Port and the average shipment size would be 100,000 tons/ship, the number of ship calls will work out to be 86 in the year 2006 and 148 in the year of 2011.

It is assumed that the number of workable days per year would be 320 days, allowing for maintenance and weather constraints, and the average working time in a day would be 20 hours.

Installing two (2) sets of 2,000-ton unloader per berth, the mineral bulk berth requirement in 2006 and 2011 could be estimated as follows:

$$\frac{8,580,000 \text{ tons}}{320x2x20x2,000x0.5} = 0.67 \text{ berth}$$

$$\frac{14,780,000 \text{ tons}}{320x2x20x2,000x0.5} = 1.15 \text{ berths}$$

As calculated above, if two (2) sets of 2,000 tons/hour unloader are installed, one berth could be enough to handle the target throughputs up to the year 2006, but requiring one more berth in 2011. If the ship size as well as the unloader capacity vary, the berth requirement will be modified.

Assuming that one Cape-Size berth is constructed off the existing Prachuap Port, a about 1.2 km long trestle would be required to link between the mineral cargo berth and the shore conveyor system as shown in Figure E.2.4.

Unlike the planning of general cargo berth, more specific planning parameters would be quite essential for the port development of mineral bulk berth. Once these data have become available, more detailed study will be undertaken.

E.2.5 Conceptual Plan of Major Port Facilities

The major port facilities required in the future port development will include breakwaters, general cargo berths, mineral bulk berths, Ro/Ro berths and commercial dock. It is expected that the breakwater expansion will be executed following the same design concept as applied in the existing port development, which is rubble-mound breakwater armoured with the precast concrete blocks "Accropode" (see Figure E.2.5).

The general cargo berths will consist of two types of structure, one with a detached wharf that is now used in the existing port and another with a marginal wharf that will be developed along the waterfront of newly reclaimed land. It is expected that the offshore berth located in the lee of the expanded breakwater will follow the same berth structure as used in the existing port. On the other hand, the marginal wharf will be developed with a

gravity type structure due to the existence of rocky subsoil underlying in the proposed berth area.

Both Ro/Ro berth as well as a commercial dock will be constructed, making full use of steel sheet-pile structure, supplemented by concrete block structures.

Most of reclamation fill will come from the dredging materials in the newly expanded port basin and navigation channel.

The typical cross sections of breakwater and berth facilities proposed for the expansion of Prachuap Port are illustrated in the next page, though, the final selection of the berth structure should be subject to the detailed soil investigation and berth usage plan prepared in due course.

The mineral bulk berth will consist of a offshore pier and a trestle equipped with belt conveyor system on top. A typical plan of the offshore mineral bulk berth and trestle structure are illustrated in Figures E.2.5 ~ E.2.8.

E.2.6 Implementation Programs of Phasewise Port Development

As the investment cost of port development is so large and the port demand in Prachuap, particularly industrial estate related general cargo, will have some uncertainty, it is proposed to develop Prachuap Port in a phasewise manner. As discussed earlier in this report, Phase I Development will be implemented, aiming at the year 2001, Phase II Development at 2011.

In line with this development policy, the cargo demand in Prachuap Port could be summarized as follows:

Phasewise Port Demand

	Phase I (2001)	Phase II (2011)
Cargo Demand (x 1000 tons)	6,300	8,000
Berth Demand (m)	1,200	1,740

To meet the above phasewise port demands, the implementation plan of Prachuap Port Development has been drawn up in Figure E.2.9.

E.2.7 Port Development Cost

(1) General Cargo Berth Zone

On the basis of the proposed port development plan (Alternative Plan C), preliminary cost estimate has been made in this section. The construction cost of port development will comprise the following:

Construction Cost of General Cargo Berth Zone

(Baht million)

Phase 1	2,016	Breakwater, berth, dredging, etc.
Phase 2	1,044	- ditto -
Total	3,420	(US$ 137 million)

(2) Mineral Cargo Berth Zone

The unloading of mineral bulk cargo will require a 140,000 DWT bulk berth along with two (2) sets of 2,000 tons/hour unloader as well as a 1.2 km conveyor system mounted on the pile-supported trestle structure.

The outline cost for these port facilities could be estimated as follows:

Construction Cost of Bulk Cargo Port

(Baht million)

Phase 1	1,445	Offshore berth, unloader, etc.
Phase 2	1,230	- ditto -
Total	2,675	(US$ 107 million)

E.2.8 Implementation Program of Port Development

Prachuap Port is being operated by Prachuap Port Co., Ltd., which is a private enterprise specializing in port management and operation. It has a head office in Bangkok and site operation office in Prachuap.

Sahaviriya Group developed the existing port and wishes to undertake further port development by itself. Historical background could well explain this stand, though, there will be a possibility that further investment for the port expansion might be shared by other investor groups, including the government body.

The development of Prachuap Port was primarily aimed at the shipment of seaborne cargoes relevant to the operation of the Sahaviriya Industrial Complex. Nevertheless, a substantial amount of non-Sahaviriya cargoes has, since its inauguration, been shipped in and out through the Port, and in future the throughput of this commercial cargo is likely to grow up.

As widely expected, the role of the Port will gradually be diversified making full use of its geographical advantage. In view of the domestic sea traffic network in Thailand, the functional role of the Port could become much more important.

In this sense, the potential role of Prachuap Port should be more intensively reviewed, referring to the future investment program. The possible scenarios of further development of Prachuap Port would include following:

(1) Prachuap Port Co., Ltd., under the financial support of the Sahaviriya Group will invest in all the port development expected in the coming stage, and will singlely operate the port as it is.

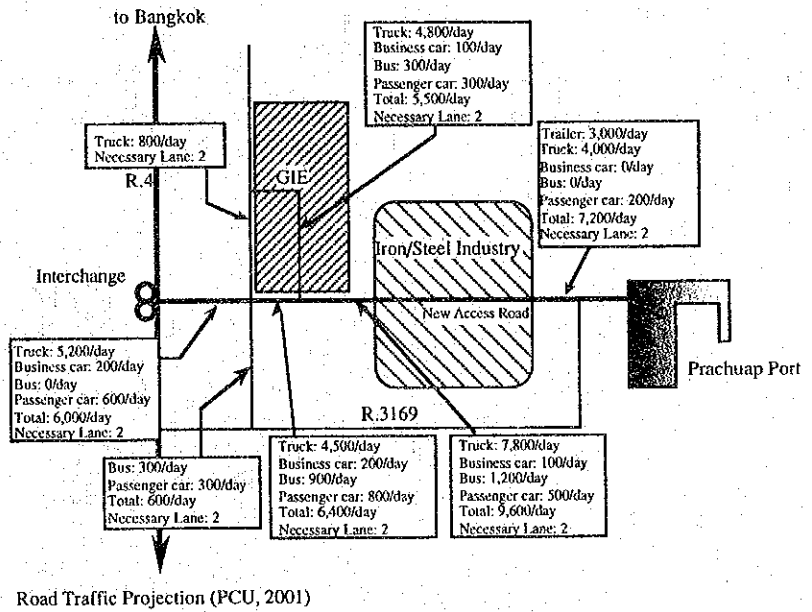
(2) IEAT or other government body will participate in the future port development, particularly in the development of the common-use port zone. In return, they will receive adequate investment returns in proportion to their participation. IEAT-financed port facilities may be leased to Prachuap Port, who will virtually take care of terminal operation on behalf of the government body.

(3) The extent of IEAT's involvement would have some latitude, either part of the future development or all of the future development. If IEAT's participation is limited, high priority would be given to the common port area such as breakwater expansion and dredging works for the future navigation zone, all of them requiring a huge amount of investment. This kind of IEAT's involvement will ease the financial burden on Prachuap Port Co., Ltd., and allowing financially sound port operation for Prachuap Port Company.

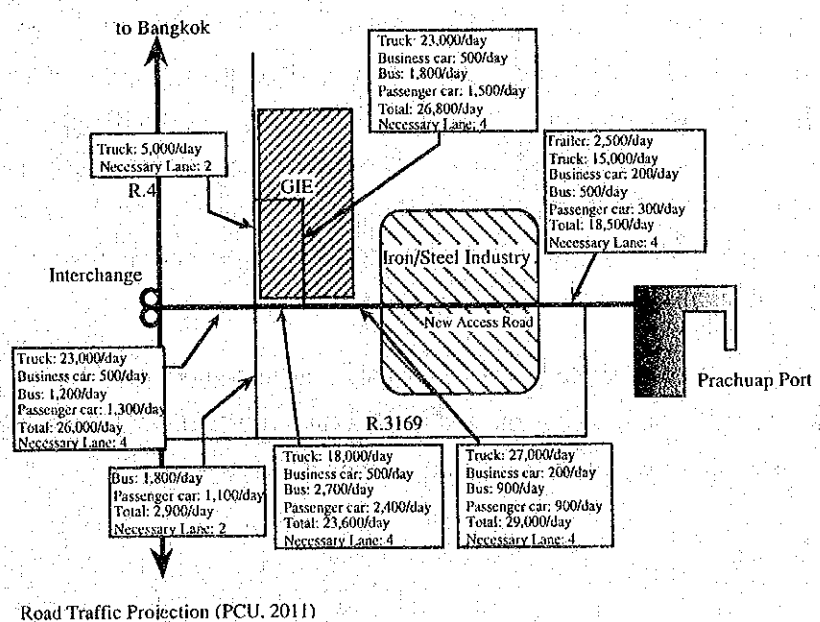
Aside from the port development itself, it is proposed that the port operation should be maintained by one operator, most recommendably by Prachuap Port Co., Ltd. as a sole operator who knows the locality very well and surely ensure efficient port operation.

E.3 Road

A new access road connecting Route 4 with the iron/steel industry and Prachuap Port is the urgent project to be developed considering that the heavy traffic to/from the industrial area and port has drastically been increasing and damaging the local community road in Amphoe Bang Saphan. Traffic on the new access road is estimated at approximately 10,000 PCU and 30,000 PCU per day in 2001 and 2011 respectively as illustrated below.



Road Traffic Projection (PCU, 2001)

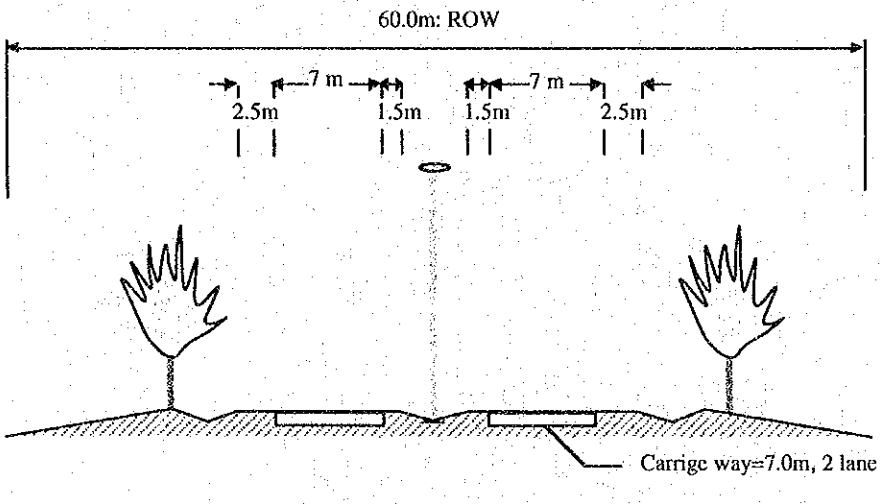


Road Traffic Projection (PCU, 2011)

Traffic Demand and Necessary Lane for Access Road

The section of the access road is proposed to have ultimately 4 lanes and a length of approximately 16 km as shown below, paying due attention to the pavement design considering the heavy vehicle traffic generated from the port and iron/steel factories located in Bang Saphan. In the preliminary development phase, a 2-lane carriage way would be sufficient. At the congested point such as the junction with the other trunk road, an additional lane will be necessary to direct the through traffic smoothly and safely.

Access Road between R.4 and Port : 4 lanes
Right of Way : 60.0 meters (in 2011)



Improvement and upgrading of the local community road in Amphoe Bang Saphan should be done to cope with the increasing traffic generated in line with the development of the manufacturing industry. The improvement and upgrading of existing Route 3169, major access to Route 4 from the Bang Saphan town, will be contributive as a countermeasure against social environmental degradation. Design for improvement of Route 3169 will be done in 1996 by DOH and construction will be commenced as quickly as possible after termination of detailed design. Improvement of the provincial road of 5.2 km long surrounding the industrial estate is also recommendable.

An interchange is recommended to be constructed at the junction of Route 4 and the new access road. At the entrance of the industrial estate, traffic signal control is inevitable in order to regulate the heavy traffic flow into the new access road.

E.4 Electricity

E.4.1 Organization of Power Sector

The electric power supply system in Thailand is organized by three state-owned enterprises.

The Electricity Generating Authority of Thailand (EGAT) is responsible for power generation and transmission to a primary substation, while the Metropolitan Electricity Authority (MEA) is responsible for power distribution from a primary substation to the Bangkok area and the Provincial Electricity Authority (PEA) is for power distribution to all provinces of Thailand except for the Bangkok area.

EGAT has been entrusted with the selling of electric power to MEA and PEA.

E.4.2 Existing Power Facilities

(1) Generating Facilities

The power network of EGAT is illustrated in Figure E.4.1. The power network is mainly concentrated at the bottom of the Gulf and the surrounding area of Bangkok city where power demand is heaviest. Future power network expansion is planned based on the regional load growth and generation of electricity, in order to optimally sustain the rated voltage and frequency and reduce the frequency of failures.

As of September 1994, EGAT has been operating 136 generating stations with a total capacity of 12,988.9 MW. The generating facilities comprised thermal plants of 6,101.5 MW (47%), combined cycle plants of 4,099.6 MW (31%), hydropower plants of 2,577.8 MW (20%), and gas turbine plants of 210 MW (2%).

Peak power generation in the fiscal 1994 was 10,708.8 MW and occurred on the 23rd of September 1994, representing the peak demand growth of 10.1% against the previous year.

Gross energy generation in 1994 reached 69,561 GWh, up 12% over the previous year.

(2) Transmission lines and substations

The nationwide generating facilities of EGAT are linked through an integrated high voltage transmission network which comprises substations and transmission lines of different voltages from 69, 115, 230 kV to 500 kV with the frequency of 50 hz.

The transmission network in 1994 comprised 1,201 km of 500 kV lines, 8,709 km of 230 kV lines, 11,052 km of 115 kV lines, and 240 km of 69 kV lines. There were 3 substations of 500 kV, 42 substations of 230 kV, 122 substations of 115 kV and 8 substations of 69 kV, with a total installed capacity of transformers of 29,613 MVA.

(3) Distribution lines of PEA

PEA has responsibility for acquisition, distribution and sales of electricity to the general public, commercial and industrial consumers in 70 provinces, accounting for 99% of the total area of the country.

The total installed capacity of transformers and distance of high voltage distribution lines in 1994 are summarized below.

Voltage Level (kV)	Tr. Capa. (MVA)	Distance of D/L (km)
3.5	7.7	119
22	19,051.9	157,950
33	3,057.2	30,557
69	80.0	36
115	5,926.0	584
Total	28,122.8	189,246

(4) Electricity Tariff

A common electricity tariff is applied to the respective regions of PEA. However, monthly demand charge and energy charge vary with energy consumption, maximum demand, use, distribution voltage level, and time of day. The tariff system is classified into seven categories.

Factories in the proposed industrial estate will come under the category of medium general service or large general service at a voltage of 11 - 33 kV, according to their power demand forecast. An extract from the PEA's tariff schedules issued in December 1991 is shown in Table E.4. 1.

(5) Existing Power Supply System in Bang Saphan Area

There is a 230/115 kV Bang Saphan substation of EGAT, with a capacity of 400 MVA (200 MVA x 2 units), connected with the 230 kV integrated grid. The Bang Saphan substation, located 22 km (approx.) to the northwest of the proposed

industrial estate area, supplies power to Sahaviriya Steel Industries Public Co. (SSIC) and another substation serves the local communities through a 115 kV single circuit distribution line operated by PEA. The peak demand in 1994 was 80 MW (2:00 p.m.) for SSIC and 10 MW (7:00 p.m.) for the communities. A new 115 kV distribution line which connects the Bang Saphan substation with new factories (72 MW in total demand.) near SSIC is under construction by PEA and will be completed by 1996.

E.4.3 Power Development Plan of EGAT

(1) Power Demand Forecast

The power demand forecasts are performed by the Thailand Load Forecast Subcommittee (TLFS), which is set up under the Energy Policy Formulation Committee. In June 1994, TLFS issued a new power demand forecast as tabulated below, called as the 1994 TLFS Forecast, which was revised from the 1993 forecast.

The average growth rate of peak power demand in the period of 1992-1996 (the 7th Plan) was 10.09%, and it is forecast to decline to 7.90%, 5.92% and 5.74% in the period of 1997 - 2001 (the 8th Plan), 2002 - 2006 (the 9th Plan), and 2007 - 2011 (the 10th Plan) respectively. The trend of decreasing growth rate reflects the trend of GDP forecast. The power development plan of EGAT is prepared on the TLFS demand forecast and the results of economic analysis.

Power Demand Forecast (1994 TLFS Forecast)

Fiscal Year	Peak Generation (MW)	Energy Generation (GWh)	Load Factor (%)
1991 (Actual)	8,045.00	49,225.03	69.85
1992 (Actual)	8,876.90	56,006.44	72.02
1996	13,009.00	85,571.00	75.09
1997	14,193.00	92,879.00	74.70
2001	19,029.00	126,025.00	75.60
2002	20,237.00	134,041.00	75.61
2006	25,371.00	171,745.00	77.28
2007	26,835.00	181,745.00	77.31
2011	33,532.00	228,445.00	77.77

Source: General Information of EGAT Power Development Plan (PDP 95-01), April 1995

(2) Power Development Plan of EGAT

EGAT has a plan to develop an additional power generation capacity of 33,676 MW under the long term plan (1995-2011), which includes 4,576 MW currently under construction, 9,600 MW during the 7th plan period (1992-1996), 7,500 MW during the 8th plan period (1997-2001), and 12,000 MW during the 9th to 10th plan period (2002-2011).

Under the 7th plan of EGAT power development (PDP 95-01), a new thermal power plant with a capacity of 1,400 MW is planned in the western region of Thailand. The power station will be constructed, owned and operated by an Independent Power Producer (IPP). On June 30, 1995, the final day for bid submission, 32 bidders submitted a total of 50 proposals. All proposals are being evaluated by the government-appointed Subcommittee.

To support IPP power plant projects, EGAT will construct a new 500 kV double circuit transmission line linking the Bang Saphan area and Sai Noi to reinforce the system. The expected commissioning year of the IPP power plant and 500 kV transmission lines is 2003 and 2001 respectively.

A new 500 kV substation connected with the national 500 kV power grid will be constructed near the existing Bang Saphan substation, and will be commissioned by the end of 2001.

In addition to the power plant of IPP, EGAT will implement another new thermal power plant with a total capacity of 4,000 MW (1,000 MW x 4 units) by 2009. The first units of 1,000 MW will be commissioned in 2005. The site of the power plant is expected to be located in the area between Prachuap Khiri Khan and Chumporn Provinces on the western coast.

In the event that EGAT's plan for power expansion is implemented as programmed, the Bang Saphan area will attain a stable power supply from the national grid.

E.4.4 Proposed Power Supply System for Bang Saphan Industrial Estate

(1) Basic Design Conditions and Criteria

Electric power for the Bang Saphan industrial estate will be supplied from the national power grid of EGAT through the transmission system of PEA. The external power supply system will be composed of on-site substations and primary transmission lines of the substations.

The basic design of the system will be prepared in accordance with the design criteria of PEA. Power supply facilities will be designed to enhance the quality of electricity so that voltage will be kept within an appropriate range according to the criteria.

The primary 115 kV transmission lines and the on-site substation for the General Industrial Estate will be developed by PEA at its own cost, provided that the substation lot in the estate area be offered free of charge to PEA.

(2) Power Demand

The power demand in the Bang Saphan area is estimated on the basis of each development stage as shown in Tables E.4.2 and E.4.3. The total power demand is summarized as follows:

(MW)

	1995	2001	2006	2011
1. Iron/Steel Group	84	359	1,746	1,746
2. General Industry	-	19	64	128
3. Port		3	6	9
4. Existing Residence	10	15	16	20
5. New Residence	-	1	3	7
Total	94	397	1,835	1,910

(3) Power Supply System

1) External Power Transmission System

In 2001

A new 500 kV substation, connected to a new 500 kV transmission line is programmed to be completed by the end of 2001. Therefore electric power for the Bang Saphan area will be fed from the existing Bang Saphan substation until 2001. It is noted, however, that because the maximum power supply capacity of the Bang Saphan substation is limited to around 250 MW, power demand of the Bang Saphan industrial city should not exceed 250 MW in total before the end of 2001. The development schedule of steel industries should be arranged carefully in line with EGAT's power development program.

For the phase 1 development of the General Industrial Estate (GIE), a new 115/22 kV on-site substation (1×50 MVA) and primary 115 kV transmission lines (2×400 A) connected with the Bang Saphan substation shall be constructed by 2000.

In 2006

A new coal-fired power station of 1,400 MW (IPP) with a new 500 kV substation is expected to be commissioned in 2003, and it is to be interconnected to the national grid by new 500 kV double circuit lines. Therefore additional electric power for the steel industries will be fed not only from the 500 kV substation near the Bang Saphan substation but also from the new 500 kV substation of IPP power plant after 2004. Accordingly, additional transmission lines shall be constructed between these substations and each consumer of steel industry.

Power for the phase 2 development of GIE will be supplied from the Bang Saphan substation through the 115 kV transmission lines constructed in phase 1 stage. However, the capacity of the on-site substation should be expanded from 50 MVA (1×50 MVA) to 100 MVA (2×50 MVA).

In 2011

In order to cope with the power demand of phase 3 development of GIE, a new 115/21 kV on-site substation (2×50 MVA) should be constructed in the GIE area by 2007. The 115 kV transmission line (2×400A) should also be

furnished between the on-site substation and the 500 kV substation on the side of IPP power plant.

A schematic diagram of each power supply system is shown in Figures E.4.2, E.4.3 and E.4.4.

E.5 Telecommunications

E.5.1 Organization of Telecommunication Sector

The Telephone Organization of Thailand (TOT) and the Communications Authority of Thailand (CAT) are responsible for the telecommunication services. TOT is responsible for providing a domestic telecommunication network and international telephone services to Malaysia and Laos. The network includes over 400 exchanges, many of which are Stone Program Control (SPC) digital systems. On the other hand, CAT provides international telecommunication, telex, telegram and data services.

E.5.2 Existing Telecommunication Services and System

As of September 1994, TOT operated about 2,441,000 telephone lines nationwide, with a telephone density of 5.3 per 100 people as shown below.

(lines)

	Telephone Lines (×1,000)	Telephone Density (per 100 people)
Bangkok area	1,511	26.1
Local area	930	2.2
Total (Ave.)	2,441	5.3

It was reported that there were about 1,600,000 people nationwide waiting for a phone.

The network structure of TOT has a five-level switching hierarchy. The national network is mainly composed of optical fiber cable, microwave and U/VHF systems. In the western area, a optical fiber cable transmission line with a capacity of 565 Mbit/s(7,920 ch) was installed along the western seaboard. The nearest TOT facility to the Bang Saphan area is the existing Bang Saphan Remote Switching station, and it is controlled from a Master Switching station in Prachuap Khiri Khan province through a 34Mbits (480ch) optical fiber cable link.

E.5.3 Telecommunication Expansion Plan of TOT

TOT is now planning to install an additional 4,900,000 lines by 1996 and 6,000,000 lines during the 8th Plan period (1997-2001). Targeted telephone ownership is estimated at between 10 and 20 per 100 people.

The existing exchange capacity of the Bang Saphan Remote Switching station is 600 lines, and TOT plans to expand it to 1,000 lines by October 1998.

TOT also plans to introduce Synchronous Digital Hierarchy (SDH) network which is composed of 156 Mb/s optical fiber cable (120 fibers) and microwave.

TOT's new network will be completed in 1998, and 120 fiber optical cables will be laid between the Prachuap Khirhi Khan master switching station and the Bang Saphan remote switching station. Consequently, there will be no shortage in the transmission side of telecommunications after 1999.

E.5.4 Proposed Telecommunication System for the Bang Saphan Industrial Estate

(1) Basic Design Conditions and Criteria

Telecommunication services for the proposed industrial estate are available through TOT. The external telecommunication system is composed of transmission lines, remote switching stations and distribution telephone lines.

The basic design of the system will be prepared in accordance with the TOT's design criteria.

(2) Telecommunication Demand

The total telecommunication demand in the Bang Saphan industrial city is estimated as summarized below.

(lines)

	2001	2006	2011
1. Iron/Steel Group	220	540	540
2. General Industry	276	872	1,730
3. Power Plant	-	20	20
4. Port	15	30	45
5. Existing Residence	7,458	8,058	9,718
6. New Residence	440	1,570	3,610
Total	8,409	11,090	15,663

Detailed projection by item of telecommunication demand is presented in Table E.5.1.

(3) Telecommunication system

A new remote Switching (RS) station for exclusive use of the Bang Saphan industrial estate is proposed to be installed in the estate by 2000 in consideration of the rather

bigger telecommunication demand of the estate. In order to link the RS station to the MS station in Prachuap Khiri Khan through the SDH network, optical fiber cables should be laid between the RS station in the industrial estate and the existing Bang Saphan RS station.

The existing Bang Saphan RS station and distribution telephone lines should be also expanded stage by stage in accordance with the demand increase of iron steel group and residence area, etc.

