steel at present.

The worldwide background of scrap demand and supply is as follows:

> There is shortage of scrap of 5-6 million tons/year in Asia and 2-4 million tons/year in the entire Europe, while there is surplus of scrap of 12-14 million tons occurred of 700,000 tons/year in Australia, 2 million tons/year in Western Europe, and 10 million tons/year in North America.

Accumulated stock of steel in the past in the form of various structures and others is increasing steadily throughout the world, and occurrence of scrap is increasing even from steel structures which are known of longevity.

Nowadays reflecting the worldwide slowdown of steel demand, scrap supply is not necessarily tight, but share of electric furnace steel produced by EAFs which rely mainly on scrap in the total steel production as against that of BOF steel based on hot metal shows a rising trend.

Share of EAF steel in the total steel production:

	1985	1986
Japan	29.0%	29.7%
USA	33.9%	37.0%
W. Germany	18.4%	18.3%
France	19.6%	23.1%

In those countries, high energy cost prohibits economic production of DRI, which makes it inevitable for EAF steel mills to operate on scrap 100%. Therefore the second steel works may have to obtain scrap in competition with EAF steel mills in those countries.

In the meantime, since DRI contains less impurities and contaminants, blending of DRI in the charge dilutes those elements in 100% scrap charge, which generally makes it possible to use low grade scrap. However, low grade scrap tends to contain rubber and non-ferrous metals and is not homogeneous. Though it depends on quality of liquid steel as specified, grade control of scrap is imperative. Scrap in closed form must be always cut open, and long scrap, even No.1 heavy melting scrap, must be cut to less than 1.5 m in length.

As regards home scrap, adoption of CC facilities and treatment of all liquid steel by ladle refining furnace will reduce casting loss due to low temperature and uneven temperature to the minimum and hence occurrence of home scrap

such as ladle and tundish skull. Moreover, quantity of return scrap from rolling mills is reduced due to the improvement of steel quality.

2-2. Limestone

P.T. Krakatau Steel has already a plan to construct a calcining plant. For this project also, it is necessary to produce burnt lime using domestic limestone. Chemical composition of limestone learned from P.T. Krakatau Steel was that of Bogor limestone showing CaO 54%, MgO 1%, SiO_2 0.5%, and ignition loss 43%.

2-3. Ferro-alloys

Similar to the present condition of P.T. Krakatau Steel and others, the second steel works will be forced to rely on imported ferro-alloys basically.

3. Prices of Raw Materials

Comment on prices of raw materials at the stage of pre-F/S is considered premature, but will be discussed just for reference with a view of foreseeing the future trend.

3-1. Iron ore

As discussed in the section 1-2, reflecting slow growth of crude steel production in future, prices of iron ore are expected to remain at the present level up to the end of this century. But the prices of DR grade pellet are expected to show a gradual rise in the 1990s and reach the level of 1974 and 1975 which was the highest in the past or a level higher than that in 1995 and after.

The market prices of iron ore are generally determined through negotiation between the representatives from both the largest buyers, Japan and Europe, and the largest suppliers, Australia and Brazil. This pattern will continue for some time and the prices thus determined need attention.

Shipping cost of iron ore has been volatile, showing much fluctuation, but it tends to lower these days. Seen from the cost in 1981, typical shipping cost in 1986 using 100,000-120,000 DWT class vessels is almost a half. Though the cost will fluctuate according to the market condition up to 1990, it is expected basically to approach the level of 1981 and then move in sliding scale with general price rise thereafter.

3-2. Scrap

Import price of scrap is governed by the factors shown below:

1) Demand/supply condition of scrap in the exporting countries (Especially USA which is the largest scrap exporter)
2) Market condition of primary products such as crude oil
3) Shipping market condition which determines ocean freight

Import of scrap by Indonesia is shown in Tables 5-3-1 and 5-3-2.

Table 5-3-1 Import Scrap in Indonesia

Year	Quantity (1,000t)	Amount (US$1,000)
1979	29.8	-
1980	39.0	-
1981	62.7	-
1982	226.9	35,976
1983	257.9	35,430
1984	243.1	34,694
1985	190.0	25,688

Source: The report of Step I Study mission

Table 5-3-2 Import Scrap in Indonesia

Year	1982	1983	1984	1985
Average unit price (US$/t)	159	137	143	135
Quantity of import (1,000t)				
Japan	7.1	1.1	0	0.9
China	8.3	0	3.9	0
Korea	17.5	19.7	31.8	8
Taiwan	26.5	18.4	26.9	18.7
N. Korea	3.4	2	0	0
Hong Kong	27.3	45.5	69.3	53.3
Singapore	7.8	14.7	33.2	30.1
Thailand	2.4	0	0	0
Malaysia	0	0.7	0	0.1
Australia	77.3	69.2	29.2	76.9
Papua New Guinea	0.7	0	0	0
W. Germany	14.5	2.2	0	0
Netherlands	0.1	0	0	0
U.K.	0	4	0	0
Canada	0.1	0	0	0
U.S.A.	34.0	80.5	48.9	2

Source: The report of Step I Study mission

According to the above table, some imports of scrap from neighboring countries are seen, but it is expected that the dependence on U.S.A., the largest supplier, will basically increase.

Trend of prices of imported scrap in Japan is shown in Table 5-3-3.