A schematic diagram of the telecommunication system at each development stage is shown in Figures E.5.1, E.5.2 and E.5.3.

Table E.1.1 Record of Daily Mean Runoff Discharge of Bang Saphan River at Ban Wang Yao in 1980

	Discharge of Bang Saphan River at Bang Wang Yao (m³/scc)												
	A	M	J	J	A	S	O	N	D	J	F	M	Total
1	0.52	0.40	1.05	13.55	2.67	7.11	3.16	3.94	1.30	0.68	0.56	0.36	
2	0.48	0.36	1.36	8.87	3.23	6.80	2.81	2.74	8.10	0.64	2.11	0.36	
3	0.44	0.40	1.66	5.60	2.60	4.55	3.46	2.39	2.81	0.64	1.97	0.36	
4	0.48	0.36	1.84	3.94	2.18	3.30	4.37	2.04	1.84	0.64	1.10	0.36	
5	0.44	0.32	3.34	3.46	1.90	2.74	4.91	1.90	1.48	0.64	0.76	0.36	
6	0.44	0.28	1.30	3.09	1.66	2.39	3.23	1.84	1.30	0.60	0.72	0.44	
7	0.40	0.40	1.30	3.02	1.60	2.25	2.60	1.72	1.20	0.56	0.68	0.48	
8	0.36	0.36	1.10	3.02	1.54	2.25	2.18	1.54	1.36	0.56	0.64	0.48	
9	0.32	0.36	1.00	2.46	1.42	1.97	1.97	1.97	2.46	0.52	0.60	0.40	
10	0.28	0.40	0.90	2.39	1.30	1.90	3.86	2.11	2.04	0.52	0.56	0.36	
11	0.28	0.56	0.85	2.04	1.25	2.25	2.53	1.66	1.60	0.52	0.56	0.36	
12	0.28	0.85	0.85	2.46	1.25	6.30	2.04	1.54	1.54	0.52	0.52	0.36	
13	0.28	2.60	1.20	2.39	1.20	3.78	1.84	1.42	1.54	0.52	3.94	0.32	
14	0.40	2.88	2.74	2.18	1.10	4.82	3.38	1.30	1.36	0.52	1.15	0.32	
15	0.36	1.36	1.25	1.97	1.00	3.46	15.63	1.25	1.54	0.48	0.80	0.28	
16	0.40	0.90	1.15	2.32	1.30	2.67	26.95	1.15	1.30	0.48	0.72	0.24	
17	1.00	0.76	1.60	1.90	1.48	2.39	13.03	1.10	1.10	0.44	0.64	0.20	
18	0.90	0.80	1.15	1.72	1.48	2.11	7.99	1.10	1.00	0.44	0.64	0.16	
19	0.60	0.90	1.10	1.54	2.74	1.78	8.87	1.05	1.00	0.40	0.56	0.16	
20	0.60	4.73	1.30	1.48	2.53	1.66	5.60	1.05	0.95	0.40	0.56	0.16	
21	0.56	4.46	1.20	1.48	1.90	1.60	4.82	1.00	0.90	0.40	0.52	0.12	
22	0.52	3.16	1.78	1.72	1.54	1.54	4.37	1.00	0.85	0.40	0.52	0.12	
23	0.48	2.53	1.60	1.90	1.42	1.48	3.94	0.95	0.80	0.40	0.48	0.12	
24	0.40	2.04	12.90	2.53	1.42	2.18	3.54	0.95	0.76	0.40	0.44	0.36	
25	0.36	1.66	5.00	3.46	1.90	1.84	3.16	0.95	0.76	0.40	0.40	0.20	
26	0.44	1.30	3.94	3.38	1.72	1.60	3.02	0.90	0.76	0.40	0.40	0.16	
27	0.44	1.25	3.94	3.09	1.72	1.42	2.74	0.85	0.76	0.36	0.40	0.12	
28	0.68	1.30	3.94	9.20	2.18	1.48	3.62	0.85	0.72	0.36	0.36	0.12	
29	0.56	1.15	5.30	5.90	2.04	2.74	2.60	0.80	0.72	0.36		0.08	
30	0.44	1.00	22.89	4.28	2.04	3.02	2.32	0.80	0.68	0.36		0.08	
31		1.15		3.16	2.81		2.18		0.68	0.36		0.04	
Total	14.14	40.98	90.53	109.50	56.12	85.38	156.72	43.86	45.21	14.92	23.31	8.04	688.71
												MCM	59.50

Source: RID

Table E.1.2 Possible Intake Vplume by Pumping Station

(Pump capacity : 0.4 m^3/sec)

	0.40 m3/sec intake												(m^3/scc)
	A	M	J	J	A	S	O	N	D	J	F	M	Total
1	0.00	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.24	0.00	0.00	
2	0.00	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.20	0.40	0.00	
3	0.00	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.20	0.40	0.00	
4	0.00	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.20	0.21	0.00	
5	0.00	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.20	0.00	0.00	
6	0.00	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.16	0.00	0.00	
7	0.00	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.12	0.00	0.00	
8	0.00	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.12	0.00	0.00	
9	0.00	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.08	0.00	0.00	
10	0.00	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.08	0.00	0.00	
11	0.00	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.08	0.00	0.00	
12	0.00	0.26	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.08	0.00	0.00	
13	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.08	0.40	0.00	
14	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.08	0.26	0.00	
15	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.04	0.00	0.00	
16	0.00	0.31	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.04	0.00	0.00	
17	0.16	0.17	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.00	0.00	0.00	
18	0.06	0.21	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.00	0.00	0.00	
19	0.00	0.31	0.40	0.27	0.40	0.40	0.40	0.40	0.40	0.00	0.00	0.00	
20	0.00	0.40	0.40	0.21	0.40	0.40	0.40	0.40	0.40	0.00	0.00	0.00	
21	0.00	0.40	0.40	0.21	0.40	0.40	0.40	0.40	0.40	0.00	0.00	0.00	
22	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.00	0.00	0.00	
23	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.00	0.00	0.00	
24	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.38	0.00	0.00	0.00	
25	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.38	0.00	0.00	0.00	
26	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.38	0.00	0.00	0.00	
27	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.38	0.00	0.00	0.00	
28	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.34	0.00	0.00	0.00	
29	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.34	0.00		0.00	
30	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.30	0.00		0.00	
31		0.40		0.40	0.40		0.40		0.30	0.00		0.00	
Total	0.22	7.26	12.00	11.89	12.40	12.00	12.40	12.00	12.03	1.95	1.67	0.00	95.83
												MCM	8.28

Table E.1.3 Possible Intake Vplume by Pumping Station

(Pump capacity : 1.0 m^3/sec)

	1.00 m^3/sec intake											(m^3/sec)	
	A	M	J	J	A	S	O	N	D	J	F	M	Total
1	0.00	0.00	0.82	1.00	1.00	1.00	1.00	1.00	0.92	0.24	0.00	0.00	
2	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.20	1.00	0.00	
3	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.20	1.00	0.00	
4	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.20	0.21	0.00	
5	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.20	0.00	0.00	
6	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.16	0.00	0.00	
7	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.82	0.12	0.00	0.00	
8	0.00	0.00	0.87	1.00	0.99	1.00	1.00	1.00	0.98	0.12	0.00	0.00	
9	0.00	0.00	0.77	1.00	0.87	1.00	1.00	1.00	1.00	0.08	0.00	0.00	
10	0.00	0.00	0.67	1.00	0.75	1.00	1.00	1.00	1.00	0.08	0.00	0.00	
11	0.00	0.00	0.62	0.77	0.70	1.00	1.00	1.00	1.00	0.08	0.00	0.00	
12	0.00	0.26	0.62	1.00	0.70	1.00	1.00	1.00	1.00	0.08	0.00	0.00	
13	0.00	1.00	0.97	1.00	0.65	1.00	1.00	1.00	1.00	0.08	1.00	0.00	
14	0.00	1.00	1.00	0.91	0.55	1.00	1.00	0.95	0.98	0.08	0.26	0.00	
15	0.00	0.77	1.00	0.70	0.45	1.00	1.00	0.90	1.00	0.04	0.00	0.00	
16	0.00	0.31	0.92	1.00	0.75	1.00	1.00	0.80	0.92	0.04	0.00	0.00	
17	0.16	0.17	1.00	0.63	0.93	1.00	1.00	0.75	0.72	0.00	0.00	0.00	
18	0.06	0.21	0.92	0.45	0.93	1.00	1.00	0.75	0.62	0.00	0.00	0.00	
19	0.00	0.31	0.87	0.27	1.00	1.00	1.00	0.70	0.62	0.00	0.00	0.00	
20	0.00	1.00	1.00	0.21	1.00	1.00	1.00	0.70	0.57	0.00	0.00	0.00	
21	0.00	1.00	0.97	0.21	1.00	1.00	1.00	0.65	0.52	0.00	0.00	0.00	
22	0.00	1.00	1.00	0.45	0.99	0.99	1.00	0.65	0.47	0.00	0.00	0.00	
23	0.00	1.00	1.00	0.63	0.87	0.93	1.00	0.60	0.42	0.00	0.00	0.00	
24	0.00	1.00	1.00	1.00	0.87	1.00	1.00	0.60	0.38	0.00	0.00	0.00	
25	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.60	0.38	0.00	0.00	0.00	
26	0.00	0.71	1.00	1.00	1.00	1.00	1.00	0.55	0.38	0.00	0.00	0.00	
27	0.00	0.66	1.00	1.00	1.00	0.87	1.00	0.50	0.38	0.00	0.00	0.00	
28	0.00	0.71	1.00	1.00	1.00	0.93	1.00	0.50	0.34	0.00	0.00	0.00	
29	0.00	0.56	1.00	1.00	1.00	1.00	1.00	0.45	0.34	0.00		0.00	
30	0.00	0.41	1.00	1.00	1.00	1.00	1.00	0.45	0.30	0.00		0.00	
31		0.56		1.00	1.00		1.00		0.30	0.00		0.00	
Total	0.22	13.64	28.05	26.24	28.03	29.70	31.00	24.10	22.36	1.95	3.47	0.00	208.77
												MCM	18.04

Table E.1.4 Possible Intake Vplume by Pumping Station

(Pump capacity : 2.0 m^3/sec)

	2.00 m^3/sec intake											(m^3/sec)	
	A	M	J	J	A	S	O	N	D	J	F	M	Total
1	0.00	0.00	0.82	2.00	2.00	2.00	2.00	2.00	0.92	0.24	0.00	0.00	
2	0.00	0.00	1.13	2.00	2.00	2.00	2.00	2.00	2.00	0.20	1.22	0.00	
3	0.00	0.00	1.43	2.00	2.00	2.00	2.00	2.00	2.00	0.20	1.08	0.00	
4	0.00	0.00	1.61	2.00	1.63	2.00	2.00	1.69	1.46	0.20	0.21	0.00	
5	0.00	0.00	2.00	2.00	1.35	2.00	2.00	1.55	1.10	0.20	0.00	0.00	
6	0.00	0.00	1.07	1.82	1.11	1.84	2.00	1.49	0.92	0.16	0.00	0.00	
7	0.00	0.00	1.07	1.75	1.05	1.70	2.00	1.37	0.82	0.12	0.00	0.00	
8	0.00	0.00	0.87	1.75	0.99	1.70	1.90	1.19	0.98	0.12	0.00	0.00	
9	0.00	0.00	0.77	1.19	0.87	1.42	1.69	1.62	2.00	0.08	0.00	0.00	
10	0.00	0.00	0.67	1.12	0.75	1.35	2.00	1.76	1.66	0.08	0.00	0.00	
11	0.00	0.00	0.62	0.77	0.70	1.70	2.00	1.31	1.22	0.08	0.00	0.00	
12	0.00	0.26	0.62	1.19	0.70	2.00	1.76	1.19	1.16	0.08	0.00	0.00	
13	0.00	2.00	0.97	1.12	0.65	2.00	1.56	1.07	1.16	0.08	2.00	0.00	
14	0.00	2.00	2.00	0.91	0.55	2.00	2.00	0.95	0.98	0.08	0.26	0.00	
15	0.00	0.77	1.02	0.70	0.45	2.00	2.00	0.90	1.16	0.04	0.00	0.00	
16	0.00	0.31	0.92	1.05	0.75	2.00	2.00	0.80	0.92	0.04	0.00	0.00	
17	0.16	0.17	1.37	0.63	0.93	1.84	2.00	0.75	0.72	0.00	0.00	0.00	
18	0.06	0.21	0.92	0.45	0.93	1.56	2.00	0.75	0.62	0.00	0.00	0.00	
19	0.00	0.31	0.87	0.27	2.00	1.23	2.00	0.70	0.62	0.00	0.00	0.00	
20	0.00	2.00	1.07	0.21	1.98	1.11	2.00	0.70	0.57	0.00	0.00	0.00	
21	0.00	2.00	0.97	0.21	1.35	1.05	2.00	0.65	0.52	0.00	0.00	0.00	
22	0.00	2.00	1.55	0.45	0.99	0.99	2.00	0.65	0.47	0.00	0.00	0.00	
23	0.00	1.94	1.37	0.63	0.87	0.93	2.00	0.60	0.42	0.00	0.00	0.00	
24	0.00	1.45	2.00	1.26	0.87	1.63	2.00	0.60	0.38	0.00	0.00	0.00	
25	0.00	1.07	2.00	2.00	1.35	1.29	2.00	0.60	0.38	0.00	0.00	0.00	
26	0.00	0.71	2.00	2.00	1.17	1.05	2.00	0.55	0.38	0.00	0.00	0.00	
27	0.00	0.66	2.00	1.82	1.17	0.87	2.00	0.50	0.38	0.00	0.00	0.00	
28	0.00	0.71	2.00	2.00	1.63	0.93	2.00	0.50	0.34	0.00	0.00	0.00	
29	0.00	0.56	2.00	2.00	1.49	2.00	2.00	0.45	0.34	0.00		0.00	
30	0.00	0.41	2.00	2.00	1.49	2.00	2.00	0.45	0.30	0.00		0.00	
31		0.56		1.89	2.00		1.90		0.30	0.00		0.00	
Total	0.22	20.10	39.77	41.21	37.82	48.10	60.81	31.34	27.31	1.95	4.77	0.00	313.41
												MCM	27.08

Table E.1.5 Possible Intake Vplume by Pumping Station

(Pump capacity : 3.0 m^3/sec)

	3.00 m^3/sec intake												(m^3/sec)
	A	M	J	J	A	S	O	N	D	J	F	M	Total
1	0.00	0.00	0.82	3.00	2.12	3.00	2.88	3.00	0.92	0.24	0.00	0.00	
2	0.00	0.00	1.13	3.00	2.68	3.00	2.53	2.39	3.00	0.20	1.22	0.00	
3	0.00	0.00	1.43	3.00	2.05	3.00	3.00	2.04	2.43	0.20	1.08	0.00	
4	0.00	0.00	1.61	2.67	1.63	2.75	3.00	1.69	1.46	0.20	0.21	0.00	
5	0.00	0.00	3.00	2.19	1.35	2.19	3.00	1.55	1.10	0.20	0.00	0.00	
6	0.00	0.00	1.07	1.82	1.11	1.84	2.95	1.49	0.92	0.16	0.00	0.00	
7	0.00	0.00	1.07	1.75	1.05	1.70	2.32	1.37	0.82	0.12	0.00	0.00	
8	0.00	0.00	0.87	1.75	0.99	1.70	1.90	1.19	0.98	0.12	0.00	0.00	
9	0.00	0.00	0.77	1.19	0.87	1.42	1.69	1.62	2.08	0.08	0.00	0.00	
10	0.00	0.00	0.67	1.12	0.75	1.35	3.00	1.76	1.66	0.08	0.00	0.00	
11	0.00	0.00	0.62	0.77	0.70	1.70	2.25	1.31	1.22	0.08	0.00	0.00	
12	0.00	0.26	0.62	1.19	0.70	3.00	1.76	1.19	1.16	0.08	0.00	0.00	
13	0.00	2.01	0.97	1.12	0.65	3.00	1.56	1.07	1.16	0.08	3.00	0.00	
14	0.00	2.29	2.51	0.91	0.55	3.00	3.00	0.95	0.98	0.08	0.26	0.00	
15	0.00	0.77	1.02	0.70	0.45	2.91	3.00	0.90	1.16	0.04	0.00	0.00	
16	0.00	0.31	0.92	1.05	0.75	2.12	3.00	0.80	0.92	0.04	0.00	0.00	
17	0.16	0.17	1.37	0.63	0.93	1.84	3.00	0.75	0.72	0.00	0.00	0.00	
18	0.06	0.21	0.92	0.45	0.93	1.56	3.00	0.75	0.62	0.00	0.00	0.00	
19	0.00	0.31	0.87	0.27	2.19	1.23	3.00	0.70	0.62	0.00	0.00	0.00	
20	0.00	3.00	1.07	0.21	1.98	1.11	3.00	0.70	0.57	0.00	0.00	0.00	
21	0.00	3.00	0.97	0.21	1.35	1.05	3.00	0.65	0.52	0.00	0.00	0.00	
22	0.00	2.57	1.55	0.45	0.99	0.99	3.00	0.65	0.47	0.00	0.00	0.00	
23	0.00	1.94	1.37	0.63	0.87	0.93	3.00	0.60	0.42	0.00	0.00	0.00	
24	0.00	1.45	3.00	1.26	0.87	1.63	3.00	0.60	0.38	0.00	0.00	0.00	
25	0.00	1.07	3.00	2.19	1.35	1.29	2.88	0.60	0.38	0.00	0.00	0.00	
26	0.00	0.71	3.00	2.11	1.17	1.05	2.74	0.55	0.38	0.00	0.00	0.00	
27	0.00	0.66	3.00	1.82	1.17	0.87	2.46	0.50	0.38	0.00	0.00	0.00	
28	0.00	0.71	3.00	3.00	1.63	0.93	3.00	0.50	0.34	0.00	0.00	0.00	
29	0.00	0.56	3.00	3.00	1.49	2.19	2.32	0.45	0.34	0.00		0.00	
30	0.00	0.41	3.00	3.00	1.49	2.47	2.04	0.45	0.30	0.00		0.00	
31		0.56		1.89	2.26		1.90		0.30	0.00		0.00	
Total	0.22	22.97	48.29	48.38	39.13	56.70	82.18	32.77	28.83	1.95	5.77	0.00	367.18
												MCM	31.72

Table E.2.1 Projection of Port Cargo Generation from Bang Saphan Industrial Estate (2001)

Japanese Industrial Category (No. is Japanese industrial code)	Thai Industrial Code	Area (m2)	Port Cargo Volume(ton/year) Total Carry in(a)	Carry in by ship(b)	Rate (c)=(a)/(b)	Total Carry out(d)	Carry out by ship(e)	Rate (f)=(d)/(e)	Ship Total (b)+(e)
211 Meat products	311	10,000	1,300	0	0.0	500	0	0.0	0
212 Dairy products	31111	10,000	5,000	50	1.0	4,800	100	2.1	150
229 Miscellaneous live-stock products	31119	5,000	17,400	12,000	69.0	17,500	500	2.9	12,500
	31121								
	31122								
	31149								
Manufacture of food group		25,000	23,700	12,050	70.0	22,800	600	5.0	12,650
624 Particleboard	33112	50,000	57,000	47,000	82.5	57,000	2,150	3.8	49,150
	33113								
711 Wooden furniture,except Japanese	33201	10,000	158,000	23,500	14.9	157,800	19,300	12.2	42,800
Manufacture of wooden and furniture group		60,000	215,000	70,500	32.8	214,800	21,450	10.0	91,950
2121 Lubricating oils	354	25,000	52,700	40,000	75.9	53,500	3,750	7.0	43,750
2122 Greases	35400	25,000	37,500	27,800	74.1	37,000	2,200	5.9	30,000
Petroleum and coal products group		50,000	90,200	67,800	75.2	90,500	5,950	6.6	73,750
3551 Fire blocks	36910	50,000	37,700	7,800	20.7	24,200	2,600	10.7	10,400
Ceramics Industry group		50,000	37,700	7,800	20.7	24,200	2,600	10.7	10,400
Iron/Steel Industry (Existing)		1,011,000	2,900,000	2,900,000	100.0	2,900,000	2,080,000	71.7	4,980,000
3646 Cold finished steel bars	371	50,000	62,500	29,000	46.4	62,500	32,800	52.5	61,800
3648 Wire drawing	371	25,000	38,500	18,000	46.8	38,500	20,200	52.5	38,200
3692 Iron and steel sheering and slitting	371	25,000	155,000	77,000	49.7	154,000	25,000	16.2	102,000
3693 Iron and steel scraping	371	25,000	103,100	51,500	50.0	103,100	16,500	16.0	68,000
3811 Tin cans and other plated sheet products	371	10,000	6,800	1,300	19.3	6,800	260	3.8	1,560
3841 Fabricated goods except structural hardware	371	50,000	10,000	2,660	26.6	10,000	1,500	15.0	4,160
3843 Fabricated plate work and sheet metal work	371	25,000	5,000	600	12.0	5,000	50	1.0	650
Steel processing industry(machinery products-line) group		210,000	380,900	180,060	47.3	379,900	96,310	25.4	276,370
2972 Air compressor. and gas compressors and blowers	38292	25,000	2,400	570	23.8	2,500	1,200	48.0	1,770
2980 Office machines	38250	50,000	3,400	170	5.0	3,400	920	27.1	1,090
2984 Refrigerators and air conditioning apparatus	382	25,000	6,800	300	4.4	5,700	1,100	19.3	1,400
2989 Miscellaneous office. surface industry and household machines	382	25,000	4,200	340	8.1	4,200	600	14.3	940
Steel Industry by processing line products group		125,000	16,800	1,380	8.2	15,800	3,820	24.2	5,200
General manufacture(except steel industry)		520,000	764,300	339,590	44.4	748,000	130,730	17.5	470,320
Steel Industry		1,011,000	2,900,000	2,900,000	100.0	2,600,000	2,080,000	80.0	4,980,000
Total		1,531,000	3,664,300	3,239,590	88.4	3,348,000	2,210,730	66.0	5,450,320

Source: JICA Study Team

Table E.2.2 Projection of Port Cargo Volume (2006)

Japanese Industrial Category (No. is Japanese industrial category's number)	Thai Industrial Code	Area (m2)	Port Cargo Volume(ton/year) Total carry in (a)	Carry in by ship (b)	Rate(%) (c)=(a)/(b)	Total carry out (d)	Carry out by ship(e)	Rate(%) (f)=(e)/(d)	Ship total (b)+(e)
1211 Meat products	311	10,000	1,300	0	0.00	500	0	0.00	0
1212 Dairy products	31111	10,000	5,000	50	1.00	4,800	100	2.08	150
	31121								
	31122								
1221 Canned seafood and seaweed	31149	5,000	17,100	0	0.00	13,900	210	1.51	210
1229 Miscellaneous seafood products		5,000	6,000	0	0.00	5,600	90	1.61	90
1242 soy source "Sioux" and edible acids	31132	50,000	72,000	60,000	83.33	72,000	100	0.14	60,100
Manufacture of food group		80,000	101,400	60,050	59.22	96,800	500	0.52	60,550
1624 Particleboard	33112	50,000	57,000	47,000	82.46	57,000	2,150	3.77	49,150
	33113								
1711 Wooden furniture, except Japanese	33201	10,000	158,000	23,500	14.87	157,800	19,300	12.23	42,800
Manufacture of wooden and furniture group		60,000	215,000	70,500	32.79	214,800	21,450	9.99	91,950
2034 Fermentation industry	35299	100,000	37,000	30,000	81.08	37,000	15,200	41.08	45,200
2121 Lubricating industry	35299	25,000	115,000	87,000	75.65	116,000	7,000	6.03	94,000
2122 Greases	35299	25,000	46,000	35,000	76.09	46,000	2,800	6.09	37,800
Manufacture of Petroleum and coal		150,000	198,000	152,000	76.77	199,000	25,000	12.56	177,000
2551 Fire blocks	36910	100,000	60,600	13,000	21.45	40,000	4,400	11.00	17,400
2559 Miscellaneous clay refectories	36910	50,000	35,200	7,500	21.31	24,000	2,500	10.42	10,000
2561 Carbonaceous electrodes	36999	350,000	48,000	33,000	68.75	46,000	2,500	5.43	35,500
Ceramics industry group		500,000	143,800	53,500	37.20	110,000	9,400	8.55	62,900
		1,438,000	4,300,000	4,300,000	100.00	2,600,000	1,950,000	75.00	6,250,000
Iron/Steel Industry (Existing)									
2644 Steel pipes and tubes	371	200,000	147,000	104,500	71.09	155,000	78,200	50.45	182,700
2646 Cold finished steel bars	371	50,000	26,200	18,500	70.61	27,500	13,800	50.18	32,300
2648 Wire drawing	371	25,000	28,200	20,000	70.92	29,600	15,000	50.68	35,000
2650 Coated steel	371	50,000	58,500	50,000	85.47	58,500	47,800	81.71	97,800
2660 Ferrous metal machine parts and tooling products	371	50,000	18,600	4,700	25.27	14,500	200	1.38	4,900
2661 Iron castings, except cast iron pipes and malleable	371	100,000	51,000	16,200	31.76	50,000	700	1.40	16,900
2662 Malleable iron castings	371	50,000	20,000	100	0.50	18,300	70	0.38	170
2694 Causation pipe	371	50,000	14,400	80	0.56	13,600	50	0.37	130
2692 Iron and steel shearing and slitting	371	25,000	237,000	118,000	49.79	237,000	38,000	16.03	156,000
2693 Iron and steel scrap preparation for smelting	371	25,000	103,000	52,000	50.49	103,000	16,500	16.02	68,500
2811 tin cans and other plated sheet products	371	10,000	15,200	2,900	19.08	15,200	570	3.75	3,470
2841 Fabricated construction use metal products	371	50,000	3,200	840	26.25	3,300	480	14.55	1,320
2843 Fabricated plate work and sheet metal work	371	25,000	3,200	840	26.25	3,300	480	14.55	1,320
Steel processing industry(machinery products-line)group		710,000	725,500	388,660	53.57	728,800	211,850	29.07	600,510
2911 Boilers	382	100,000	110,000	0	0.00	110,000	0	0.00	0
2912 Steam engines, turbans and water wheels, except machine engines	382	200,000	187,000	0	0.00	187,000	0	0.00	0
2972 Air compressors, gas compressors and blowers	38292	25,000	2,400	600	25.00	2,500	1,200	48.00	1,800
2974 Conveyors and conveying equipment	382	25,000	2,500	620	24.80	2,700	1,270	47.04	1,890
2978 Chemical machinery and and its equipment	382	25,000	2,350	570	24.26	2,450	1,200	48.98	1,770
2981 Office machines	38250	50,000	13,500	600	4.44	23,400	1,100	4.70	1,700
2984 Refrigerators and air conditioning apparatus	382	50,000	13,500	600	4.44	23,400	1,100	4.70	1,700
2989 Miscellaneous office, service industry and household machines	382	25,000	3,800	170	4.47	6,500	300	4.62	470
Steel industry by processing line products group		500,000	335,050	3,160	0.94	357,950	6,170	1.72	9,330
3141 Steel shipbuilding and repairing	38411	69,000	12,100	9,600	79.33	9,600	6,770	70.52	16,370
3142 Hull blocks	38419	5,000	1,250	1,000	79.37	1,000	700	70.00	1,700
Shipbuilding and repairing group		74,000	13,350	10,600	79.40	10,600	7,470	70.47	18,070
General manufacture(except steel industry)		2,074,000	1,732,100	738,470	42.63	1,717,950	281,840	16.41	1,020,310
Steel industry		1,438,000	4,300,000	4,300,000	100.00	2,600,000	1,950,000	75.00	6,250,000
Total		3,512,000	6,032,100	5,038,470	83.53	4,317,950	2,231,840	51.69	7,270,310

Table E.2.3 Projection of Port Cargo Volume (2011)

Japanese Industrial Category (No. is Japanese industrial Code)	Thai ndustri Code	Area (m2)	Port Cargo Volume (ton/year) Total carry in(a)	Carry in by ship(b)	Rate(%) c)=(a)/(b)	Total carry out (d)	Carry out by ship(e)	Rate(%) (f)=(e)/(d)	Ship total (b)+(e)
1211 Meat products	311	10,000	1,300	0	0.00	500	0	0.00	0
1212 Dairy products	31111 31121 31122	10,000	11,500	0	0.00	10,000	0	0.00	0
1221 Canned seafood and seaweed	31149	5,000	17,100	11,700	68.42	17,100	470	2.75	12,170
1229 Miscellaneous seafood products		5,000	38,550	20,500	53.18	51,650	6,720	13.01	27,220
1242 Soy source "Sioux" and edible acids	31132	50,000	36,943	115	0.31	658	193	29.33	308
1253 Glucose, starch syrup and high-fructose corn syrup	31211	50,000	76,500	49,725	65.00	10,900	2,000	18.35	51,725
1263 Wheat flour milling	31163 31169	50,000	113,000	73,450	65.00	116,000	5,300	4.57	78,750
1281 Vegetable oil and fats	31151	50,000	180,000	135,000	75.00	187,400	56,220	30.00	191,220
1283 Edible oil and fats	31151	50,000	59,000	44,250	75.00	65,500	19,650	30.00	63,900
1293 Noodles, macaroni and spaghetti	31173	10,000	17,500	12,900	73.71	18,300	2,750	15.03	15,650
1361 Balanced compound feeds	31120	200,000	1,080,000	1,080,000	100.00	1,080,000	21,600	2.00	1,101,600
Manufacture of food group		**490,000**	**1,631,393**	**1,427,640**	**87.51**	**1,558,008**	**114,903**	**7.37**	**1,642,543**
1421 Spinning mills and cotton	32112	100,000	6,500	1,600	24.62	6,650	210	3.16	1,810
1431 Twisting yarns, except bulky yarns	32113	10,000	5,850	0	0.00	5,850	0	0.00	0
1441 Fabric mills, woven cotton acned spun rayon	32190	10,000	3,870	2,500	64.60	3,870	2,100	54.26	4,600
Manufacture of textile group		**120,000**	**16,220**	**4,100**	**25.28**	**16,370**	**2,310**	**14.11**	**6,410**
1617 Flooring mills	33190	25,000	98,000	83,300	85.00	98,000	10,600	10.82	93,900
1619 Sawing and planning mills, n.e.c.	33111	25,000	88,000	75,000	85.23	88,000	9,500	10.80	84,500
1624 Particleboard	33112 33113	50,000	131,300	108,000	82.25	182,000	5,000	2.75	113,000
1711 Wooden furniture, except Japanese	33201	10,000	3,500	50	1.43	5,200	70	1.35	120
Manufacture of wooden and furniture group		**110,000**	**320,800**	**266,350**	**83.03**	**373,200**	**25,170**	**6.74**	**291,520**
1841 Office paper products	34190	10,000	9,000	1,100	12.22	5,000	40	0.80	1,140
1851 Sacks for heavy weight shipping	34120	10,000	12,700	1,600	12.60	7,200	60	0.83	1,660
Manufacture of paper and pulp group		**20,000**	**21,700**	**2,700**	**12.44**	**12,200**	**100**	**0.82**	**2,800**
2011 Nitrogenous and phosphatic fertilizers	35120	100,000	65,000	29,250	45.00	68,000	7,600	11.18	36,850
2012 Compound fertilizers	35120	50,000	41,500	18,675	45.00	44,000	4,900	11.14	23,575
2023 Inorganic pigments	35299	50,000	90,000	40,500	45.00	47,000	5,200	11.06	45,700
2024 Compressed and liquefied gases	35299	25,000	32,000	14,400	45.00	41,000	10,000	24.39	24,400
2033 Methane derivatives	35111	200,000	181,000	63,350	35.00	172,000	82,560	48.00	145,910
2034 Fermentation industry	35299	100,000	120,000	48,000	40.00	115,000	59,500	51.74	107,500
2121 Lubricating industry	35299	50,000	115,000	46,000	40.00	116,000	7,000	6.03	53,000
2122 Greases	35299	25,000	46,000	23,000	50.00	46,000	2,800	6.09	25,800
tubes, pipe fittings and profile extrusions	356	50,000	15,500	0	0.00	15,500	100	0.65	100
2230 Industrial plastic products	356	10,000	3,400	100	2.94	3,400	60	1.76	160
Manufacture of Petroleum and coal(C, chemkuls)		**660,000**	**709,400**	**283,275**	**39.93**	**667,900**	**179,720**	**26.91**	**462,995**
2512 Processed flat glass	36200	100,000	113,000	50,850	45.00	113,000	27,800	24.60	78,650
2514 Glass containers	36200	50,000	45,000	20,250	45.00	44,500	11,100	24.94	31,350
2551 Fire blocks	36910	100,000	60,600	13,000	21.45	40,000	4,400	11.00	17,400
2559 Miscellaneous clay refectories	36910	50,000	35,200	7,500	21.31	24,000	2,500	10.42	10,000
2561 Carbonaceous electrodes	36999	350,000	45,000	24,000	50.00	46,000	2,500	5.43	26,500
Ceramics industry group		**650,000**	**301,800**	**115,600**	**38.30**	**267,500**	**48,300**	**18.06**	**163,900**
Iron/Steel Industry(Existing)		**2,575,000**	**10,300,000**	**10,300,000**	**100.00**	**5,600,000**	**3,080,000**	**55.00**	**13,380,000**
2644 Steel pipes and tubes	371	200,000	147,000	104,500	71.09	155,000	78,200	50.45	182,700
2646 Cold finished steel bars	371	50,000	26,200	18,500	70.61	27,500	13,800	50.18	32,300
2648 Wire drawing	371	50,000	38,200	20,000	70.92	29,600	15,000	50.68	35,000
2650 Coated steel	371	50,000	54,500	50,000	85.47	58,500	47,800	81.71	97,800
2660 Ferrous metal machine parts and tooling products	371	50,000	14,800	4,700	31.76	14,500	200	1.38	4,900
2661 Iron castings, except cast iron pipes and malleable	371	100,000	51,000	16,200	31.76	50,000	700	1.40	16,900
2694 Cast iron pipe	371	50,000	20,000	100	0.50	18,300	70	0.38	170
2662 Malleable iron castine	371	50,000	14,400	80	0.56	13,600	50	0.37	130
2692 Iron and steel shearing and slitting	371	25,000	237,000	118,000	49.79	237,000	38,000	16.03	156,000
2693 Iron and steel scrap preparation for smelting	371	25,000	103,000	52,000	50.49	103,000	16,500	16.02	68,500
2811 Tin cans and other plated sheet products	371	10,000	15,200	2,900	19.08	15,200	570	3.75	3,470
2841 Fabricated construction-use metal products	371	50,000	10,000	2,660	26.60	10,300	1,500	14.56	4,160
2842 Fabricated architectural metal products, except structural hardware	371	25,000	7,200	1,900	26.39	7,400	1,100	14.86	3,000
2843 Fabricated plate work and sheet metal work	371	25,000	3,200	840	26.25	3,300	480	14.55	1,320
Iine/group		**760,000**	**735,700**	**392,380**	**53.33**	**743,200**	**213,970**	**28.79**	**606,350**
2911 Boilers	382	100,000	110,000	0	0.00	110,000	0	0.00	0
2912 Steam engines, turbines and water wheels, except machine engines	382	200,000	187,000	0	0.00	187,000	0	0.00	0
2972 Air compressors, gas compressors and blowers	38292	25,000	2,400	600	25.00	2,500	1,200	48.00	1,860
2974 Conveyors and conveying equipment	382	25,000	2,500	620	24.80	2,700	1,270	47.04	1,890
2978 Chemical machinery and and its equipment	382	25,000	2,350	570	24.26	2,450	1,200	48.98	1,770
2979 Miscellaneous general industry machinery and equipment	382	25,000	1,900	460	24.21	2,000	950	47.50	1,410
2980 Office, service industry and household machines	382	50,000	13,500	600	4.44	23,400	1,100	4.70	1,700
2984 Refrigerators and air conditioning apparatus	382	50,000	13,500	600	4.44	23,400	1,100	4.70	1,700
2989 Miscellaneous office, service industry and household machines		25,000	3,800	170	4.47	6,500	300	4.62	470
3011 Generators, motors and other rotating electrical machinery	38310	50,000	4,600	100	2.17	5,300	600	11.32	700
3021 Household electric appliances		50,000	58,500	0	0.00	58,500	58,500	100.00	58,500
3041 Commendation equipment (wired)	38320	10,000	1,350	100	7.41	100	0	0.00	100
3091 Storage batteries	38392	50,000	8,300	4,300	51.81	7,700	3,800	49.35	8,100
3112 Motor vehicle bodies and trailers	38432	50,000	13,900	3,200	23.48	14,700	5,500	37.41	8,700
3113 Motor vehicle parts and accessories	38434	50,000	8,200	1,800	21.95	8,200	3,000	36.59	4,800
Steel industry by processing line products group		**785,000**	**432,800**	**13,120**	**3.03**	**484,450**	**78,520**	**17.28**	**91,640**
3141 Steel shipbuilding and repairing	38411	69,000	12,100	9,600	79.33	9,600	6,770	70.52	16,370
3142 Hull blocks	38419	5,000	1,250	1,000	79.37	1,000	700	70.00	1,700
Shipbuilding and repairing group		**74,000**	**13,350**	**10,600**	**79.40**	**10,600**	**7,470**	**70.47**	**18,070**
Reserve lot		545,000	708,500	425,100	60.00	735,750	110,363	15.00	535,463
Shipbuilding and repairing group		**545,000**	**708,500**	**425,100**	**60.00**	**735,750**	**110,363**	**15.00**	**535,463**
General manufacture(except steel industry)		**4,214,000**	**4,891,663**	**2,040,865**	**60.12**	**4,939,178**	**780,826**	**16.14**	**3,721,691**
bulk			1,080,000	1,080,000		0	0		1,080,000
general cargo			3,811,663	1,389,865		4,939,178	780,826		2,641,691
Steel industry		**2,575,000**	**10,300,000**	**10,300,000**	**100.00**	**5,600,000**	**3,080,000**	**55.00**	**13,380,000**
Total		**6,789,000**	**15,191,663**	**13,340,865**	**87.16**	**10,439,178**	**3,860,826**	**36.98**	**17,101,691**

Table E.4.1 Electricity Tariffs

Category	Applicable Conditions		Unit Charge
Schedule 3 (Medium General Service)	1) At Voltage of 69 kV and above		
	Demand charge		
	18:30 p.m.-21:30 p.m.	(On Peak)	240.00 Baht/kW
30 kW ≤ P* < 2,000 kW	08:00 a.m.-18:30 p.m. (only the excess on Peak)	(Partial Peak)	32.00 Baht/kW
	21:30 p.m.-08:00 a.m.	(Off Peak)	No demand charge
	Energy charge		1.03 Baht/kWh
	2) At Voltage of 11-33 kV		
	Demand charge		
	18:30 p.m.-21:30 p.m.	(On Peak)	305.00 Baht/kW
	08:00 a.m.-18:30 p.m. (only the excess on Peak)	(Partial Peak)	63.00 Baht/kW
	21:30 p.m.-08:00 a.m.	(Off Peak)	No demand charge
	Energy charge		1.07 Baht/kWh
	3) At Voltage of less than 11 kV		
	Demand charge		
	18:30 p.m.-21:30 p.m.	(On Peak)	356.00 Baht/kW
	08:00 a.m.-18:30 p.m. (only the excess on Peak)	(Partial Peak)	73.00 Baht/kW
	21:30 p.m.-08:00 a.m.	(Off Peak)	No demand charge
	Energy charge		1.10 Baht/kWh
Schedule 4 (Large General Service)	1) At Voltage of 69 kV and above		
	Demand charge		
	18:30 p.m.-21:30 p.m.	(On Peak)	240.00 Baht/kW
P* ≥ 2,000 kW	08:00 a.m.-18:30 p.m. (only the excess on Peak)	(Partial Peak)	32.00 Baht/kW
	21:30 p.m.-08:00 a.m.	(Off Peak)	No demand charge
	Energy charge		1.03 Baht/kWh
	2) At Voltage of 11-33 kV		
	Demand charge		
	18:30 p.m.-21:30 p.m.	(On Peak)	305.00 Baht/kW
	08:00 a.m.-18:30 p.m. (only the excess on Peak)	(Partial Peak)	63.00 Baht/kW
	21:30 p.m.-08:00 a.m.	(Off Peak)	No demand charge
	Energy charge		1.07 Baht/kWh

* : Maximum 15 minutes integrated demand.

Table E.4.2 Power Demand Projection

Year		Area (ha)	Direct Employee	Unit Demand (MW/ha)	Electric Demand (MW)	Remarks
1995	Iron/Steel Group	35	560		84	
	General Industry	0	0		0	
	Existing Residential Area in Bang Saphan ,Others				10	
	New Residential Area in Bang Saphan				0	
	Total	35	560		94	
2001	Iron/Steel Group	102	2,400		359	
	General Industry	123	2,400		19	
	(Factory)	(52)		0.3	(16)	
	(IE Center)	(118)			(0.2)	
	(S.T. Plant)	(10)			(0.9)	
	(W.P. Plant)	(5)			(1.8)	
	(St. Lighting)				(0.1)	
	Subtotal	225	4,800		378	
	Port	30	1,600	0.1	3	
	Existing Residential Area in Bang Saphan ,Others	280			15	(14,916hos × 1kW/ho)
	New Residential Area in Bang Saphan	40			1	(880hos × 1kW/ho)
	Total	575	6,400		397	
2006	Iron/Steel Group	260	4,700		1,746	
	General Industry	310	6,000		64	
	(Factory)	(201)		0.3	(61)	
	(IE Center)	(1.8)			(0.2)	
	(S.T. Plant)	(10)			(0.9)	
	(W.P. Plant)	(5)			(1.8)	
	(St. Lighting)				(0.2)	
	Subtotal	570	10,700		1,810	
	Power Plant	105	200		0	
	Port	60	1,600	0.1	6	
	Existing Residential Area in Bang Saphan ,Others	520			16	(16,116hos × 1kW/ho)
	New Residential Area in Bang Saphan	150			3	(3,140hos × 1kW/ho)
	Total	1,405	12,500		1,835	
2011	Iron/Steel Group	260	4,700		1,746	
	General Industry	600	11,900		128	
	(Factory)	(415)		0.3	(125)	
	(IE Center)	(1.8)			(0.2)	
	(S.T. Plant)	(10)			(0.9)	
	(W.P. Plant)	(5)			(1.8)	
	(St. Lighting)				(0.3)	
	Subtotal	860	16,600		1,874	
	Power Plant	105	200		0	
	Port	90	2,300	0.1	9	
	Existing Residential Area in Bang Saphan ,Others	1,180			20	(19,436hos × 1kW/ho)
	New Residential Area in Bang Saphan	350			7	(7,220hos × 1kW/ho)
	Total	2,585	19,100		1,910	

Table E.4.3 Power Demand Requirement of Iron / Steel Group

Year	Process	Facilities	Capacity (per annum) (1,000 ton)	Area (Gross) (ha)	N Max.Capa. (per month) [1,000ton]	a Unit kWh/t	P Max.Power Demand [MW]
1995		Hot Strip Mill (operated) x 1	2,400	26.40	220	110	77.56
		EGL (Electrogalvanizing, operated) x 1	135	8.80	10	195	6.25
	Total			**35.20**			**83.81**
2001	Steelmaking	EAF (Electric Arc Furnace) x 2	1,000	34.40	90	600	173.08
		LF (Ladle Furnace) x 2	1,000	inclusive of	90	50	14.42
		CC (Continuous Caster) for Slab x 1	1,000	scrap yard 8 ha	90	15	4.33
	Hot rolling	Hot Strip Mill (operated) x 1	2,400	26.40	220	110	77.56
		Bar Mill (being constructed) x 2	720	10.50	70	105	23.56
	Cold rolling and others	Cold Strip Mill (being constructed) x 1	1,000	21.30	100	150	48.08
		EGL (Electrogalvanizing, operated) x 1	150	8.80	15	195	9.38
		CGL (Continuous Galvanizing Line) x 1	100	0.80	9	90	2.60
	Related facilities	OX Plant	1,000		90	20	5.77
	Total			**102.20**			**358.77**
2006	Ironmaking	DRI (Direct Reduced Iron) x 12	5,400	123.40	500	96	153.85
	Steelmaking	EAF (Electric Arc Furnace) x 9	6,500	inclusive of	610	600	1173.08
		LF (Ladle Furnace) x 9	6,500	scrap yard 15ha,	610	50	97.76
		CC (Continuous Caster) for Slab x 2	2,500	material yard 14ha	230	15	11.06
		BT, BLCC 2	2,000		190	15	9.13
	Hot rolling	Hot Strip Mill x 1	2,400	26.40	220	110	77.56
		TSP (Thin Slab Process: CC+HSM) x 1	2,000	26.40	190	90	54.81
		Bar Mill x 2	720	10.50	70	105	23.56
		Section Mill x 1	600	25.00	60	105	20.19
		Wire Rod Mill x 1	400	15.00	40	150	19.23
	Cold rolling and others	Cold Strip Mill x 1	1,000	21.30	100	150	48.08
		EGL (Electrogalvanizing) x 1	200	8.80	18	195	11.25
		CGL (Continuous Galvanizing Line) x 2	300	1.80	28	90	8.08
	Subtotal			258.60			1707.63
	Related facilities	Coal-fried power station (1400MW) x 1(IPP)	(1,400MW)	105.00	-	-	-
		OX Plant	(6,500)		600	20	38.46
	Total			**363.60**			**1746.09**
2011	Ironmaking	DRI (Direct Reduced Iron) x 12	5,400	123.40	500	96	153.85
	Steelmaking	EAF (Electric Arc Furnace) x 9	6,500	inclusive of	610	600	1173.08
		LF (Ladle Furnace) x 9	6,500	scrap yard 15ha,	610	50	97.76
		CC (Continuous Caster) for Slab x 2	2,500	material yard 14ha	230	15	11.06
		BT, BLCC 2	2,000		190	15	9.13
	Hot rolling	Hot Strip Mill x 1	2,400	26.40	220	110	77.56
		TSP (Thin Slab Process: CC+HSM) x 1	2,000	26.40	190	90	54.81
		Bar Mill x 2	720	10.50	70	105	23.56
		Section Mill x 1	600	25.00	60	105	20.19
		Wire Rod Mill x 1	400	15.00	40	150	19.23
	Cold rolling and others	Cold Strip Mill x 1	1,000	21.30	100	150	48.08
		EGL (Electrogalvanizing) x 1	200	8.80	18	195	11.25
		CGL (Continuous Galvanizing Line) x 2	300	1.80	28	90	8.08
	Subtotal			258.60			1707.63
	Related facilities	Coal-fried power station (1400MW) x 1(IPP)	(1,400MW)	105.00	-	-	-
		OX Plant	(6,500)		600	20	38.46
	Total			**363.60**			**1746.09**

Remarks : $(N \times a/T) \times (1/L) \times 100$ [Mw]
T : Operating hours per month = 624(hrs)
L : Monthly load factor = 50%

Table E.5.1 Telephone Demand Projection

Year		Area (ha)	Direct Employee	Unit Demand (lines/ha)	Telephone Demand (lines)	Remarks
2001	Iron/Steel Group	102	2,400		220	
	General Industry	123	2,400		276	
	(Factory)	(52)		4.0	(208)	
	(IE Center)	(1.8)			(60)	
	(S.T. Plant)	(10)			(3)	
	(W.P. Plant)	(5)			(3)	
	(Substation)	(2)			(2)	
	Subtotal	225	4,800		496	
	Port	30	1,600		15	
	Existing Residential Area in Bang Saphan , Others	280			7,458	(14,916hos × 0.5line/ho)
	New Residential Area in Bang Saphan	40			440	(880hos × 0.5line/ho)
	Total	575	6,400		8,409	
2006	Iron/Steel Group	260	4,700		540	
	General Industry	310	6,000		872	
	(Factory)	(201)		4.0	(804)	
	(IE Center)	(1.8)			(60)	
	(S.T. Plant)	(10)			(3)	
	(W.P. Plant)	(5)			(3)	
	(Substation)	(2)			(2)	
	Subtotal	570	10,700		1,412	
	Power Plant	105	200		20	
	Port	60	1,600		30	
	Existing Residential Area in Bang Saphan , Others	520			8,058	(16,116hos × 0.5line/ho)
	New Residential Area in Bang Saphan	150			1,570	(3,140hos × 0.5line/ho)
	Total	1,405	12,500		11,090	
2011	Iron/Steel Group	260	4,700		540	
	General Industry	600	11,900		1,730	
	(Factory)	(415)		4.0	(1660)	
	(IE Center)	(1.8)			(60)	
	(S.T. Plant)	(10)			(3)	
	(W.P. Plant)	(5)			(3)	
	(Substation)	(4)			(4)	
	Subtotal	860	16,600		2,270	
	Power Plant	105	200		20	
	Port	90	2,300		45	
	Existing Residential Area in Bang Saphan , Others	1,180			9,718	(19,436hos × 0.5line/ho)
	New Residential Area in Bang Saphan	350			3,610	(7,220hos × 0.5line/ho)
	Total	2,585	19,100		15,663	