Table 5-3-3 Import Scrap in Japan

Year	Quantity (1,000t)	Amount (US$1,000)	Import from USA (1,000t)	Average Unit Price (US$/t)
1979	3,346	491,823	2,727	147
1980	2,986	497,226	2,581	167
1981	1,791	226,178	1,132	149
1982	2,025	262,858	1,365	130
1983	3,906	450,781	2,310	115
1984	4,018	528,507	2,484	132
1985	3,254	406,977	1,933	125
1986	3,224	375,186	1,635	116

Though it is difficult to forecast future prices, it is expected to be around US$110-120/ton.

Chapter VI. PROJECT LOCATIONS AND SITES

Chapter VI. PROJECT LOCATIONS AND SITES

1. Natural Condition

1-1. Outline

This section describes natural conditions of location, topographic, meteorological, oceanographic and soil conditions as well as seismic condition of areas around Cilegon and Arun areas proposed as site for the new steel works.

1-2. Location

1-2-1. Cilegon area

The site proposed for the new steel works is in Cilegon area in West Jawa Province and adjacent to the existing P.T. Krakatau Steel and faces the Sunda Strait. It is located about 105°59' E and 5°59' S. (Fig. 6-1-1)

1-2-2. Arun area

The proposed site is on the northeastern shore of D.I. Aceh, part of Lhokseumawe industrial zone, and neighbors on the west side of Asean Aceh Fertilizer plant and faces the Strait of Malacca. It is located about 97°01' E and 5°15' N. (Fig. 6-1-2)

1-3. Topographic condition

1-3-1. Cilegon area

The area has adequate water area even considering the existing ore berth of P.T. Krakatau Steel, a public berth under construction and the existing sea berth about 1 km off the power station. According to a hydrographical chart, the water area is generally shallower to the north (Merak side),

but the area used as a port for the new steel works is 8-10 meters deep 300 m off the shoreline and the sea bottom shows mild slope up to this point and then sharp drop. There are pasir brouwers with water depth of 5-6 m, 2.5-3.0 km off the shore, in parallel with the shoreline.

The proposed site is very flat land with M.S.L. +2.0 to +3.0 m. Around the site, there are structures such as railway, power transmission lines and roads.

1-3-2. Arun area

The area faces the Strait of Malacca, known of severe oceanographic condition, and without proper shelter, there tends to occur a large amount of drift sand. The sea bottom slope is, according to the chart, mild reaching depth of 10 m or more about 1.0-1.2 km from the shoreline.

The proposed site is very flat land with almost no up and down difference and its ground elevation is M.S.L. +2.0 to +2.5 m. But along the shoreline, there are fishponds and their bottoms are assumed to be very soft.

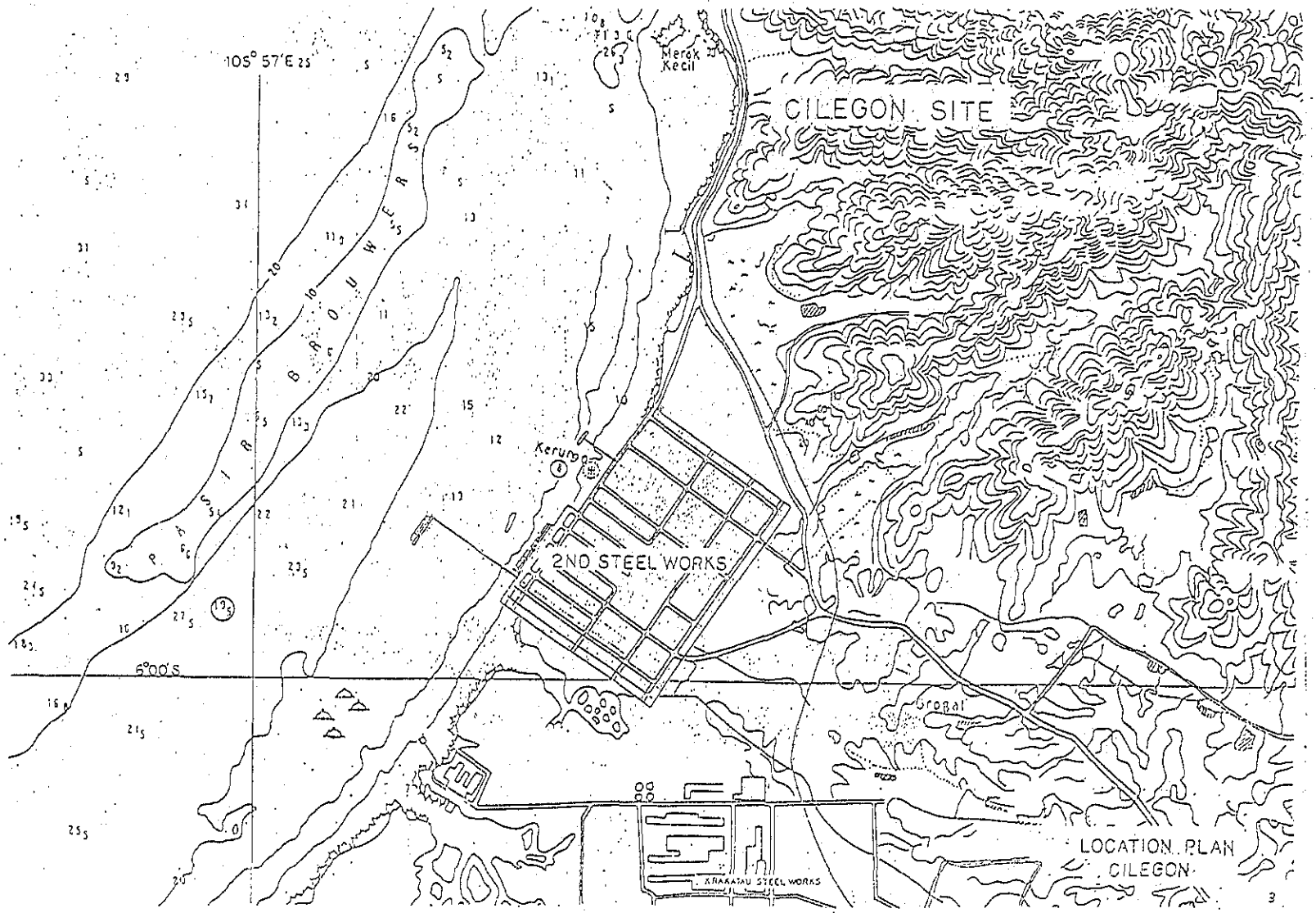


Fig. 6-1-1 Location Plan Cilegon

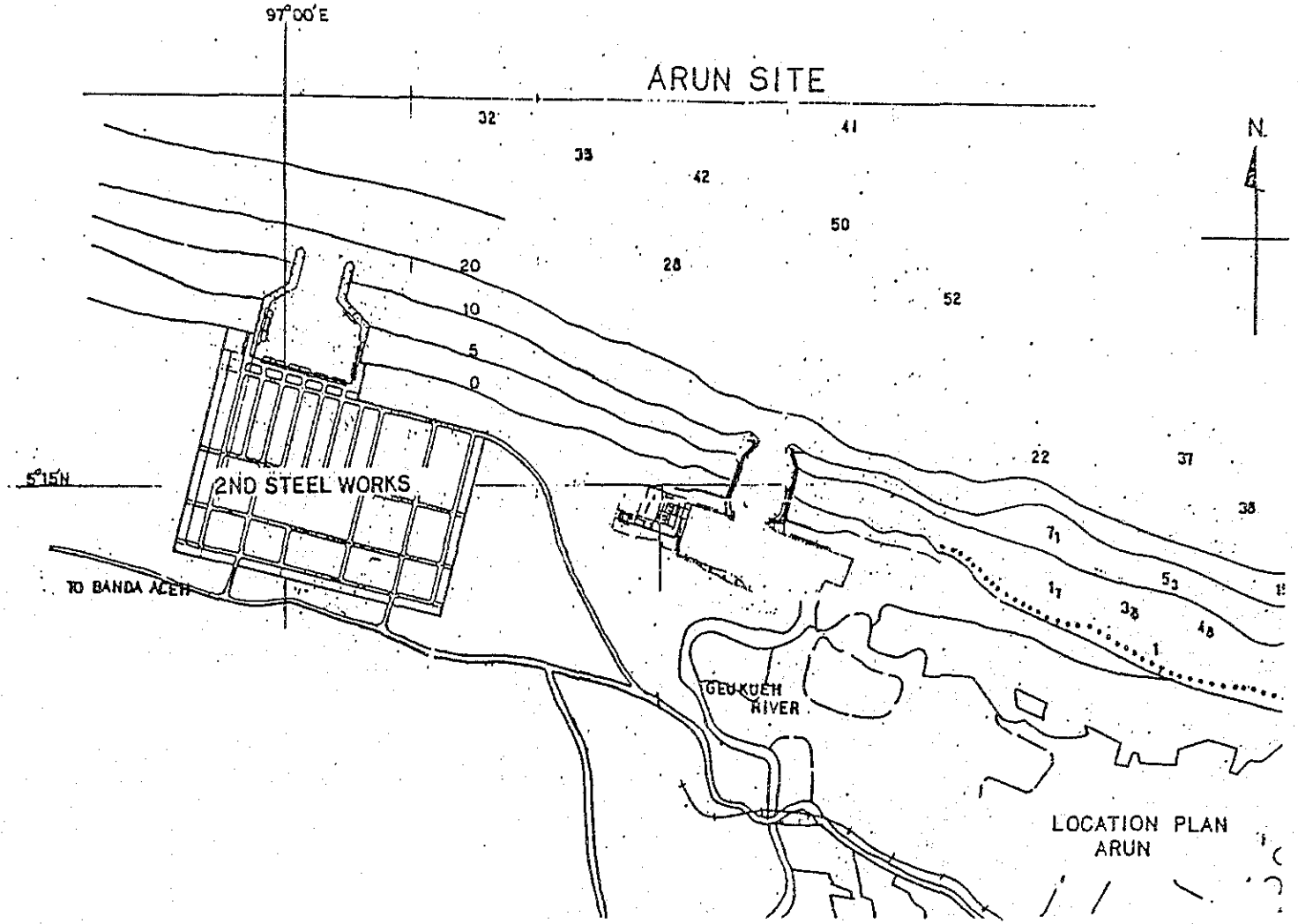


Fig. 6-1-2 Location Plan Arun

1-4. Meteorological condition

There are no meteorological data of both Cilegon and Arun areas, but the statistics of observation at Serang and Cot. Gierek are given below as reference data for Cilegon and Arun, respectively.