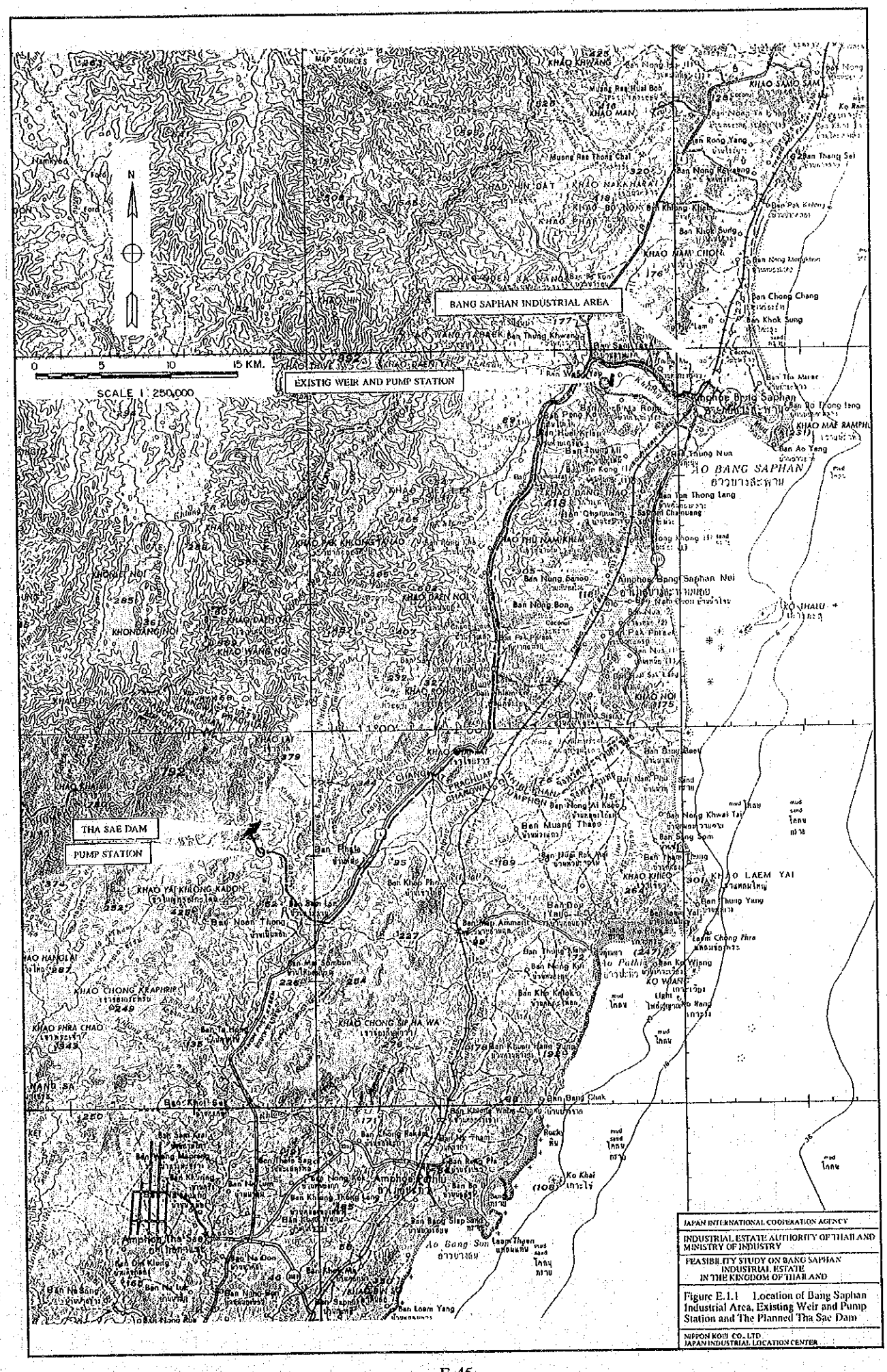

MAP SOURCES
N
0 5 10 15 KM.
SCALE 1: 250,000
BANG SAPHAN INDUSTRIAL AREA
EXISTIG WEIR AND PUMP STATION
THA SAE DAM
PUMP STATION
KHAO BANG SAPHAN
Amphoe Bang Saphan Noi
Amphoe Thung Tako
Ao Bang Son
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Figure E.1.1 Location of Bang Saphan Industrial Area, Existing Weir and Pump Station and The Planned Tha Sae Dam
NIPPON KOEI CO., LTD
JAPAN INDUSTRIAL LOCATION CENTER

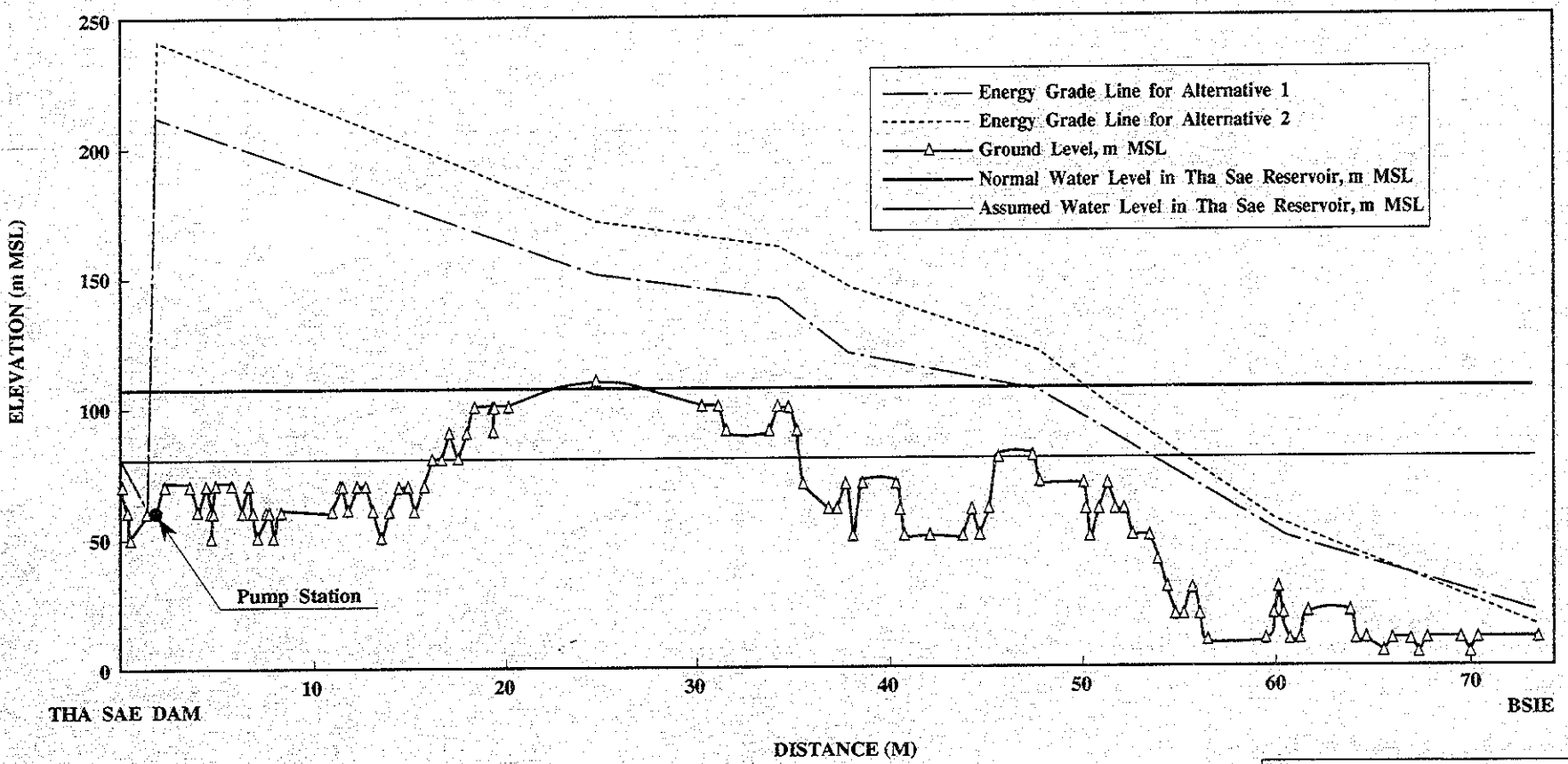

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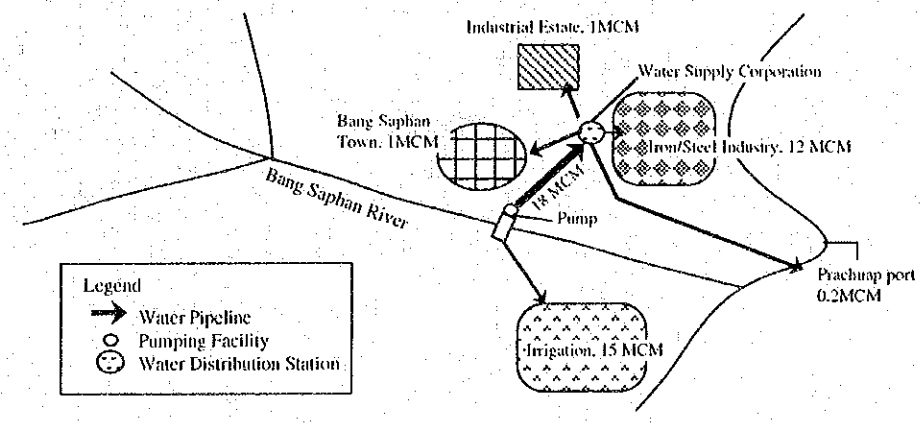
Figure E.1.2 Ground Level Profile and Energy Grade Lines along the Proposed Tha Sae-Bsie Pipeline Route

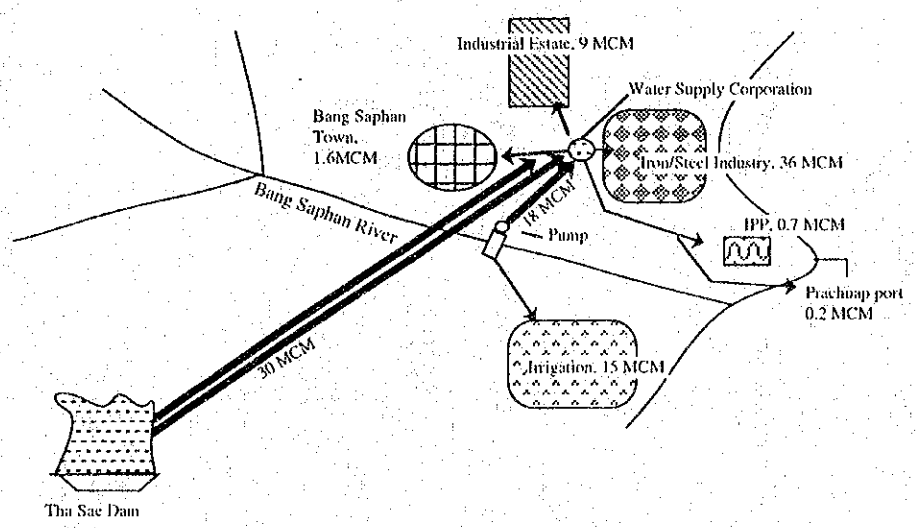
NIPPON KOEI CO., LTD.
JAPAN INDUSTRIAL LOCATION CENTER



in 2001

From Bang Saphan River : 33 MCM
- Pump 18 MCM
- Irrigation 15 MCM

Demand : 30 MCM
- Iron industry : 12 MCM
- IE : 1 MCM
- Domestic use : 1 MCM
- Irrigation : 15 MCM
- Others : 0.2 MCM
- Total : 30 MCM

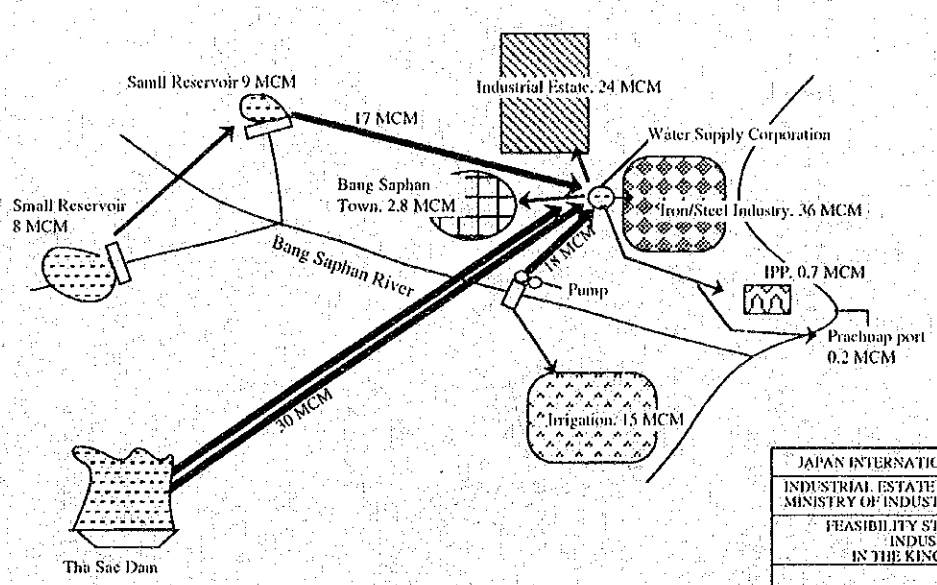


in 2006

From Bang Saphan River : 33 MCM
- Pump 18 MCM
- Irrigation 15 MCM

From Tha Sae Dam : 30 MCM
Total : 63 MCM

Demand : 63 MCM
- Iron industry : 36 MCM
- IE : 9 MCM
- Domestic use : 2 MCM
- Irrigation : 15 MCM
- Others : 1 MCM
- Total : 63 MCM



in 2011

From Bang Saphan River : 50 MCM
- Pump 18 MCM
- Dam 17 MCM
- Irrigation 15 MCM

From Tha Sae Dam : 30 MCM
Total : 80 MCM

Demand : 77 MCM
- Iron industry : 36 MCM
- IE : 22 MCM
- Domestic use : 3 MCM
- Irrigation : 15 MCM
- Others : 1 MCM
- Total : 77 MCM

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Figure E.1.3 Plan of Water Supply System in Bang Saphan (External Facility)

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JAPAN INDUSTRIAL LOCATION CENTER

PRACHUAP PORT DEVELOPMENT
ALTERNATIVE PLAN A

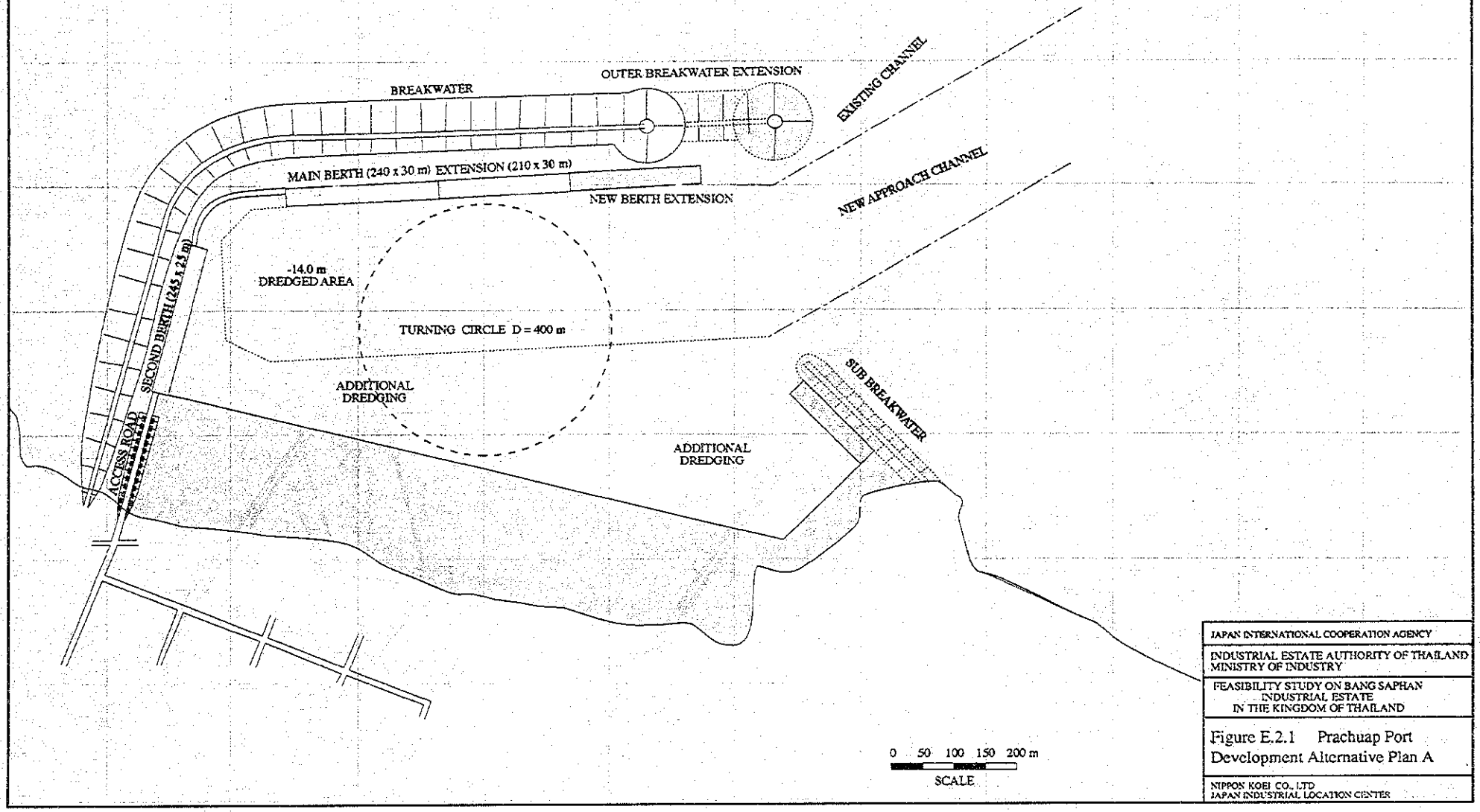

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Figure E.2.1 Prachuap Port Development Alternative Plan A

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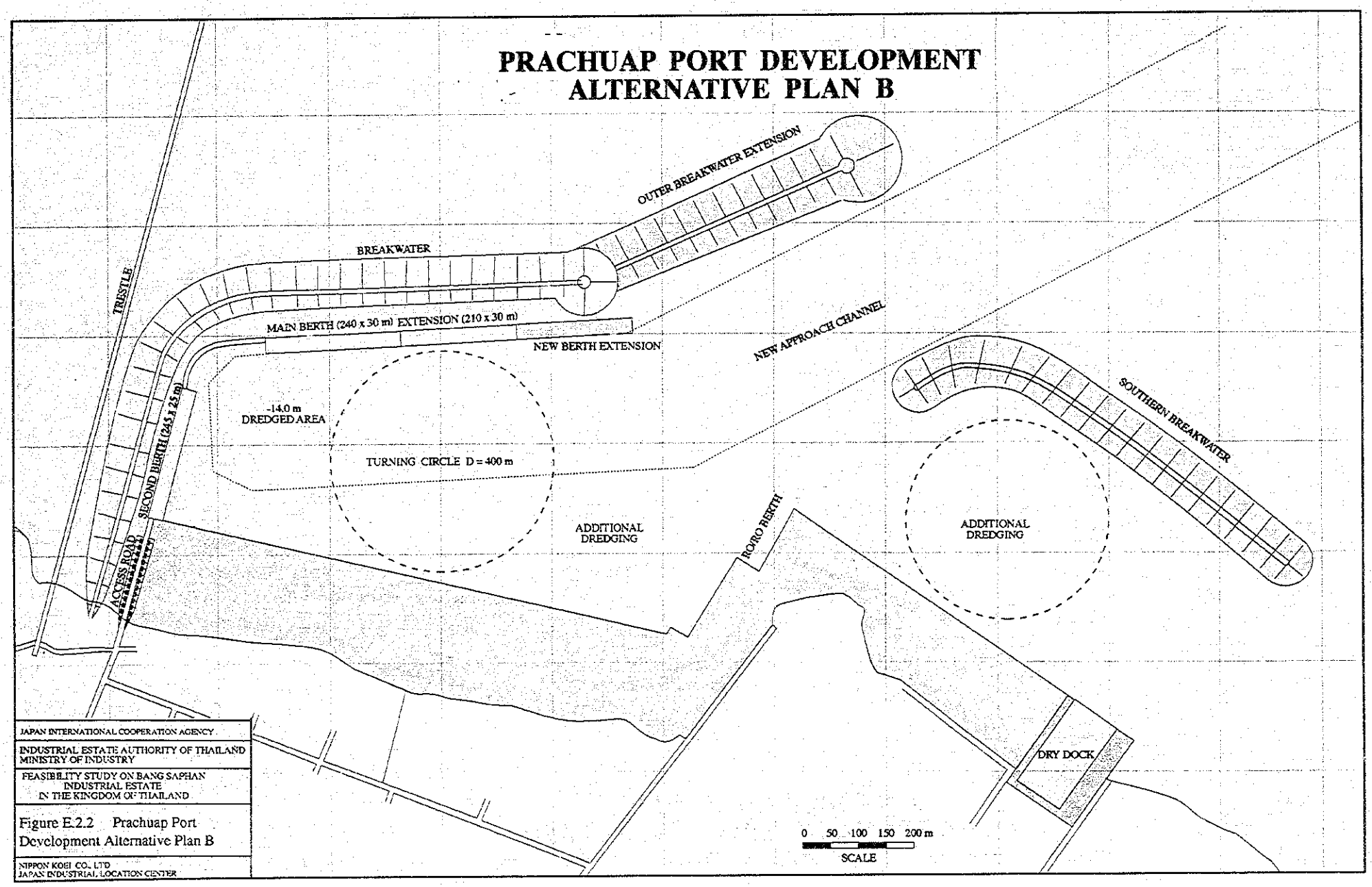
PRACHUAP PORT DEVELOPMENT
ALTERNATIVE PLAN B
OUTER BREAKWATER EXTENSION
BREAKWATER
TRESTLE
MAIN BERTH (240 x 30 m) EXTENSION (210 x 30 m)
NEW BERTH EXTENSION
NEW APPROACH CHANNEL
SOUTHERN BREAKWATER
-14.0 m
DREDGED AREA
TURNING CIRCLE D = 400 m
SECOND BERTH (245 x 25 m)
ACCESS ROAD
ADDITIONAL
DREDGING
RO/RO BERTH
ADDITIONAL
DREDGING
DRY DOCK
0 50 100 150 200 m
SCALE
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Figure E.2.2 Prachuap Port
Development Alternative Plan B
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PRACHUAP PORT DEVELOPMENT
ALTERNATIVE PLAN C

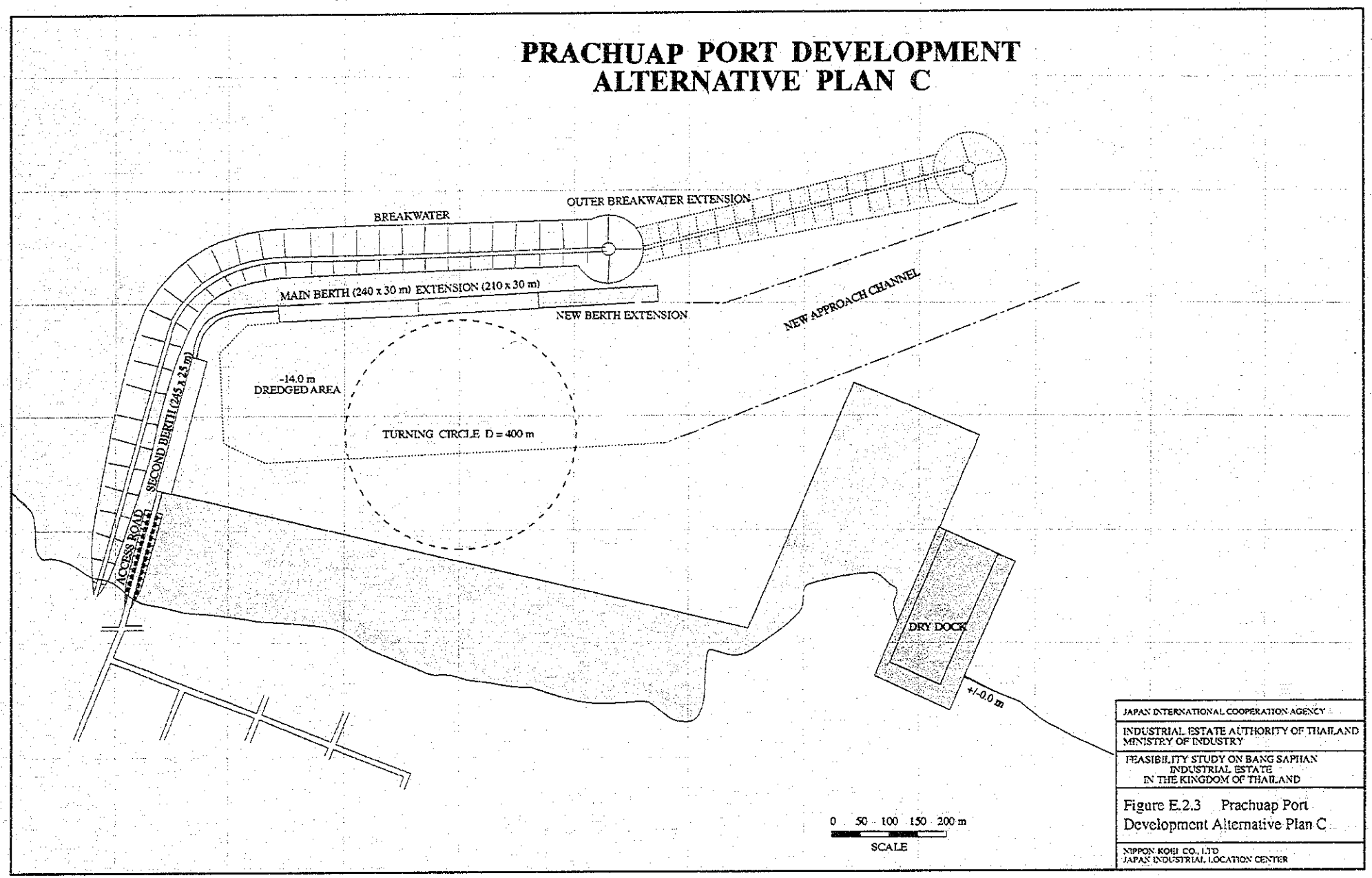

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Figure E.2.3 Prachuap Port Development Alternative Plan C