Table 6-1-1 Meteorological and Oceanographic Condition

Area: / Items	CILEGON	ARUN
	Observation statistics at Serang, 1975-1984	Observation statistics at Cot Gierek, 1975-79
(1) Temperature		
Annual av.	26.7°C	25.8°C
Monthly av. highest	33.7°C (Oct.)	33.4°C (May)
lowest	21.5°C (Jul./ Aug.)	21.2°C (Jan.)
(2) Humidity		
Annual av.	70%	87%
(3) Rainfall		
Annual av.	1635 mm	2259 mm
Monthly av. highest	321 mm (Jun.)	306 mm (Nov.)
lowest	62 mm (Jan.)	60 mm (Jan.)
Rainy season	Dec. - Mar.	Apr. - Dec.
Dry season	Apr. - Nov.	Jan. - Mar.
(4) Wind direction & velocity	Mar.-Nov. Dec.-Feb.	Mar.-Nov. Dec.-Feb.
Prevailing wind	N W or N	SW NE-SW
Velocity (knot)	3.8-4.4 4.1-4.3	2.0-4.5 3.0-4.0

1-5. Oceanographic condition

1-5-1 Cilegon area

At Sunda Strait seasonal SE wind begins to blow in April and continues to around October with the strongest wind in August and September. From around December it changes to NW seasonal wind and reportedly is most apparent in January and February. Aside from the seasonal wind, sea and land breeze tends to develop well at the coast area and when wind direction of the breeze coincides with that of the seasonal wind, wind velocity at the coast area is increased. In this sea area average height of deepwater wave through the year is about 0.6 m and wave of average height exceeding 2 m is said to occur rarely.

In Cigading area adjacent to the proposed site, P.T. Krakatau Steel has operated 60,000 DWT vessel port facilities already for more than 10 years. According to the port administrator, height of waves inside the harbor is mainly 0.3 m to 1.5 m. During the seasonal NW wind period from December to March, swell from the Indonesian Ocean at times enters the harbor and hinders loading and unloading operation.

Fig. 6-1-3 shows tide levels at Merak port about 7 km northeast of the site. The tide is in almost half day cycle and spring range is about 0.6 m and neap range as small as about 0.1 m.

Within Sunda Strait marine current of prevailingly south-westerly prevails throughout the year, but tidal current is mainly in daily cycle and in the direction to northeast and southwest. It is said that the marine current and tidal current coincide in their direction. A study at P.T. Krakatau Steel's Cigading port tells that the tidal current in the port is almost in parallel with the shoreline and its velocity is normally 0.7 knot and

about 1.2 knots at max.

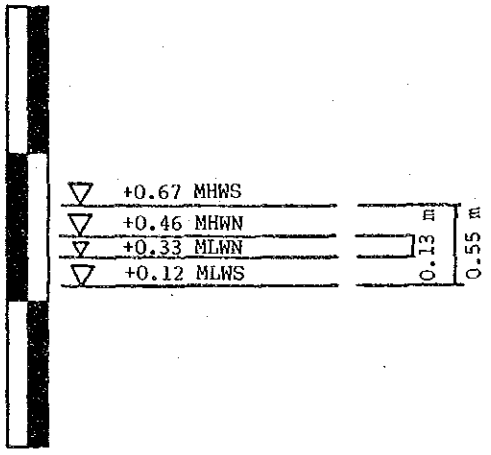


Fig. 6-1-3 Typical Tide Levels (Merak Port)

1-5-2 Arun area

At the north part of Strait of Malacca, wind direction is comparatively unstable throughout the year, but it is said that the area close to the shoreline is under the influence of sea and land wind.

In this sea area annual average height of deep water wave is about 0.5 m and frequency of wave with average height exceeding 2 m is extremely low. However, it is said that long swell from the direction of Bay of Bengal enters to this sea area frequently. In planning a harbor in the area, it is imperative to give full consideration to such swell.

As shown in Fig. 6-1-2, in the vicinity of the proposed site there are already an LNG shipping port (P.T. Arun) and exclusive fertilizer shipping ports (P.T. Asean Aceh Fertilizer and P.T. Pupuk Iskandar Muda). Wave designs used in planning and designing those port facilities are given below:

Exclusive port for LNG:

100 years storm wave	H1/3=4.27 m T=11 sec
Operational wave	H1/3=1.30 m T=10 sec

Exclusive port for fertilizer:

20 years cyclone wave	H_0=3.5 m T=8 sec
NE monsoon wave	H_0=3.3 m T=8 sec
50 years cyclone wave	H_0=3.9 m T=9 sec
NE monsoon wave	H_0=3.4 m T=8 sec

Fig. 6-1-4 shows tide levels around the proposed site. Spring range is about 1.7 m. According to a study by P.T. Arun, it is said the highest astronomical tide is about +2.4 m.

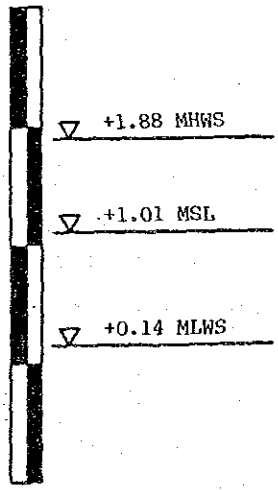


Fig. 6-1-4 Typical Tide Levels (Lhokseumawe)

1-6. Soil condition

1-6-1. Cilegon area

No soil data are available for the proposed site. But it is said that when deciding the site for neighboring P.T. Krakatau Steel, the land of poor soil condition along the shoreline was avoided and inland area about 6 km from the shoreline was selected. From this it can be assumed that ground of marshland along the shoreline is very soft. The proposed site, however, is located at some distance from the above marshland and it is assumed that compared with the ground of marshland, it has more or less better ground. But it is assumed from the soil data of P.T. Krakatau Steel that subsurface ground of the proposed site has soft bed in depth of 15 ∿ 20 m and supporting bed appears in depth of 15 m or more from the ground level.

An example of geologic columns at P.T. krakatau Steel is shown for reference in Fig. 6-1-5.

1-6-2. Arun area

Though no soil data are available for the proposed site, an example of soil test results at Asean Aceh Fertilizer plant neighboring the site is shown for reference in Fig. 6-1-6. In view of the condition of surroundings, soil condition of the site is assumed to be similar to that of Asean Aceh Fertilizer plant.

From Fig. 6-1-6, it may be assumed that the ground of the site has such ground that silt/sand layer with N value of 10 or so exists under loose fine sand layer at surface and pile support bed appears in depth of M.S.L. -15 m or so.

1-7. Seismic condition

According to Indonesian Earthquake Study "Seismic Zoning", both Cilegon and Arun areas belong to Zone 3-4. (Fig. 6-1-7)