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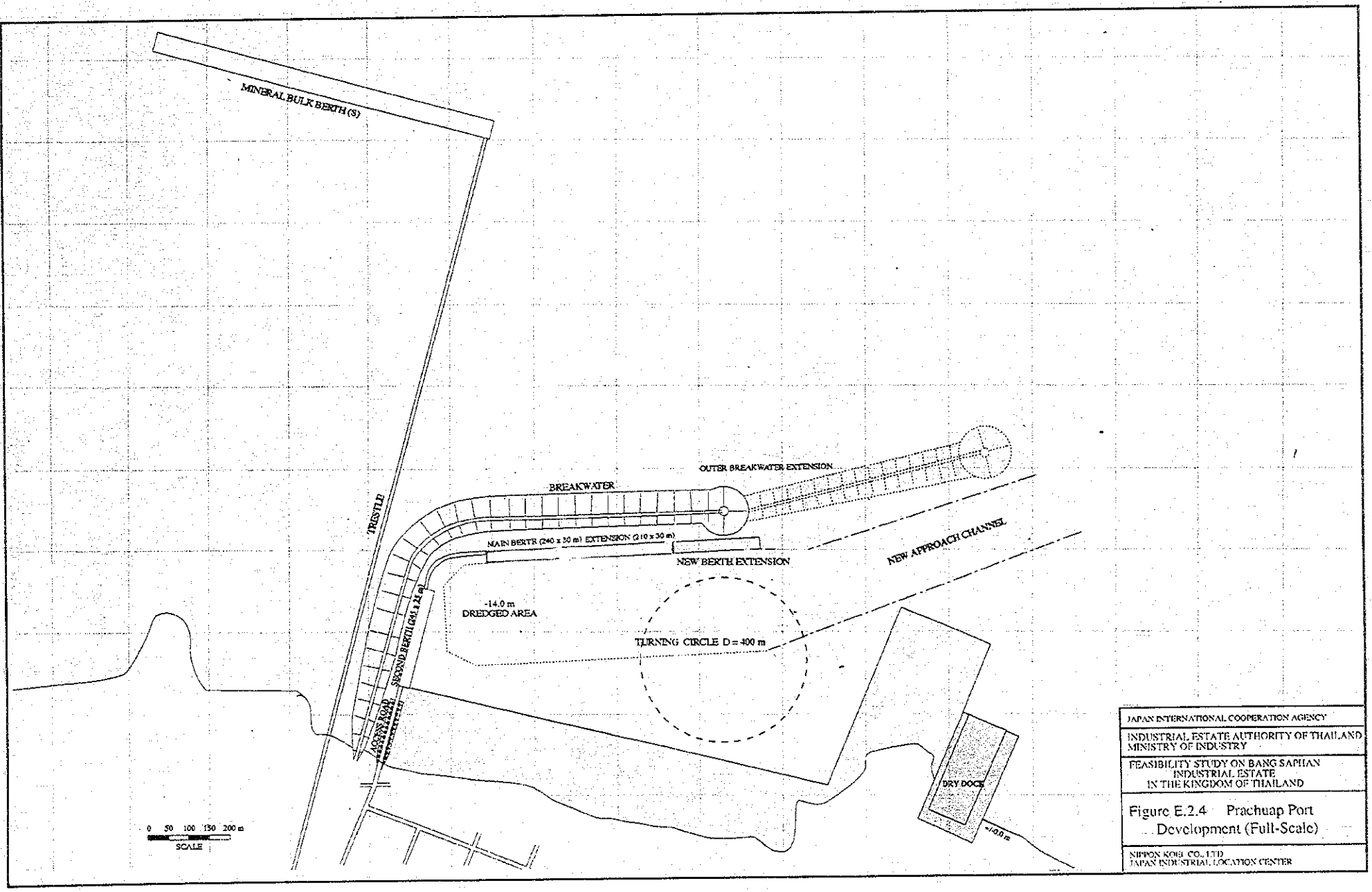

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Figure E.2.4 Prachuap Port Development (Full-Scale)

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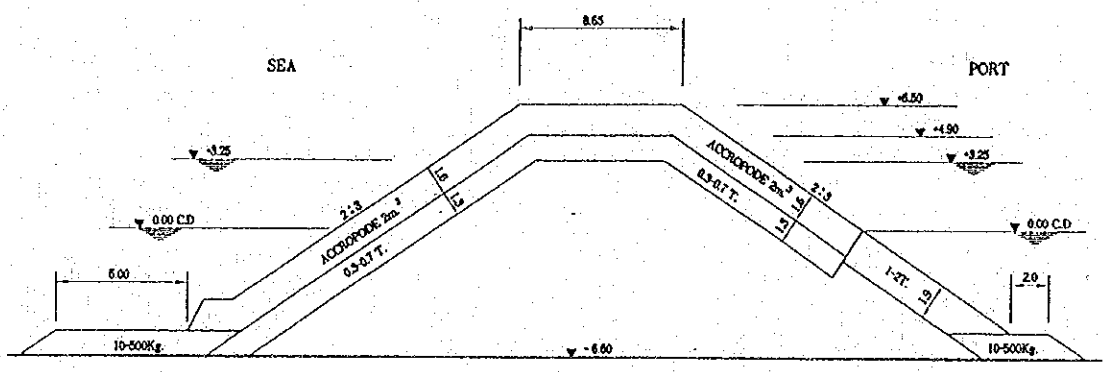
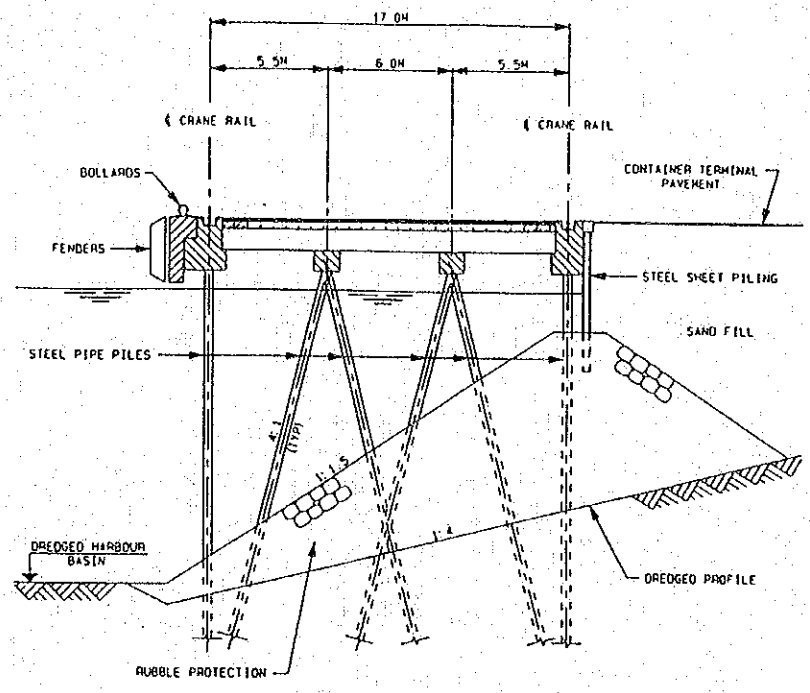
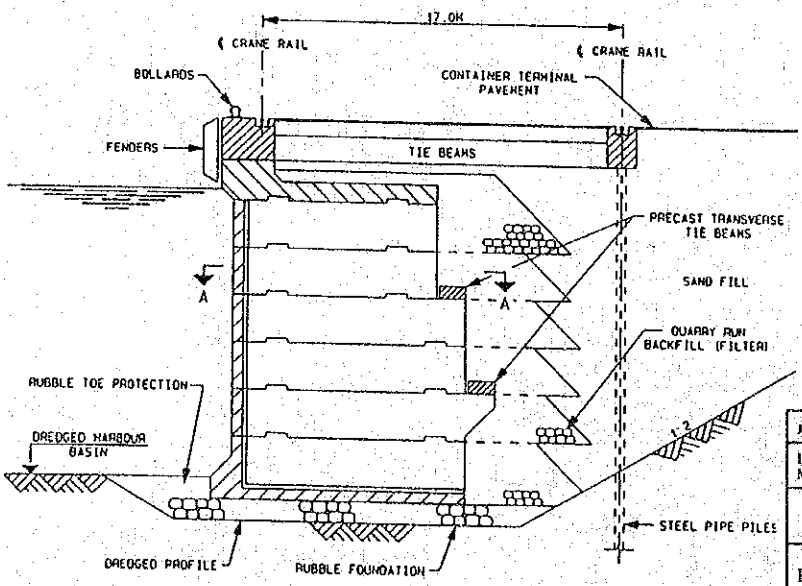


Accropode-Armoured Breakwater



Detached Wharf



Gravity-Type Wharf

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Figure E.2.5 Breakwater and Wharf Structure

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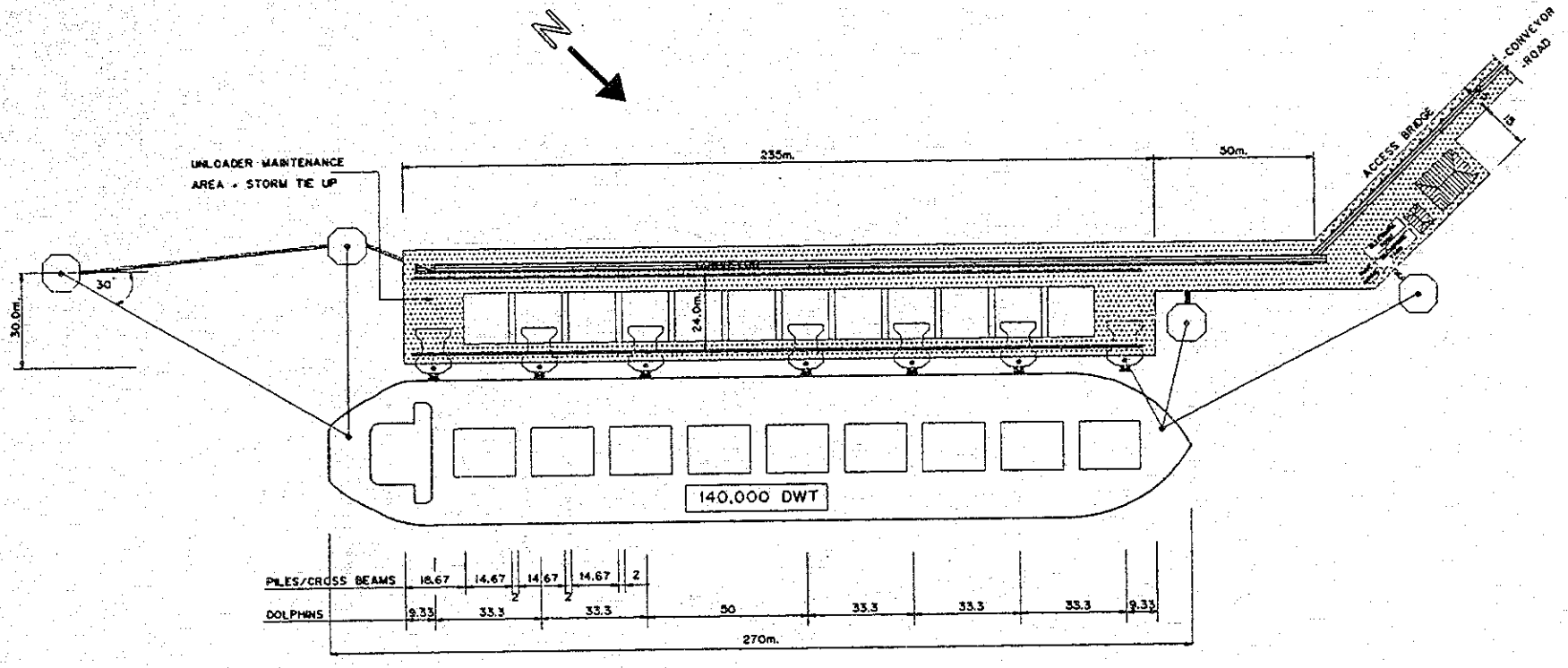

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Figure E.2.6 140,000 DWT Mineral Bulk Berth
NIPPON KOEI CO., LTD. JAPAN INDUSTRIAL LOCATION CENTER

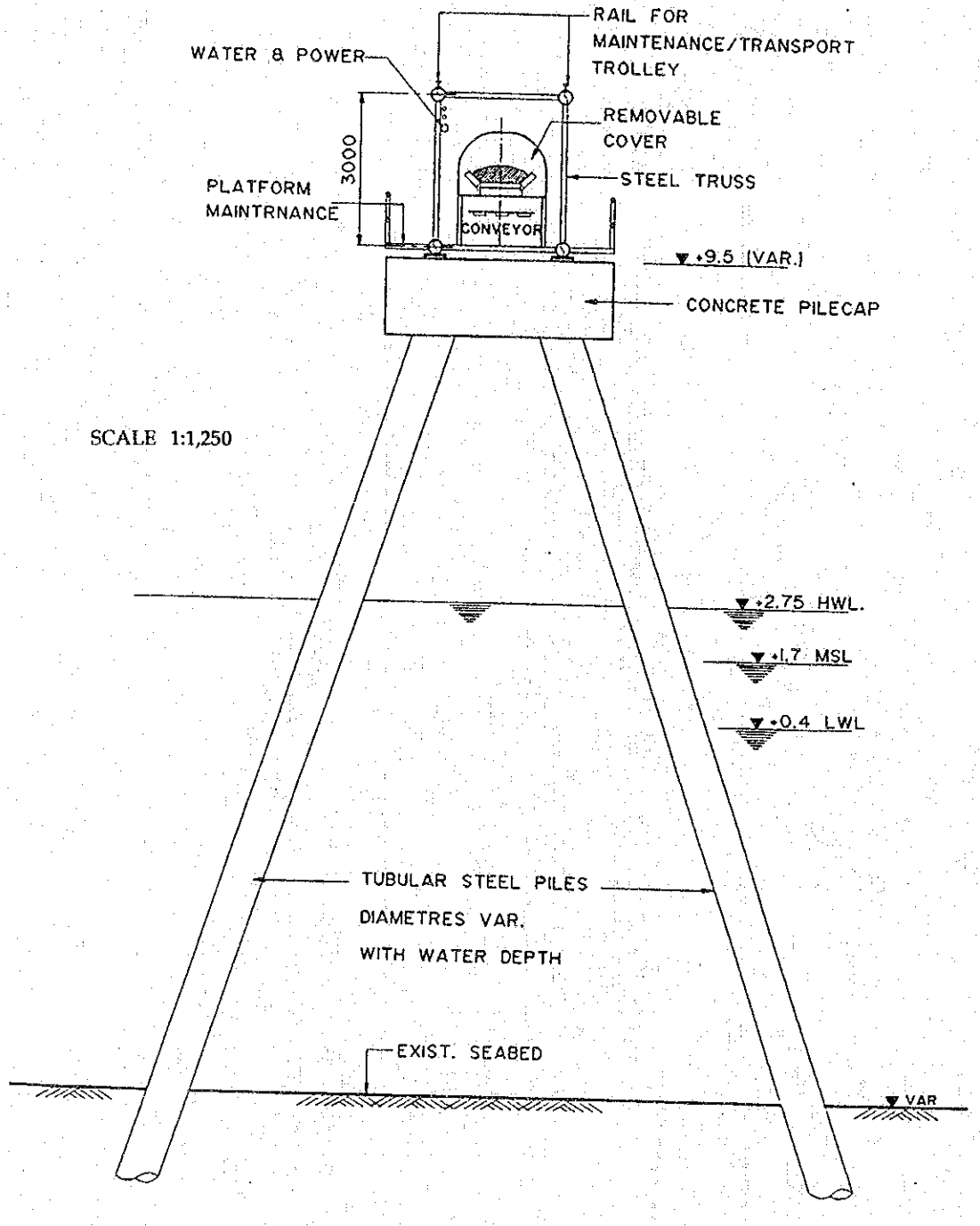

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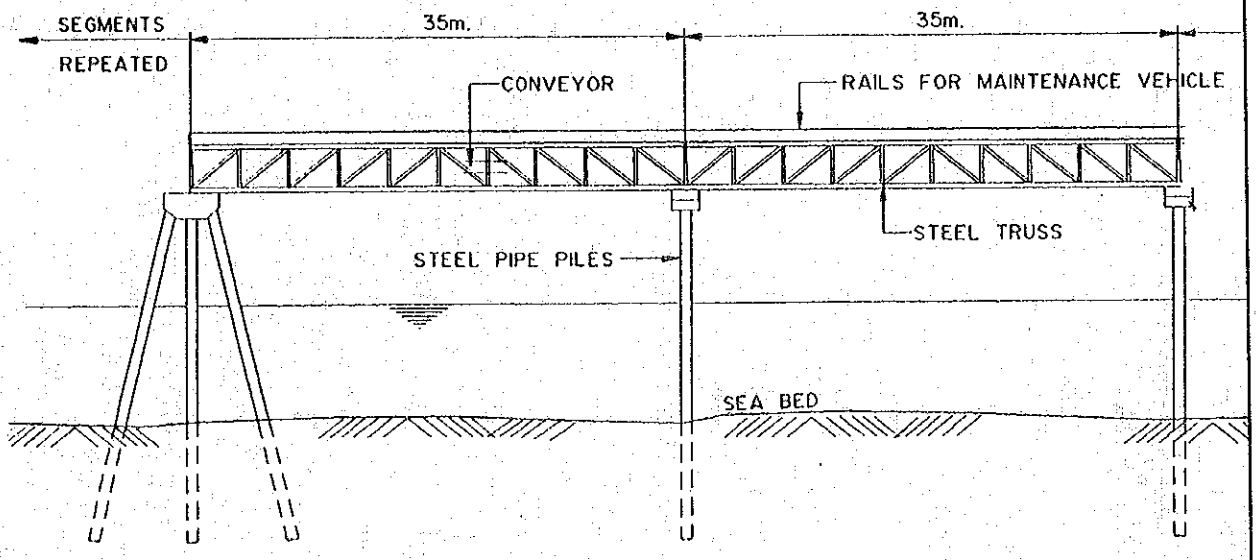
Figure E.2.7 Approach Trestle for Mineral Bulk Berth Standard Cross Section Steel Truss Girder & Pier
NIPPON KOEI CO., LTD JAPAN INDUSTRIAL LOCATION CENTER



SCALE 1:500

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Figure E.2.8 Approach Trestle for Mineral Bulk Berth Steel Pipe Truss without Road, but with Self Powered Elevation Rail Mounted Maintenance and Transport Vehicle
NIPPON KOEI CO., LTD JAPAN INDUSTRIAL LOCATION CENTER

PRACHUAP PORT DEVELOPMENT
PHASEWISE IMPLEMENTATION

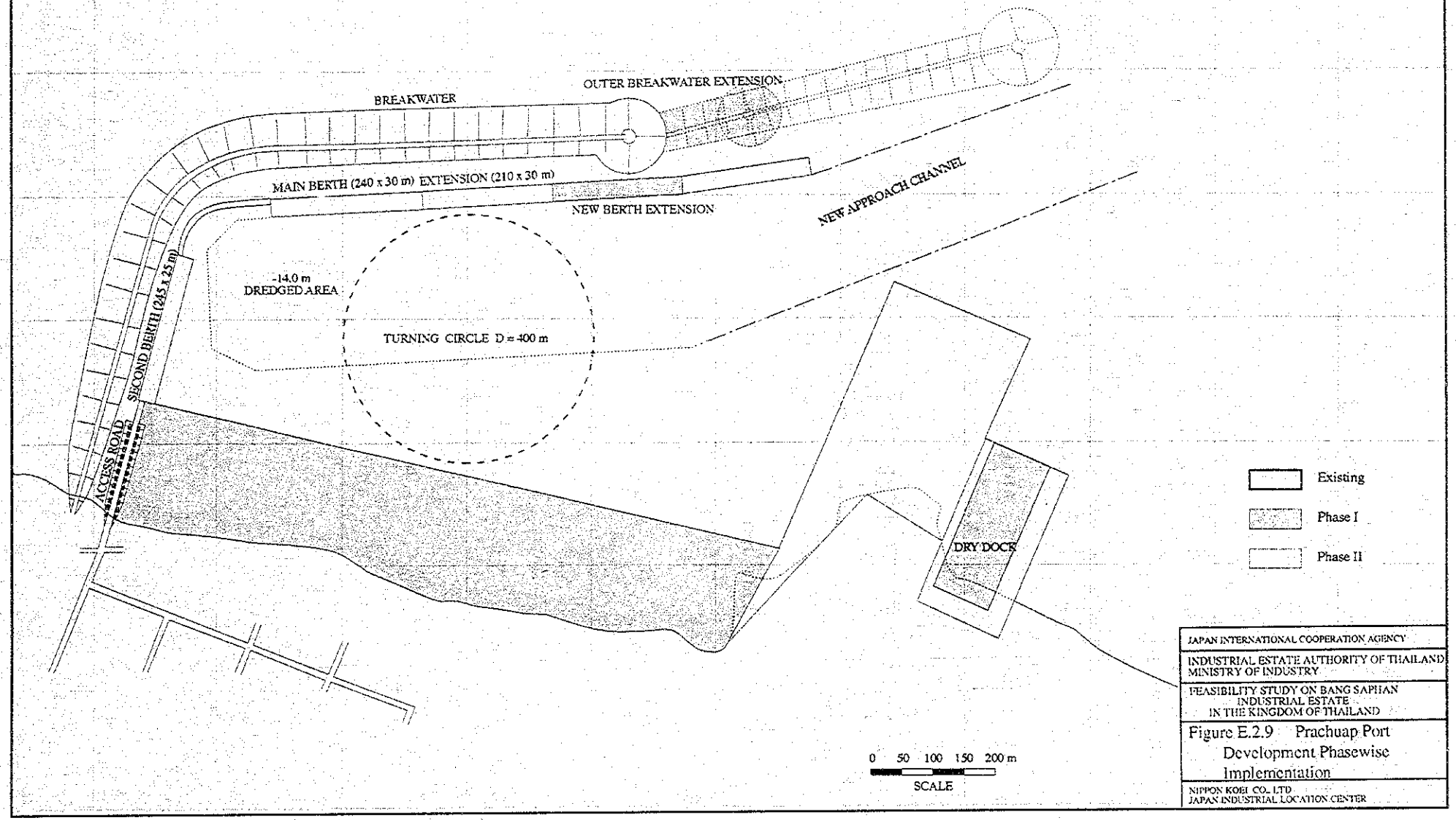

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Figure E.2.9 Prachuap Port Development Phasewise Implementation

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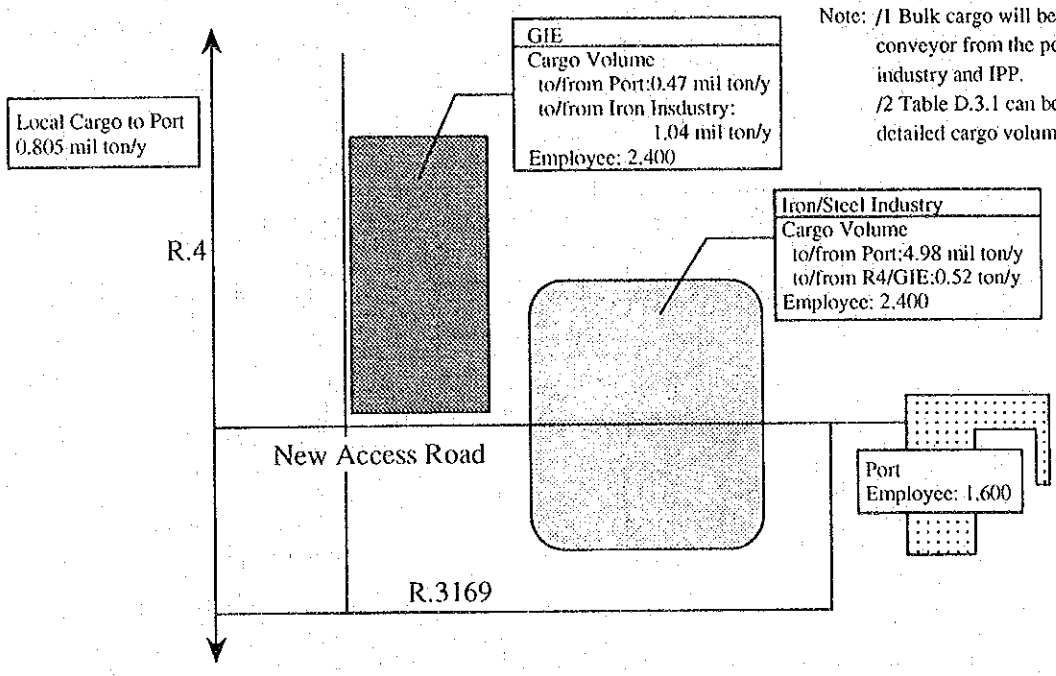
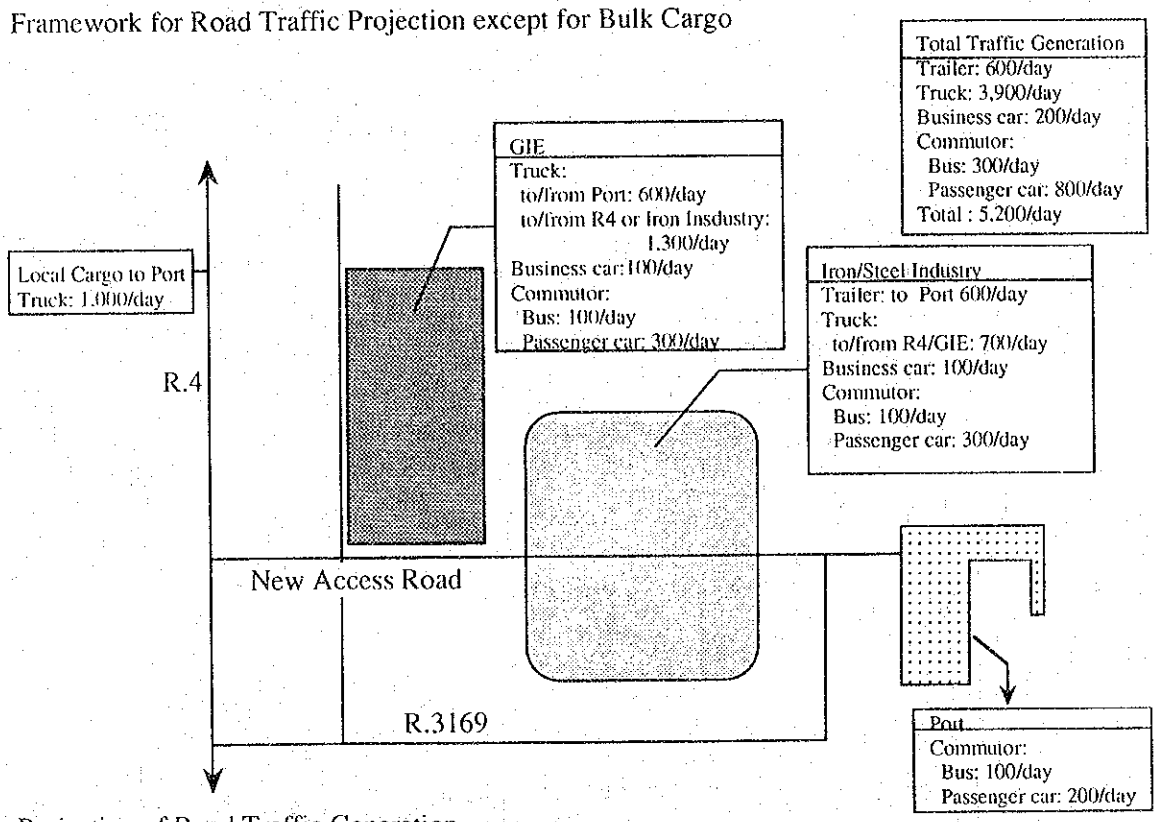


Framework for Road Traffic Projection except for Bulk Cargo



Projection of Road Traffic Generation

Estimate Basis
Trailer:Cargo volume/40ton/320days x 1.5
Truck: Cargo volume/4ton/300days x 1.5
Business car: Employee x 0.04
Commutor:
Bus: Employee x 90%/40 x 2
Passenger car: Employee x 10%/1.5 x 2

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Figure E.3.1 Projection of Traffic Generation in 2001

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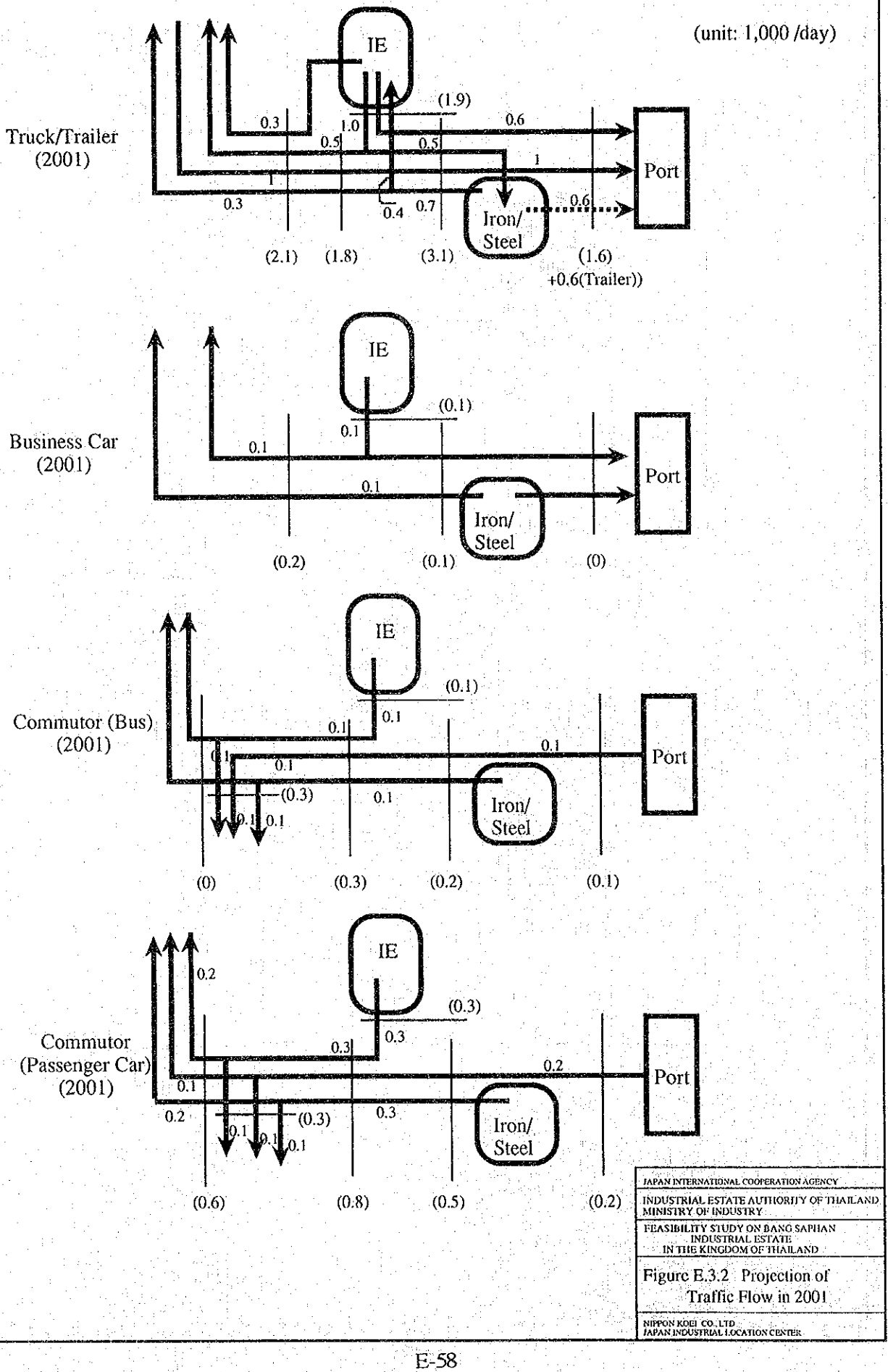
(unit: 1,000 /day)
Truck/Trailer
(2001)
IE
Port
Iron/
Steel
(1.9)
0.3
1.0
0.6
0.5
0.5
1
1
0.3
0.4
0.7
0.6
(2.1)
(1.8)
(3.1)
(1.6)
+0.6(Trailer))
Business Car
(2001)
IE
Port
Iron/
Steel
(0.1)
0.1
0.1
0.1
(0.2)
(0.1)
(0)
Commutor (Bus)
(2001)
IE
Port
Iron/
Steel
(0.1)
0.1
0.1
0.1
0.1
0.1
(0.3)
0.1
0.1
0.1
(0)
(0.3)
(0.2)
(0.1)
Commutor
(Passenger Car)
(2001)
IE
Port
Iron/
Steel
0.2
(0.3)
0.3
0.3
0.2
0.1
0.2
(0.3)
0.3
0.1
0.1
0.1
(0.6)
(0.8)
(0.5)
(0.2)
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Figure E.3.2 Projection of
Traffic Flow in 2001
NIPPON KOEI CO., LTD
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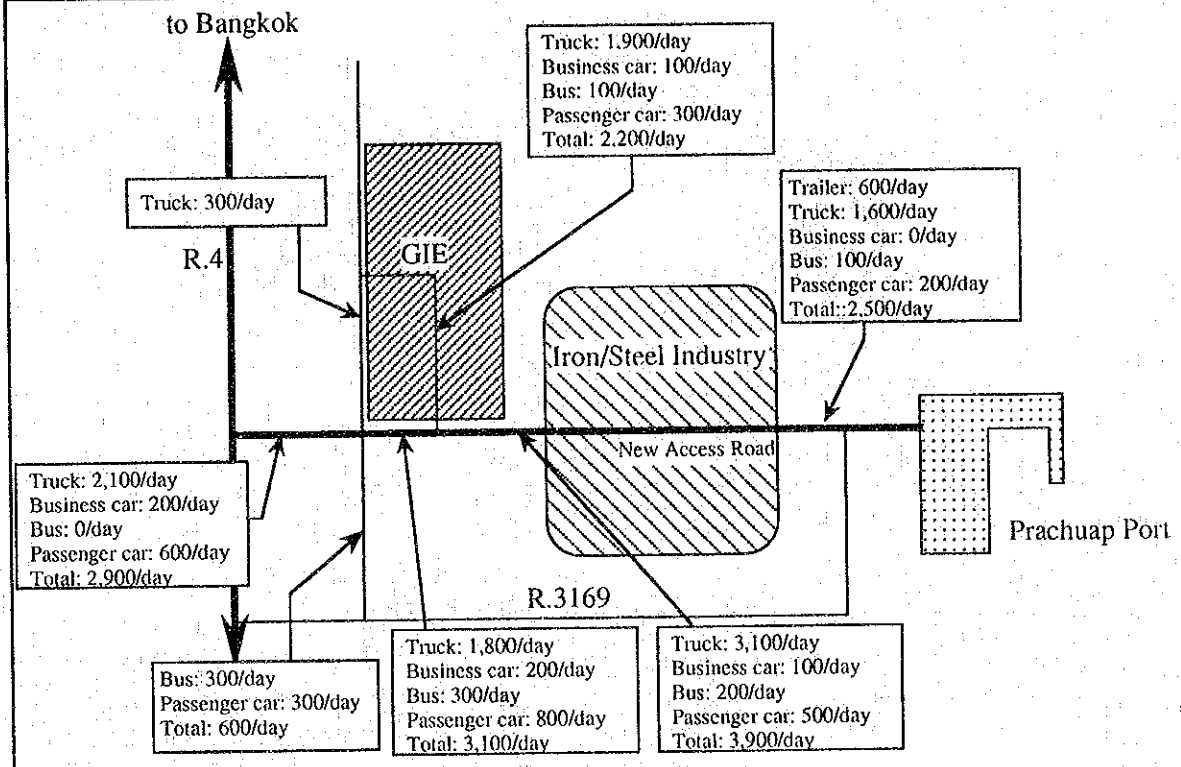
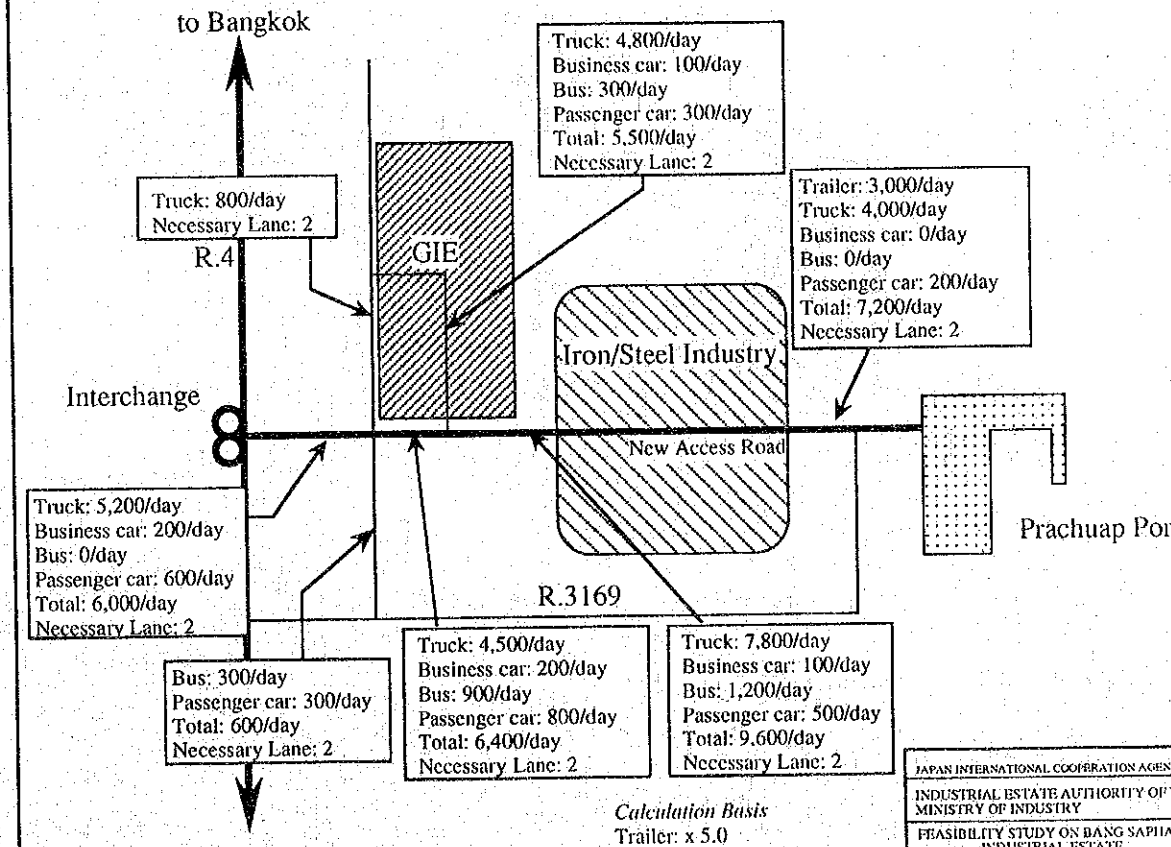


Road Traffic Projection (Actual Number of Vehicles, 2001)



Road Traffic Projection (PCU, 2001)

Calculation Basis
Trailer: x 5.0
Truck: x 2.5
Business car: x 1.0
Bus: x 3.0
Passenger car: x 1.0
Capacity per lane: 10,000 PCU

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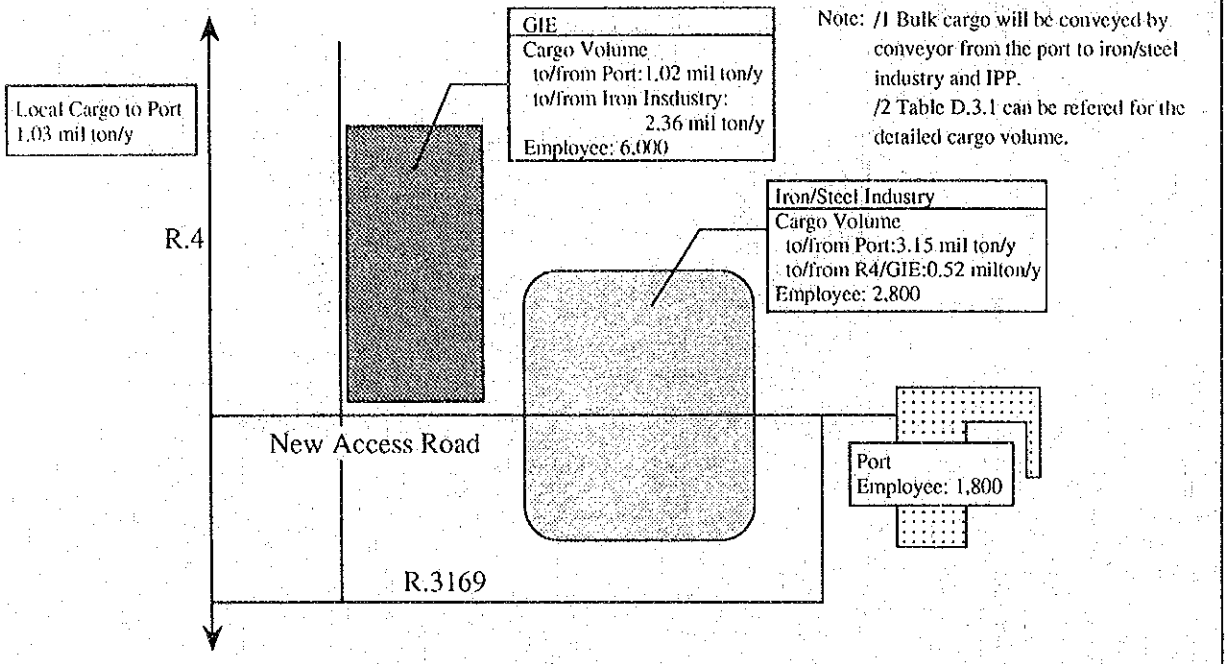
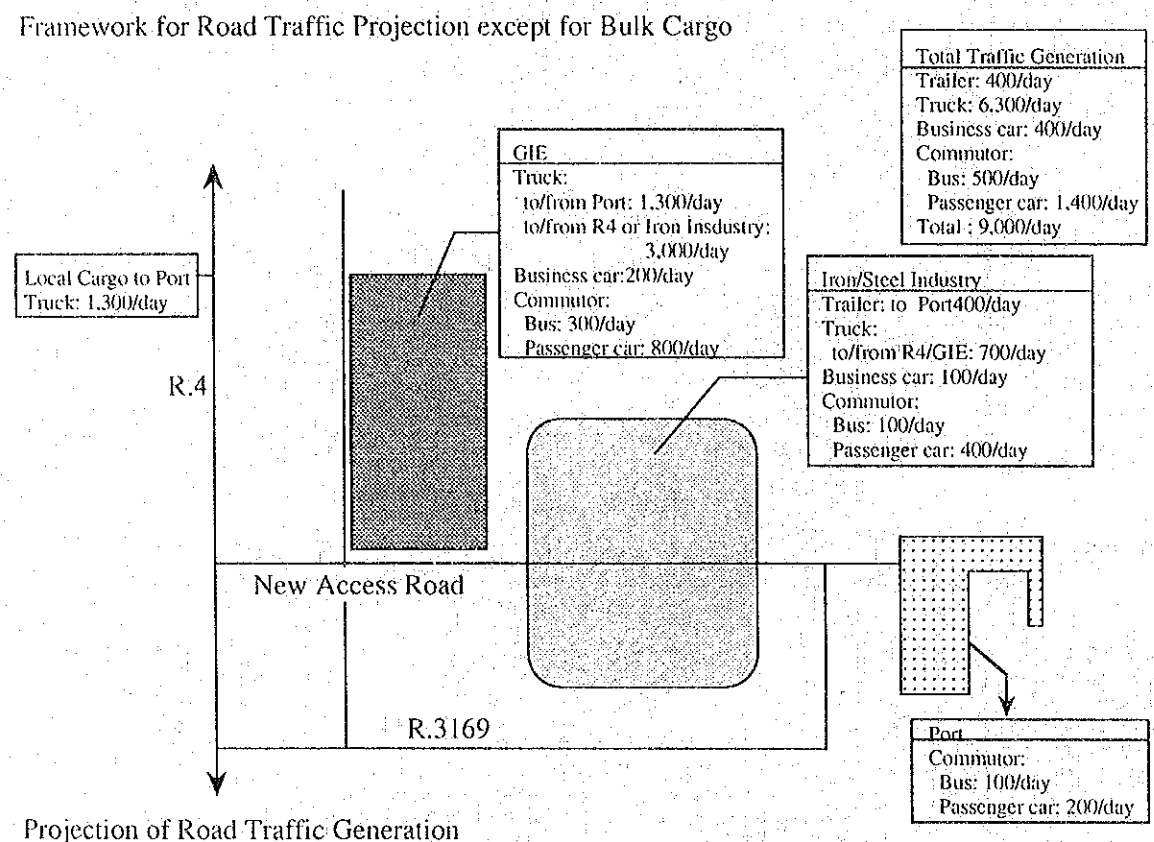
Figure E.3.3
Road Traffic Projection in 2001

NIPPON KOEI CO., LTD
JAPAN INDUSTRIAL LOCATION CENTER



Framework for Road Traffic Projection except for Bulk Cargo



Projection of Road Traffic Generation

Estimate Basis
Trailer:Cargo volume/40ton/320days x 1.5
Truck: Cargo volume/4ton/300days x 1.5
Business car: Employee x 0.04
Commutor:
Bus: Employee x 90%/40 x 2
Passenger car: Employee x 10%/1.5 x 2

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Figure E.3.4 Projection of Traffic Generation in 2006

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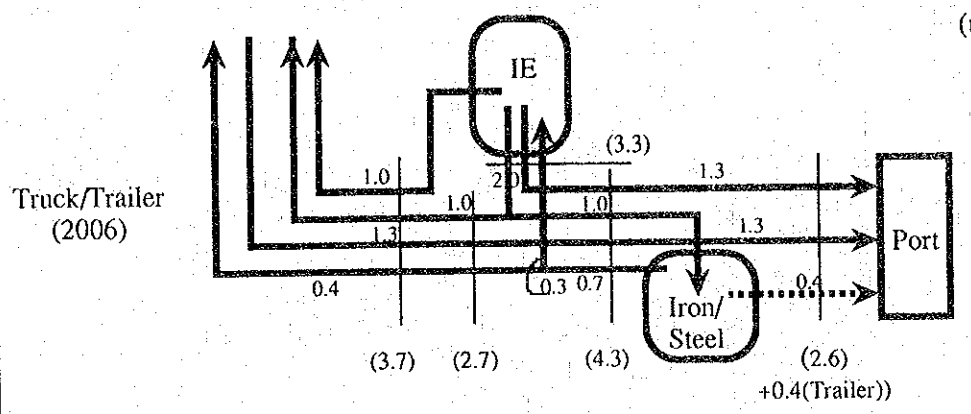
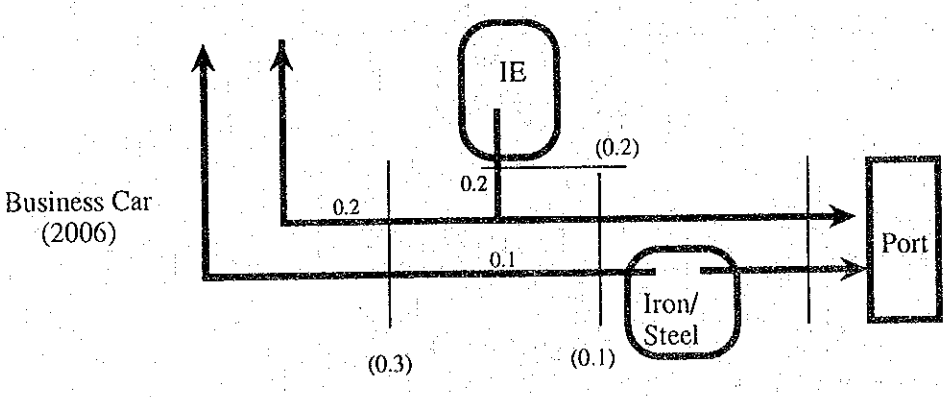
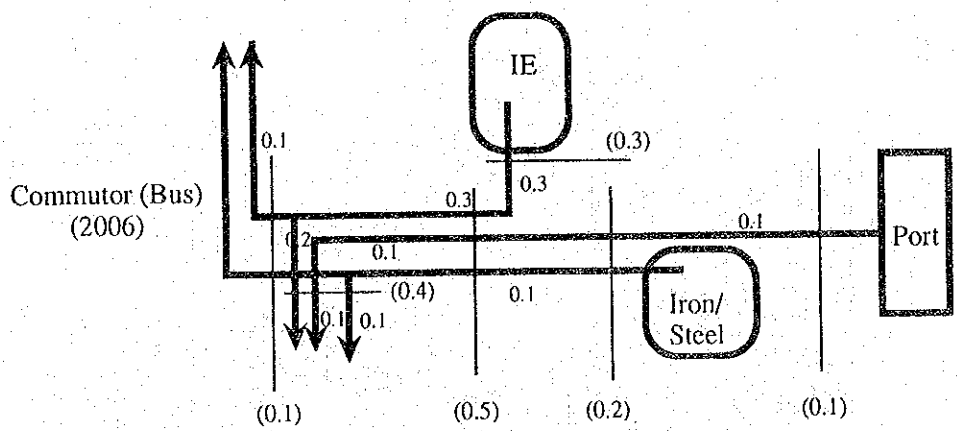
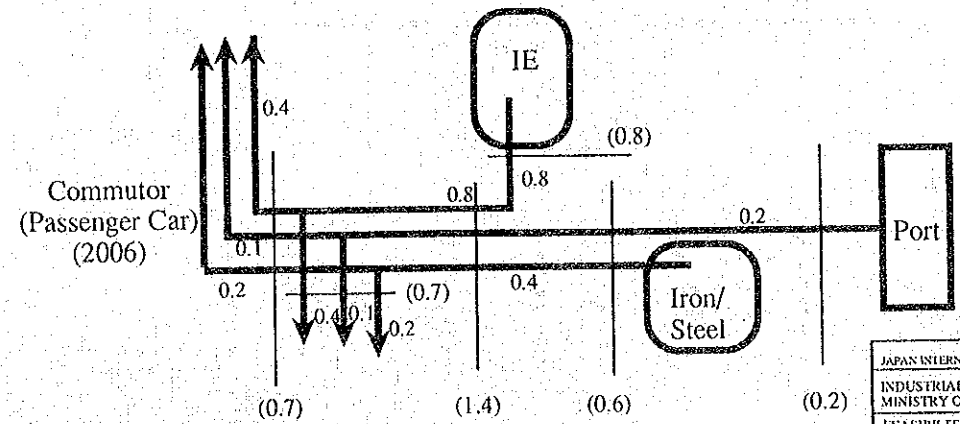
(unit: 1,000 /day)