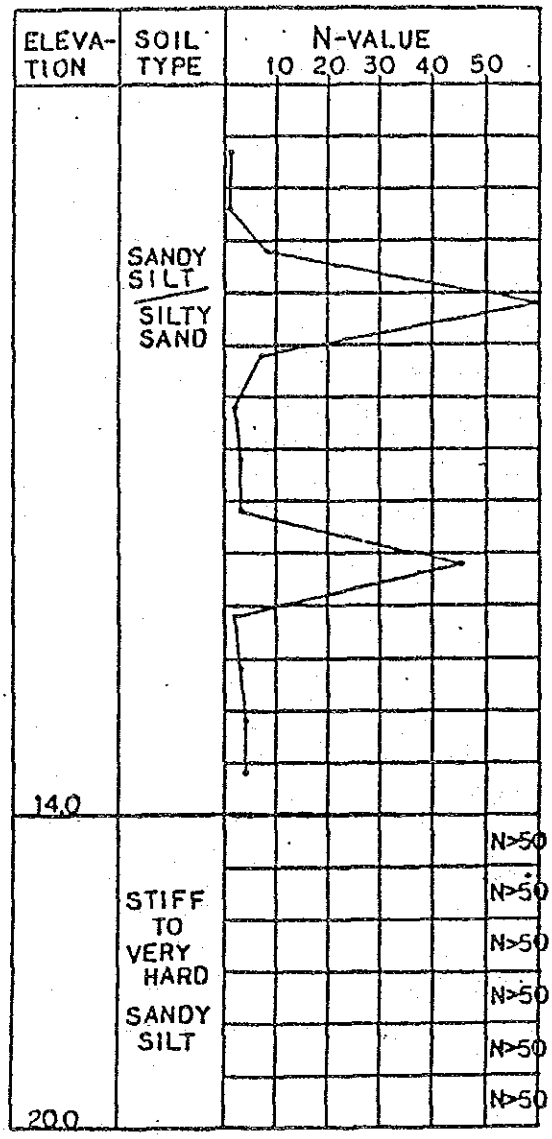


Fig. 6-1-5 Soil Profile Cilegon

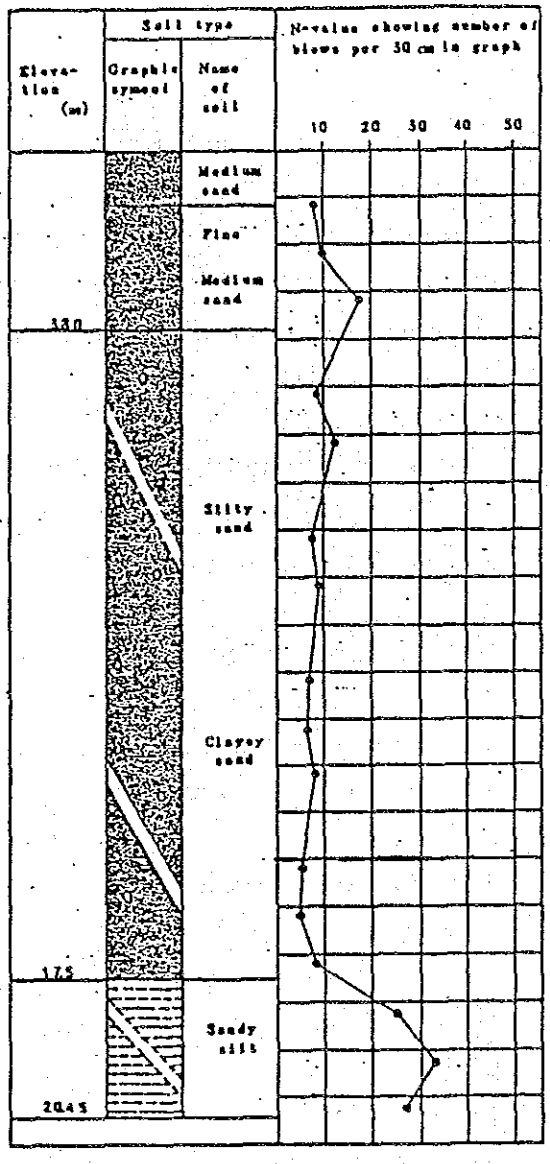
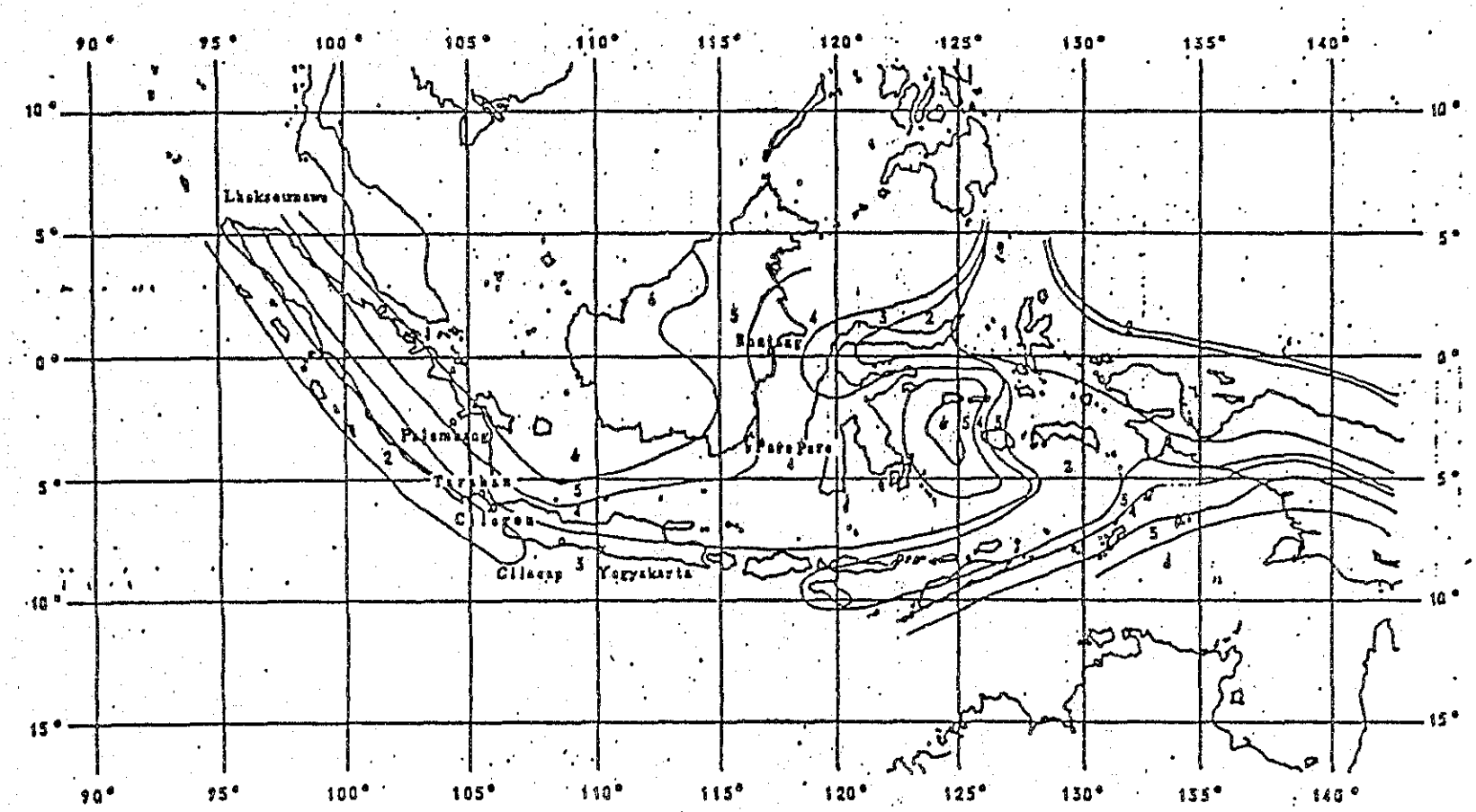


Fig. 6-1-6 Soil Profile Arun



Source: "Standard Design Criteria for Port in Indonesia" reported in MASTER PLAN & FEASIBILITY STUDY "PROT OF PAREPARE" by SOFREMER, France.

Soil Type \ Zone	1	2	3	4	5	6
Stiff Soil	0.09g	0.07g	0.05g	0.03g	0.01g	0
Soft Soil	0.12g	0.09g	0.07g	0.05g	0.03g	0

Fig. 6-1-7 Classification of Seismicity by Regional Areas in Indonesia

2. Socio-Economic Condition

2-1. Population and man power

2-1-1 Population

Population of Indonesia reached 165 million in 1985, ranking the fifth largest in the world.