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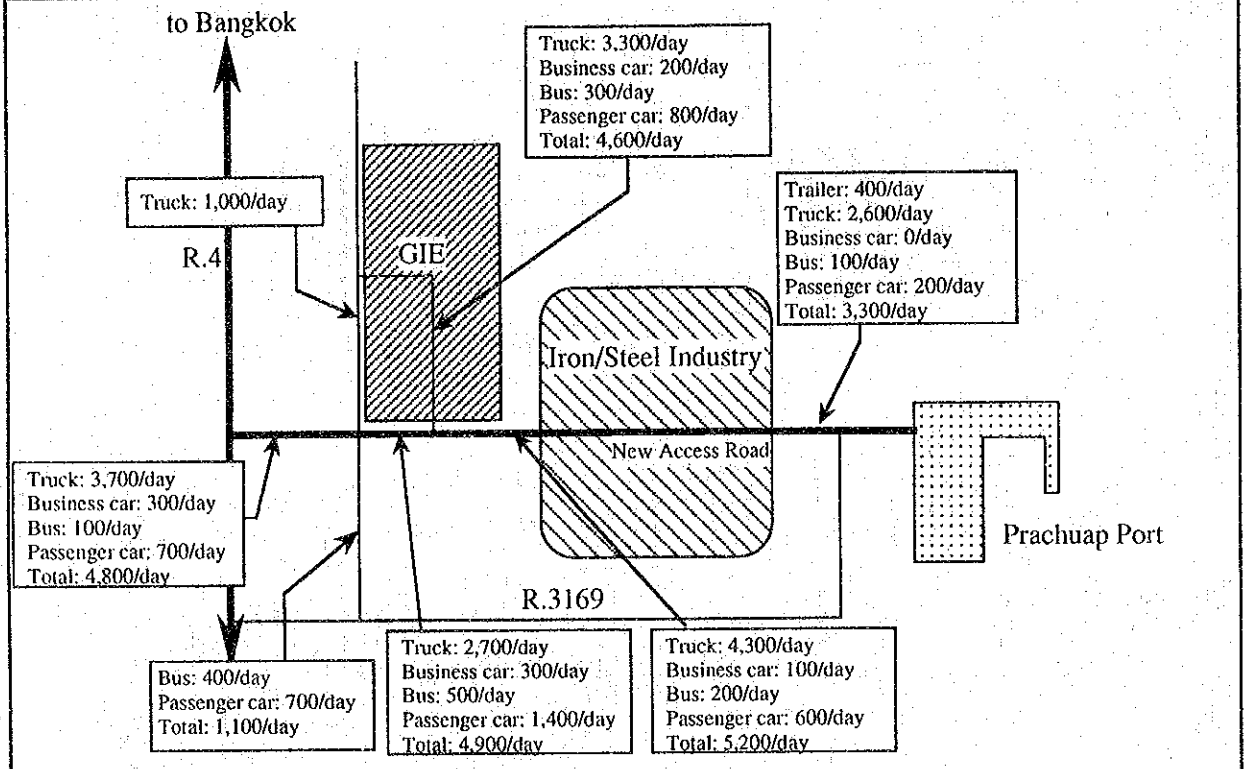
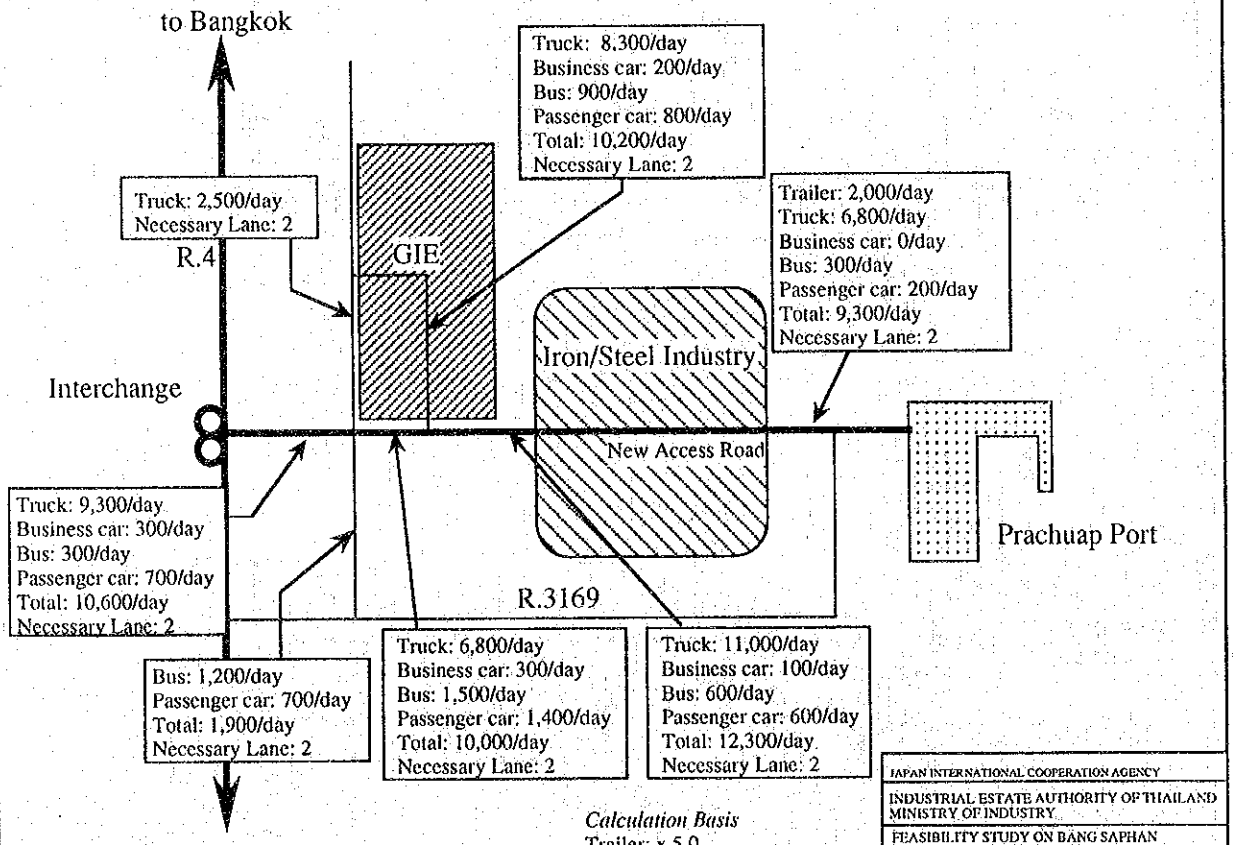
FEASIBILITY STUDY ON BANG SAPHAN INDUSTRIAL ESTATE IN THE KINGDOM OF THAILAND
Figure E.3.5 Projection of Traffic Flow in 2006
NIPPON KOEI CO., LTD JAPAN INDUSTRIAL LOCATION CENTER



Road Traffic Projection (Actual Number of Vehicles, 2006)



Road Traffic Projection (PCU, 2006)

Calculation Basis
Trailer: x 5.0
Truck: x 2.5
Business car: x 1.0
Bus: x 3.0
Passenger car: x 1.0
Capacity per lane: 10,000 PCU

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Figure E.3.6
Road Traffic Projection in 2006

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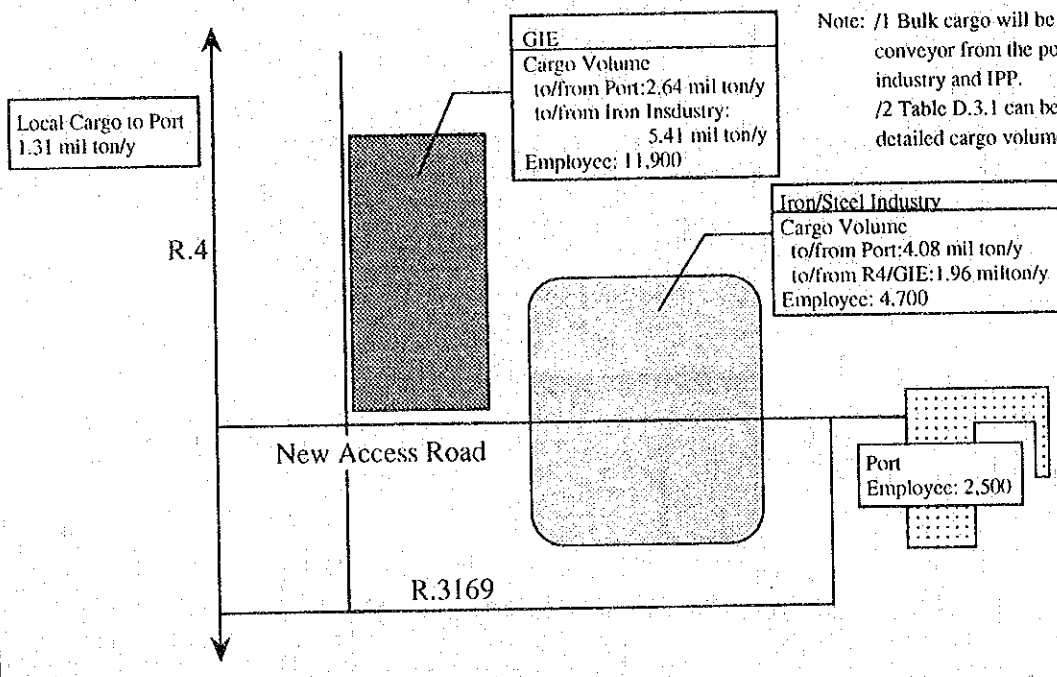
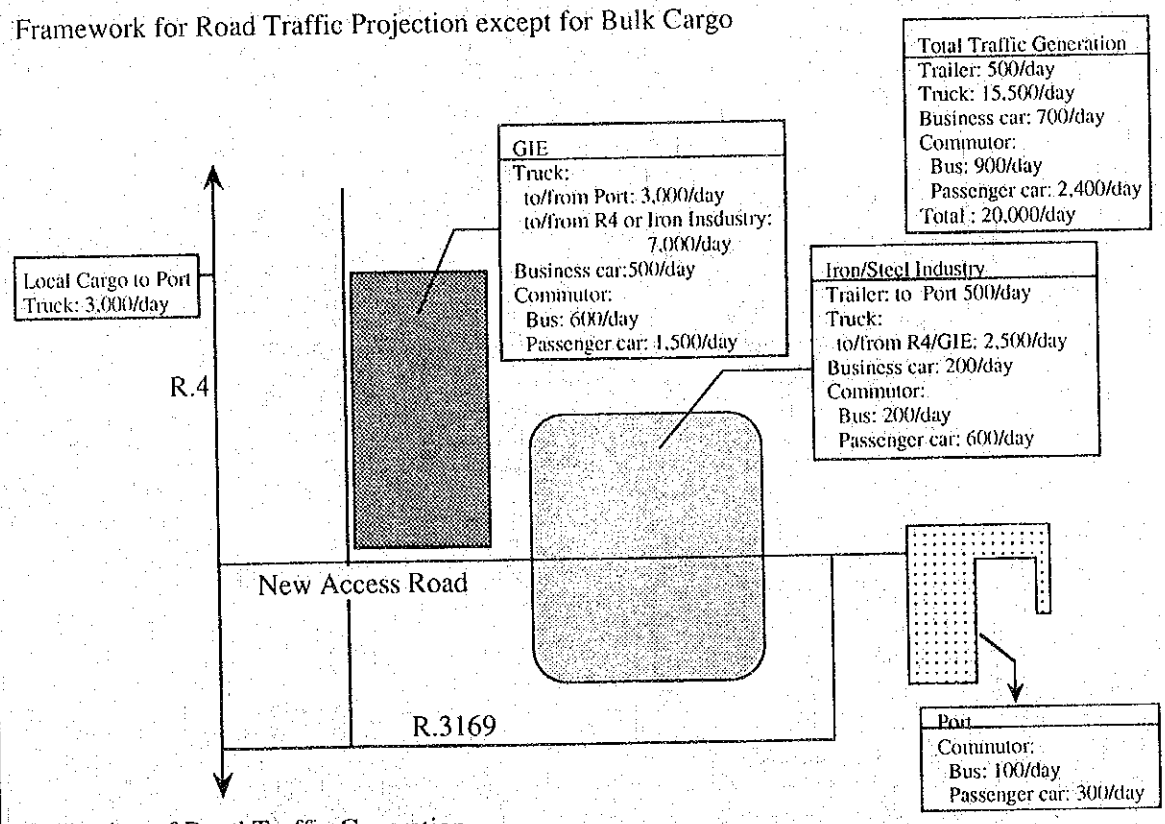


Framework for Road Traffic Projection except for Bulk Cargo



Projection of Road Traffic Generation

Estimate Basis
Trailer:Cargo volume/40ton/320days x 1.5
Truck: Cargo volume/4ton/300days x 1.5
Business car: Employee x 0.04
Commutor:
Bus: Employee x 90%/40 x 2
Passenger car: Employee x 10%/1.5 x 2

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Figure E.3.7 Projection of Traffic Generation in 2011

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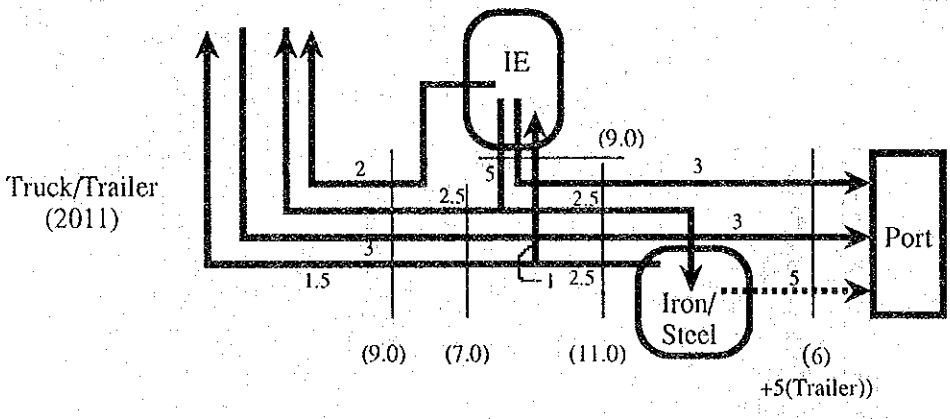
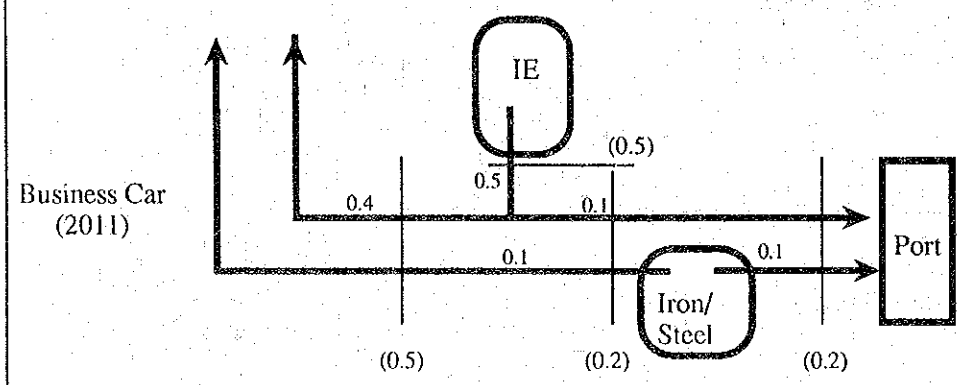
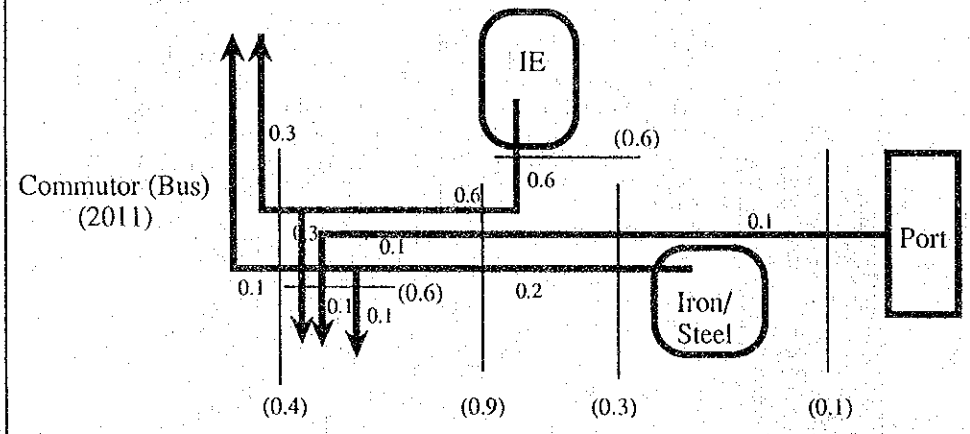
(unit: 1,000 /day)







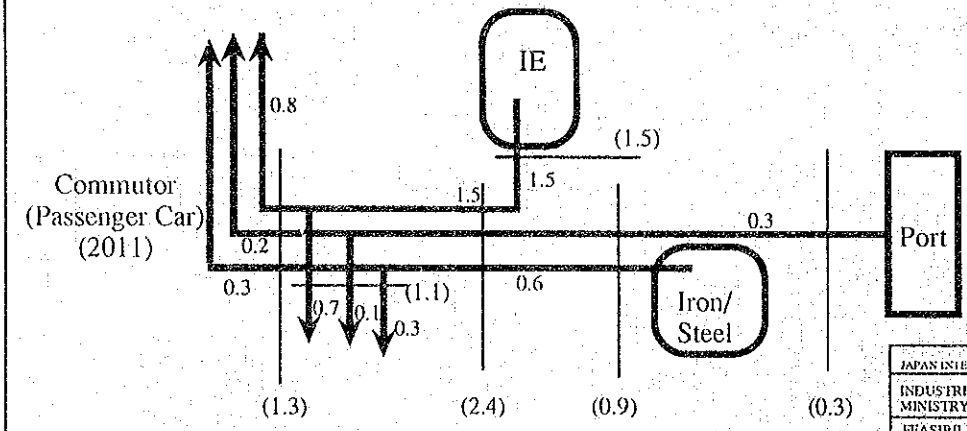


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Figure E.3.8 Projection of Traffic Flow in 2011
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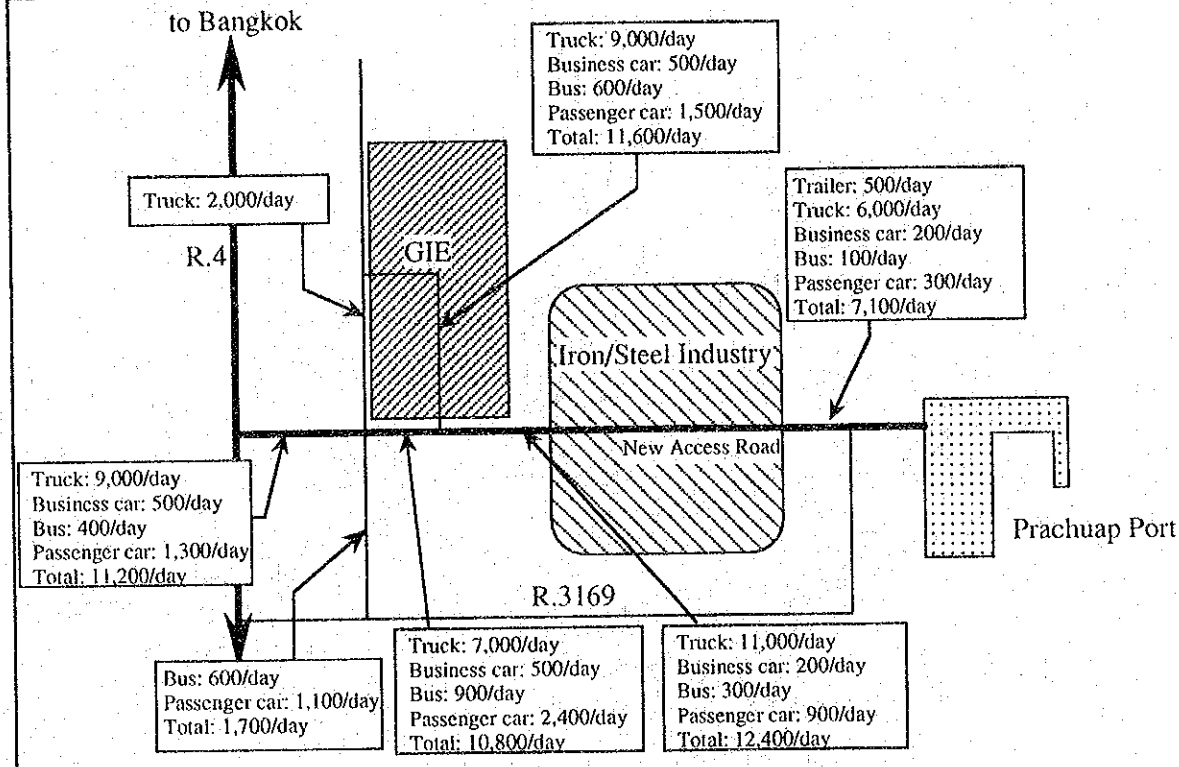
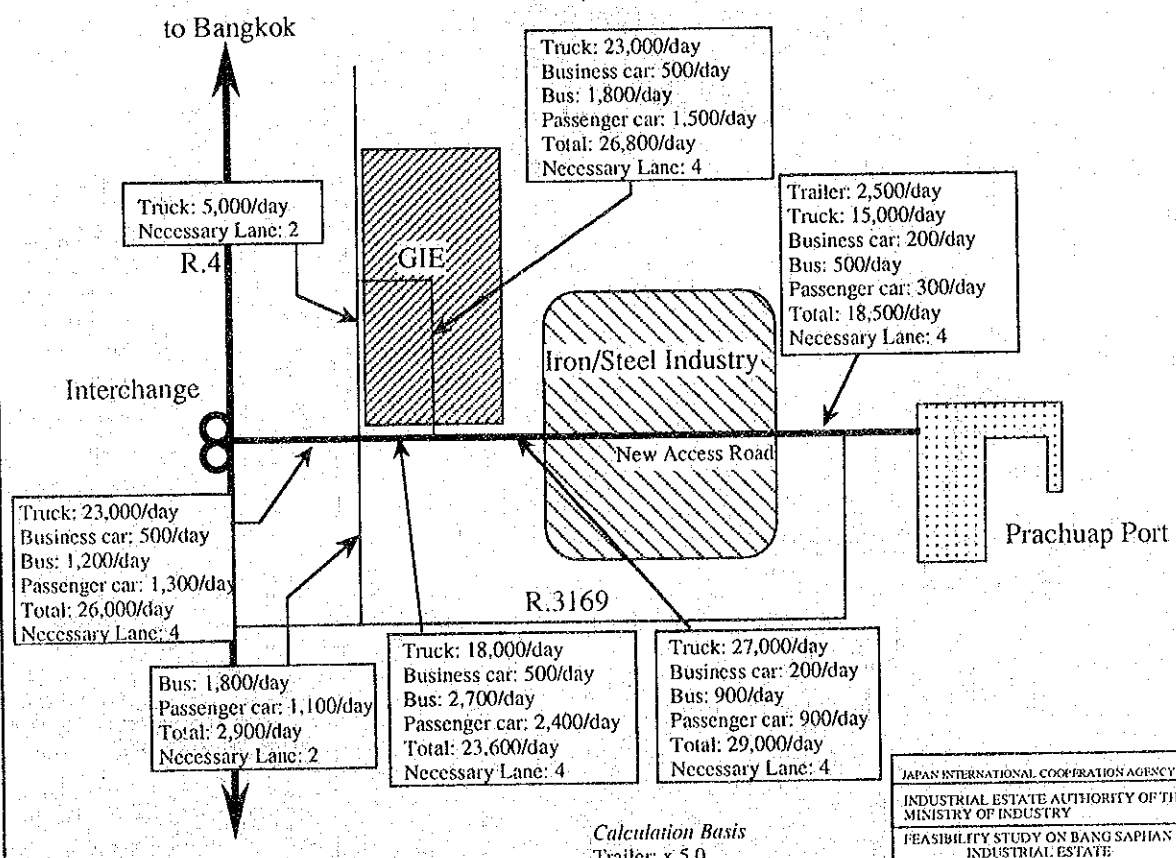


Road Traffic Projection (Actual Number of Vehicles, 2011)



Road Traffic Projection (PCU, 2011)

Calculation Basis
Trailer: x 5.0
Truck: x 2.5
Business car: x 1.0
Bus: x 3.0
Passenger car: x 1.0
Capacity per lane: 10,000 PCU

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Figure E.3.9
Road Traffic Projection in 2011

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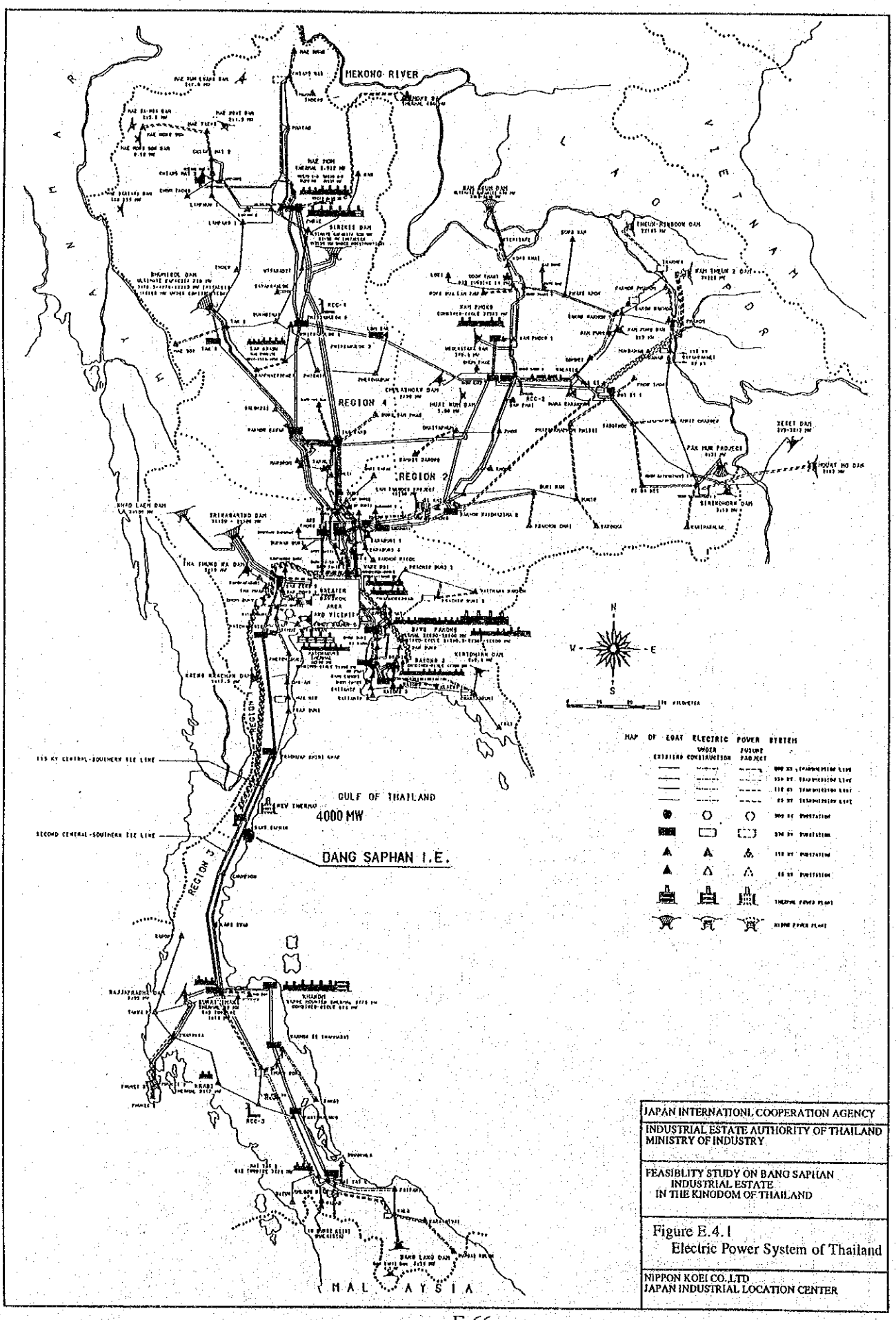

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Figure E.4.1 Electric Power System of Thailand
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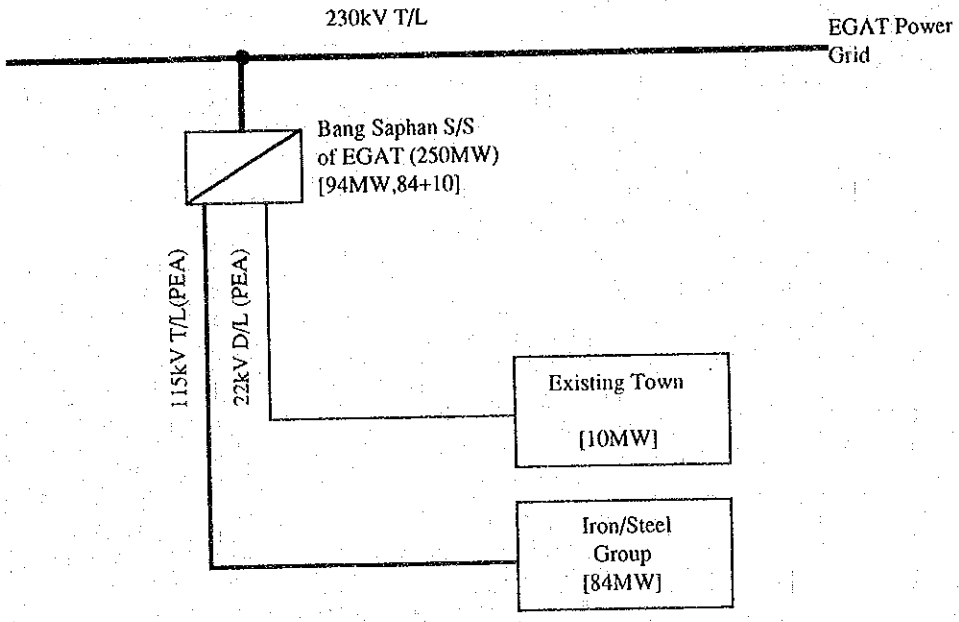
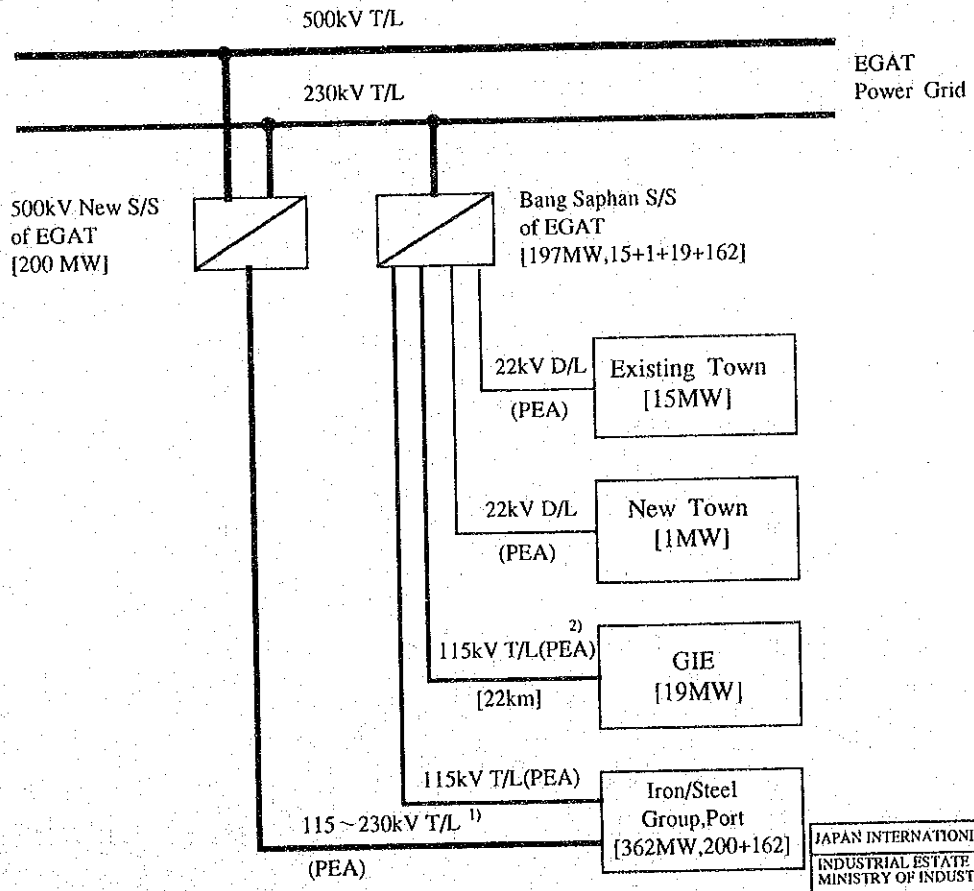
in 1995



End of 2001



Remarks 1) : Transmission voltage will depend on electricity demand of each consumer.

2) : To be constructed by the end of 2000.

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Figure E.4.2 Schematic Diagram of Power Supply System in 1995 & 2001
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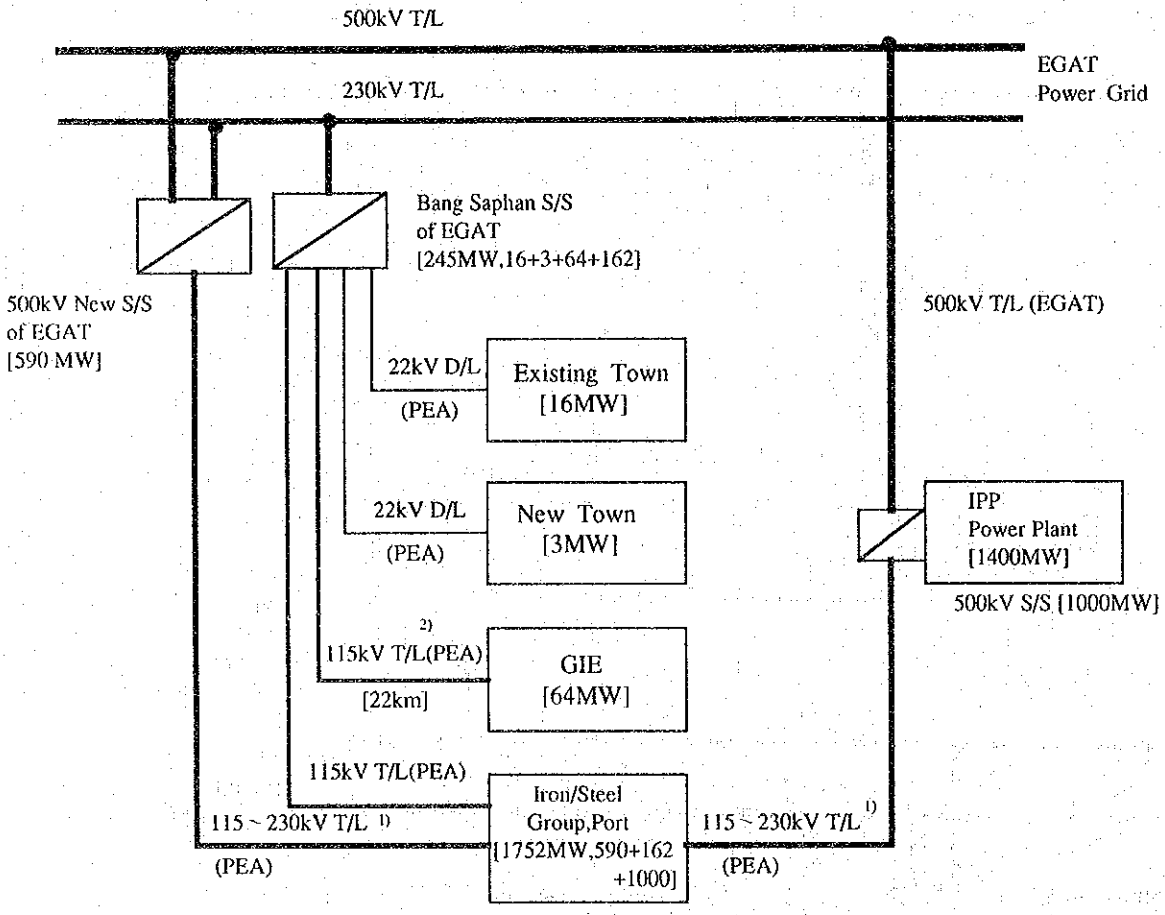
in 2006



Remarks 1) : Transmission voltage will depend on electricity demand of each consumer.

2) : To be constructed by the end of 2000.

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Figure E.4.3 Schematic Diagram of Power Supply System in 2006
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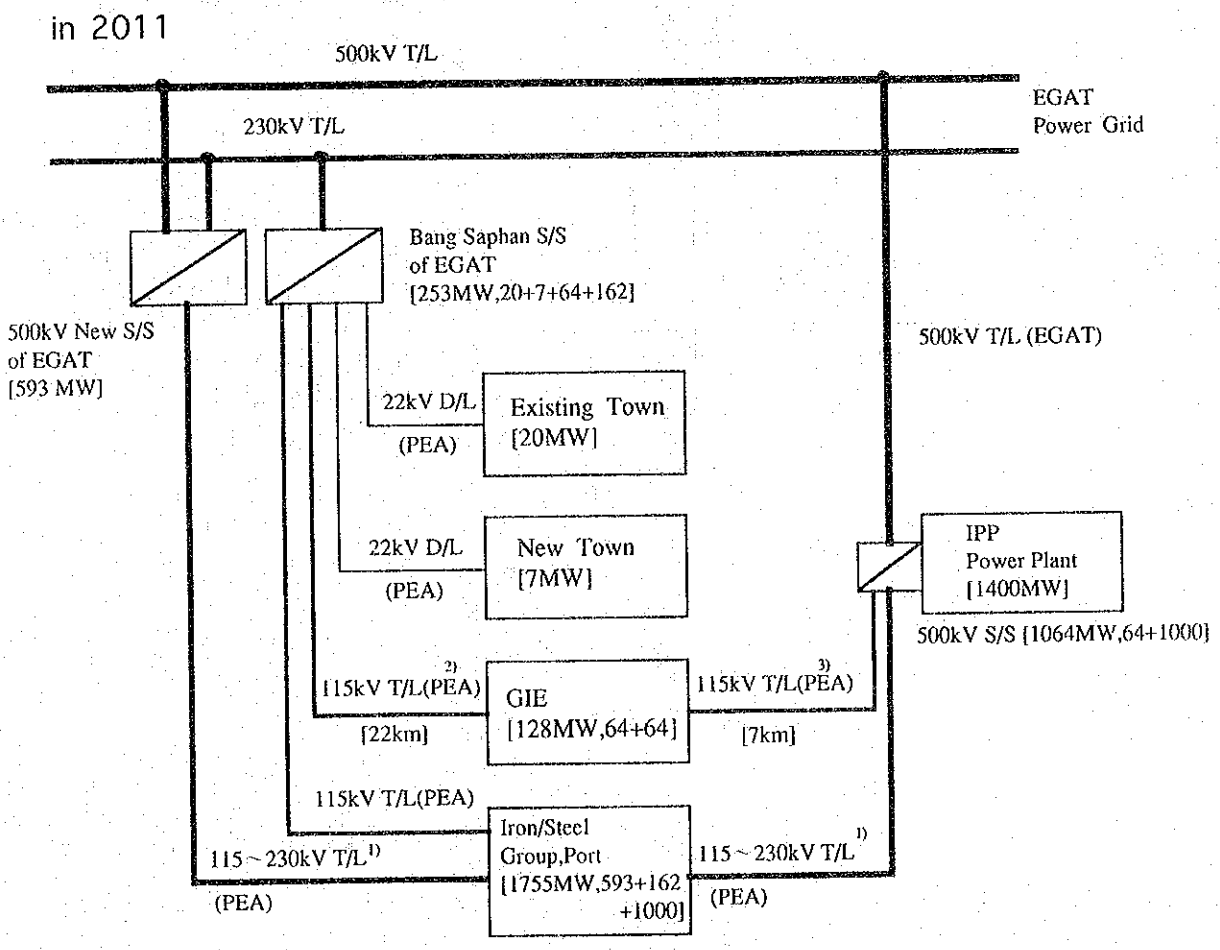

Remarks 1) : Transmission voltage will depend on electricity demand of each consumer.

2) : To be constructed by the end of 2000.

3) : To be constructed by the end of 2007.

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Figure E.4.4 Schematic Diagram of Power Supply System in 2011
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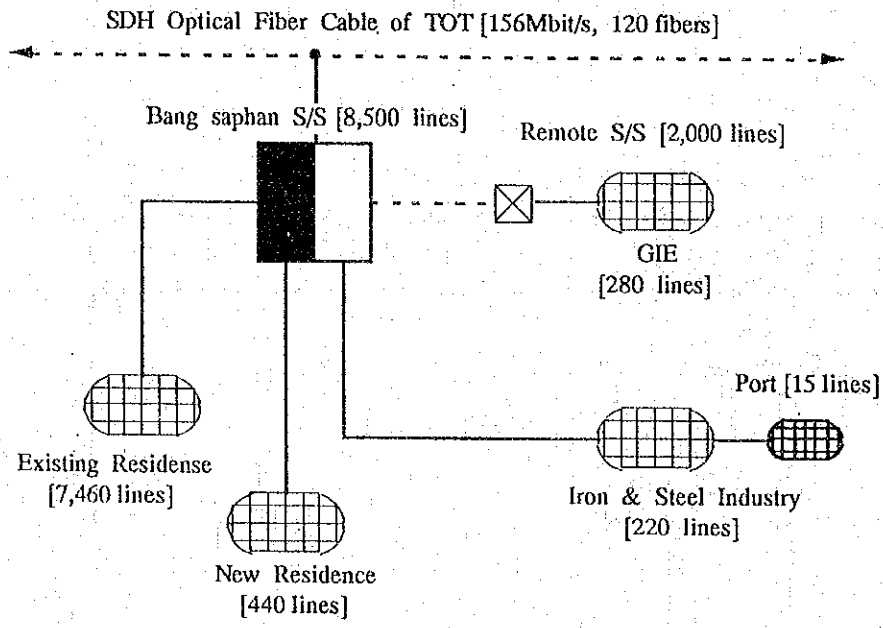
in 2001



Legend

- Switching station to be expanded
- Remote Switching station to be constructed by 2000
- Distribution line to be constructed
- Optical fiber cable to be constructed by 2000
- Distribution grid line to be constructed

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Figure E.5.1
Schematic Diagram of Telecommunications System in 2001

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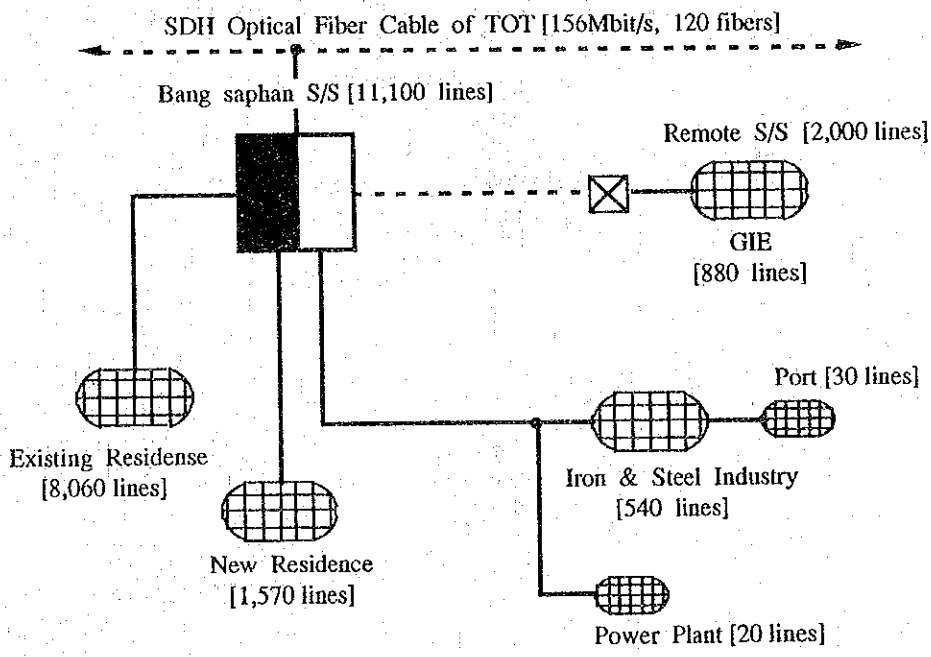
in 2006



Legend

- Switching station to be expanded
- Remote Switching station
- Distribution line to be expanded
- Optical fiber cable
- Distribution grid line to be expanded

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Figure E.5.2
Schematic Diagram of Telecommunications System in 2006

NIPPON KOEI CO.,LTD
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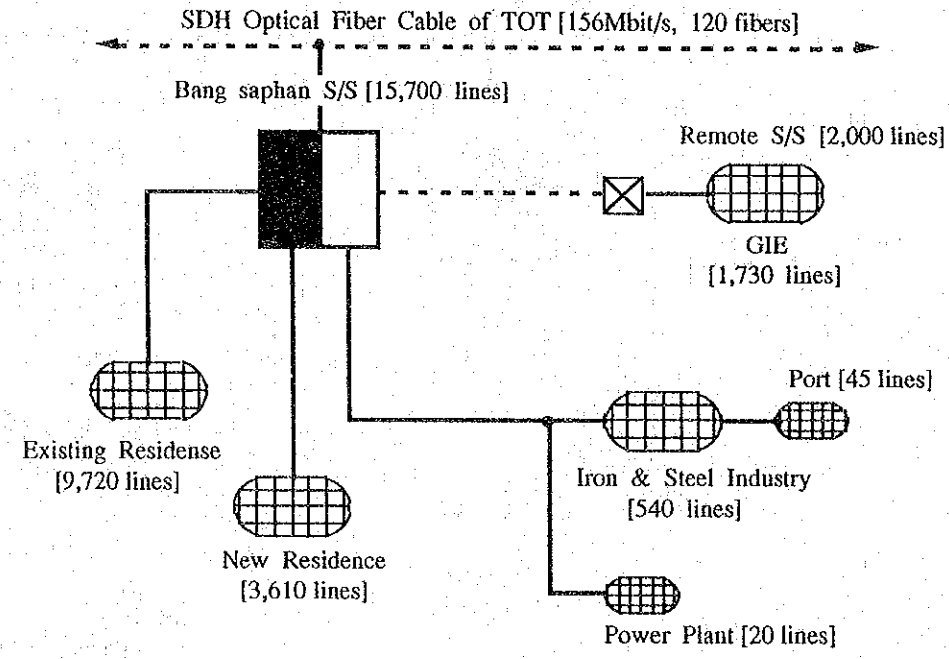
in 2011



Legend

- Switching station to be expanded
- Remote Switching station
- Distribution line to be expanded
- Optical fiber cable
- Distribution grid line to be expanded

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Figure E.5.3 Schematic Diagram of Telecommunications System in 2011
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APPENDIX F PRELIMINARY ENVIRONMENTAL IMPACT ASSESSMENT

CONTENTS

Tables

Figures

APPENDIX F PRELIMINARY ENVIRONMENTAL IMPACT ASSESSMENT

F.1 Present Conditions

F.1.1 Natural Environment in Bang Saphan area

Climatology and Air Quality

The proposed Bang Saphan Industrial Estate site is under the influence of two major monsoons, i.e. the northeast and southwest monsoons. Based on the climatological data of Prachuap Khirikhan Province for a period of 30 years (1961-1990), the monthly average values of main parameters are summarized in Table F. 1.1

The ambient air quality in the vicinity of the site was monitored by several governmental authorities and/or institutions as shown in Table F. 1.2. The three significant air pollutants i.e. TSP, SO_2 and NO_2, were measured. The results indicate that the concentrations of pollutants of interest were generally very low and well below the National Ambient Air Quality Standards of Thailand.

Water Quality

Information on surface water and groundwater in the area is limited. Significant water pollution indices measured in Klong Maerampung in the Bang Saphan area are shown in Table F.1.3. Groundwater in the area is moderately hard water. Color, chloride and iron contents are generally higher than the drinking water standards.

With regard to the coastal water, a regional survey of water quality was undertaken by several institutions. The results of water analysis are summarized in Table F. 1.4, showing that the coastal water quality in Bang Saphan District is good.

Land use

The present land use pattern of Bang Saphan District can be divided into 5 major categories as follows:

i) Urban Land : This category consists of built-up structures. Most of the urban land is located near the district government office.

ii) Agricultural Land : This category can be sub-divided into inactive paddy fields, coconut plantation, pasture, and shrimp farm.

iii) Forest Land : The forests in the area are mostly evergreen forests. Most of the forests in the Bang Saphan area are conserved by law.

iv) Idle Land : This area consists sparse patches of grass, bushes, scrub forest, and swamp which are not currently used for agricultural purpose.

v) Industrial Land and Deep Sea Port : The main industrial area is Sahaviriya Steel Complex which comprises mainly a hot-rolled mill, a cold-rolled mill, an electro-galvanizing line, and a deep sea port.

Others

i) Agriculture

The main occupation of people in Bang Saphan District is mainly agriculture. Main economic crops of the District are pineapple and coconut.

ii) Transportation

The primary highway passing through Bang Saphan District is National Highway No. 4 or Phetchkasem Road which is an artery road connecting the southern part of Thailand to the central region.

iii) Archaeology and Historical Values

It is found that there are no ancient places nor ancient objects which have been registrated with the Department of Art.

iv) Tourism and Aesthetic Values

The proposed site is a plain adjacent to the sea, with a steep seashore. Coconut plantations line the shore. The beach is narrow and a tourist spot for local tourists.

F.1.2 Social Environment

Considering project implementation, the current conditions of the basic characteristics of social environment in the Bang Saphan Area are studied and elaborated.

Population

As of 1995, Amphoe Bang Saphan had a total population of 65,503 and a total area of 876 km^2, which account for 14.6% of the total population of and 13.8% of the total area of Changwat Prachuap Khiri Khan. The population of the Amphoe has not grown significantly in the past, showing only a fairly low annual average growth rate of 0.68%. In fact, the total population of the Amphoe has increased only by 3,864 from 1987 to 1995, as presented in Table F.1.5.

Amphoe Bang Saphan consists of seven tambons: Tongchai, Chaikasem, Thongmongkon, Ron Thong, Kamnert Noppakhun, Pongprasart, and Maeramperng. As observed through the previous population trend of the Amphoe, population growth of each tambon has been also fairly stable in the past with a relatively low annual average growth rate ranging from -1.77% in Tambon Kamnert Noppakhun to 1.55% in Tambon Maeramperng. An exception is Tambon Ron Thong where a fairly high growth rate of 4.33% was observed.

The most populated area in Amphoe Bang Saphan is Tambon Ron Thong with a total population of 14,228 or 21.7% of the Amphoe's total population as of 1995. This area is becoming another Amphoe's town core as local industry grows, due mostly to its location at a junction of the national highway Route 4 running from Bangkok in the north to Malaysia in the south and the local road Route 3196 connecting the Amphoe's town center. The population density of Tambon Ron Thong is 62 people/km^2, which is lower than the Amphoe's average of 75 people/km^2, giving potential for further development in this area. There are a total of 13,476 households in the Amphoe with an average household size of 4.9 people, as presented in Table F.1.6.

In Amphoe Bang Saphan, three sanitary districts have been established in the populated areas: Tambon Kamnert Noppakhun in the town center, Tambon Ban Kurt to the north along the coastal area, and Tambon Ron Thong to the west of the town center. The population of the sanitary districts as of 1995 is estimated at 18,740, accounting for 28.6% of the total population. Characteristics of each sanitary district are summarized in Table F.1.7.

Labor Force

As presented in Table F.1.8, 3,268 workers were engaged in the industrial sector and 1,280 workers in the service sector as of 1995, accounting for 4.9% of the total population of Amphoe Bang Saphan. The number of workers has increased at a fairly