The country is an island nation consisting of more than 13,600 islands, and density of population varies considerably among islands. Namely, 100 million people of 61% of the population live in Jawa Island, area of which accounts for only 6.9% of the total area, with density of population being 759 persons per km² while density of population in islands with large area such as Kalimantan and Sumatera is far less than in Jawa Island. In order to solve the problem of unbalanced distribution of population, the Government established in 1978 Transmigration Coordinating Board to promote transmigration from Jawa to other islands and also promote family planning to cope with overpopulation.

Table 6-2-1 Population of Indonesia by Province (1985)

	Population		Area		Density
	million	%	km²	%	Person/km²
Sumatera	32.92	19.9	473,606	24.7	70
Jawa	100.28	60.7	132,187	6.9	759
Nusa Tenggara	9.41	5.7	88,488	4.6	106
Kalimantan	7.84	4.8	539,460	28.1	15
Sulawesi	11.69	7.1	189,216	9.8	62
Irian Jawa	3.01	1.8	496,486	25.9	6
Total	165.15	100.0	1,919,443	100.0	86

Source: Statistical Year Book of Indonesia 1985

2-1-2 Labor force

According to a publication of the Central Bureau of Statistics, labor force in Indonesia in 1982 was 59.6 million persons (of which 57.8 million was the employed and 1.8 million the unemployed) and under the fourth 5-year development plan (REPELITA IV) it is forecasted to increase to 63.50 million in 1983 and 72.80 million in 1988, with an annual growth rate of 2.8%. To provide employment opportunity to 9.3 million persons who come into labor market during the five years is made one of important subjects of the Government.

Table 6-2-2 Labor Force in Indonesia by Province (1982)
(Population of ages of 10 and over)

(Unit: million)

	Employed	Unemployed	Total
Jawa	37.27	1.30	38.57
Sumatera	10.35	0.28	10.63
Sulawesi	3.34	0.11	3.45
Kalimantan	2.76	0.06	2.82
Others	4.08	0.05	4.13
Total	57.80	1.80	59.60

Source: Statistical Year Book of Indonesia (1985)

2-1-3 Employment

(1) Employment by industry

Population of ages of 10 and over who worked during the previous week (which will be termed simply "employment" in this section) by industry is as shown in Table 6-2-3. In 1982, employment in agriculture, forestry, hunting and fishery was 31.59 million, accounting for 55% of the total, followed by wholesale retail trade and restaurants being 15.0%, public services 12% and manufacturing industry 10% ranking the fourth.

Table 6-2-3 Employment by Industry in Indonesia

(Unit: 1,000)

	1977		1982	
	Person	%	Person	%
Agriculture, forestry, hunting & fishery	29,694	61.5	31,593	54.7
Mining & quarrying	171	0.4	391	0.7
Manufacturing industry	4,171	8.6	6,022	10.4
Electricity, gas & water	32	0.1	62	0.1
Construction	838	1.7	2,146	3.7
Wholesale & retail trade, restaurants	4,776	9.9	8,554	14.8
Transportation, storage & communication	1,421	2.9	1,796	3.1
Finance, insurance real estate & business services	85	0.2	113	0.2
Public services	5,094	10.5	7,125	12.3
Others	2,033	4.2	---	--
Total	48,315	100.0	57,803	100.0

Source: Statistical Year Book of Indonesia, 1983, 1985

Breakdown of the figure by province in 1982 is as shown in Table 6-2-4.

Table 6-2-4 Employment by Industry and Province (1982)

(Unit: 1,000)

	Jawa	Sumatera	Sulawesi	Kali-mantan	Others	Total
Agriculture, forestry, hunting & fishery	18,048	6,957	2,030	1,810	2,748	31,593
Mining & quarrying	235	83	12	27	34	391
Manufacturing industry	4,535	619	310	242	316	6,022
Electricity, gas & water	42	12	3	2	3	62
Construction	1,538	285	100	91	132	2,146
Wholesale & retail trade, restaurants	6,418	1,145	341	240	410	8,554
Transportation, storage & communication	1,291	263	107	68	67	1,796
Finance, insurance, real estate & business services	89	14	4	2	4	113
Public services	5,074	977	432	275	367	7,125
Others	---	1	---	---	---	---
Total	37,270	10,356	3,339	2,757	4,081	57,803

Source: Statistical Year Book of Indonesia, 1983, 1985

1) Jawa

Employment is 37.27 million and agriculture, forestry, hunting and fishery account for 48%, ranking the first, followed by wholesale, retail trade and restaurants 17%, public services 14.0% and manufacturing industry 12%.

2) Sumatera

Employment is 10.36 million and more than two-thirds, 67% is accounted for by agriculture forestry, hunting and fishery, followed by 11% of wholesale, retail trade and restaurants, 9% of public services and 6% of manufacturing industry which is very low and about one half of the national average (10.4%).

3) Sulawesi

Employment is 3.34 million and 61% is accounted for by agriculture forestry, hunting and fishery, followed by 13% of public services, 10% of wholesale, retail trade and restaurants and 9% of manufacturing industry.

4) Kalimantan

Employment is 2.75 million and 65% is accounted for by agriculture forestry, hunting and fishery, followed by 10% of public services, 9% of wholesale, retail trade and restaurants and manufacturing industry respectively, similar to Sumatera.

(2) Employment by occupation

Employment by occupation is as shown in Table 6-2-5. In 1982, farmers and agricultural workers accounted for 55% of the total employment, ranking the first, and production, transport equipment operators and related workers was the second with 20% and sales workers the third with 14%. Compared with 1977, the 1982 figures shows that while share of farmers and agricultural workers decreased, that of production, transport equipment operators and related workers increased.

Table 6-2-5 Employment by Occupation

Year / Main occupation	1977		1982	
	000	%	000	%
Professinal, technical and related workers	1,111	2.3	1,711	3.0
Managers and administrators	76	0.2	39	0.1
Clerical and related workers	1,421	2.9	2,053	3.5
Sales workers	6,692	13.9	8,302	14.3
Service workers	2,456	5.1	2,312	4.0
Farmers & agricultural workers	29,586	61.2	31,574	54.6
Production, transport equipment operators and related workers	6,938	14.3	11,595	20.1
Others	35	0.1	207	0.4
Total	48,315	100.0	57,803	100.0

Source: Statistical Year Book of Indonesia 1983, 1985

Breakdown of the 1982 figure by province is as shown in Table 6-2-6.

Table 6-2-6 Employment by Occupation and by Province (1982)

(Unit: 1,000)

Province/Islands / Main Occupation	Jawa	Sumatera	Sulawesi	Kali-mantan	Others	Total
Professional, technical and related workers	1,100	283	137	69	121	1,711
Managers and administ-rators	26	6	2	1	4	39
Clerical and related workers	1,349	327	151	100	126	2,053
Sales workers	6,240	1,112	325	233	392	8,303
Service workers	1,841	247	69	72	83	2,313
Farmers & agricultural workers	18,036	6,955	2,029	1,809	2,746	31,574
Production, transport equipment operators and related workers	8,526	1,340	612	457	600	11,595
Others	151	27	12	15	9	214
Total	37,270	10,356	3,339	2,757	4,080	57,803

Source: Statistical Year Book of Indonesia 1985

2-1-4. Wages

(1) Wage level

There are few reliable data on wages in Indonesia and also there are considerable differentials in wage levels among different regions, between urban and rural districts, among foreign affiliates, Chinese companies and national companies, as well as between large and small enterprises. Therefore, the wage level cannot be generalized.

There are no national laws pertaining to minimum wages, but provincial governments set up the minimum wages for all or specific industries. Though they are not enforceable legally, they provide some standards for wages.

Table 6-2-7 The minimum wages by regions in 1983

(Unit: Rp)

Region	Daily	Monthly
Aceh	1,533	39,858
Sumatera Utara	850	22,100
Sumatera Barat	900	23,400
Riau	1,500	39,000
Jambi	1,000	26,000
Sumatera Selatan	1,300	33,800
Bengkulu	1,000	26,000
Lampung	922	23,972
DKI. Jakarta	1,050	27,300
Jawa Barat	1,260	37,260
Jawa Tengah	498	12,948
D.I. Yogyakarta	590	15,340
Jawa Timur	517	13,442
Nusa Tenggara Barat	815	21,190
Nusa Tenggara Timur	906	23,556
Maluku	975	25,350
Sulawesi Utara	1,350	35,100
Sulawesi Selatan	888	23,088
Sulawesi Tengah	775	20,150
Sulawesi Tenggara	600	15,600
Kalimantan Barat	600	15,600
Kalimantan Timur	900	23,400
Kalimantan Selatan	750	19,500

Source: Berita Pasar Kerja, April 1984

Apart from agricultural labor, wages by industry show that wages of tobacco, leather and food processing, labor-intensive industry in countryside, are at low level and so are wages at sundries, wood products, fibers, metals, etc. On the other hand, wages at exploitation of resources, oil in particular, electric machinery, machinery and automobiles are at much higher levels.

The details of wage level of the steel industry are not available, but the average of all employees ranges from Rp. 75,000 to 150,000 a month, and on the average it is about Rp.100,000 a month.

Table 6-2-8 The minimum wages by industry

(Unit: Rp monthly)

Industry \ Year	1979	1980	1981	1982	1983
Agriculture	14,919	17,606	21,877	25,191	26,074
Mining	46,826	60,069	64,510	86,188	71,894
Manufacturing	36,255	42,137	46,299	55,045	64,400
Construction	26,381	29,105	29,893	34,125	26,250
Energy	20,494	21,050	27,279	32,609	52,204
Commerce, bank, finance insurance	34,681	42,112	53,245	62,474	64,730
Transportation	36,116	41,972	50,517	58,194	67,881
Service	30,977	33,270	39,391	50,042	54,800
Others	16,280	26,500	32,400	32,400	32,400

Source: Ministry of Labor

(2) Characteristics of wages

Matters characteristic of Indonesian wages are as given below.

1) Usually wages consist of two components, namely cash wages and wages in kind, but recently the latter is decreasing.
2) Weight of various types of allowance is very high. (Such as medical allowance, transportation allowance, meal allowance, diligence allowance, etc.) But the government is recently providing guidance to unify wages to those based on the basic wages.
3) Wage differential among school careers is big. Also the differential is very large between simple, unskilled labor and technical and clerical labor.
4) There is a large differential between the highest and the lowest wages.
5) The differential is fairly large among different industries and regions.
6) The principle is same wages for same labor and equal for male and female employees.
7) The method of payment varies in monthly, daily or weekly.