JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

No. 36

MINISTRY OF INDUSTRY
VIET NAM STEEL CORPORATION
THE SOCIALIST REPUBLIC OF VIET NAM

THE MASTER PLAN STUDY ON THE DEVELOPMENT OF THE STEEL INDUSTRY IN THE SOCIALIST REPUBLIC OF VIET NAM

FINAL REPORT EXCERPT FOR EXECUTIVES

March 1998

NIPPON STEEL CORPORATION

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The Master Plan Study on the Development of the Steel Industry in The Socialist Republic of Viet Nam

Final Report (Excerpt for Summary)

March 1998

Nippon Steel Corporation, Tokyo

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Section 1 Recommendations

Chapter I Background to "the Master Plan Study on the Development of the Steel Industry in the Socialist Republic of Viet Nam"

Part 1 Background to "the Master Plan Study on the Development of the Steel Industry in the Socialist Republic of Viet Nam"

Section 1 Background to "the Master Plan Study on the Development of the Steel Industry in the Socialist Republic of Viet Nam"

1. Background to the study

After Viet Nam won its independence from France (September 1945), it went through a long period of war. In July 1976, the unification of North and South was realized, and the Socialist Republic of Viet Nam has since then been engaged in postwar reconstruction under a socialistic system. In December 1986, the country decided to adopt Doi Moi (reform) policy, and this policy aims at:

(1) relaxation of the centrally planned production, introduction of the independent profit system, and introduction of the production contracting system

(2) placing weight of production on food, essential goods and export goods

(3) opening economy to outside, and legislation for accepting foreign investments.

Afterwards, agricultural produce remarkably increased under the policies of reducing agricultural tax rates etc.

On the other hand, although inflation advanced in the latter half of the 1980's, it was successfully restrained by inflation control policies such as reduction in government subsidies, tight budget, interest rate raising, and curbing of the rise of wages. Owing, however, to the influence of the collapse of the USSR, the COMECON trade system was disrupted, and trade settlement by hard currency became necessary. Then, because of the cessation of economic assistance from Russia and the shortage of imported fundamental materials due to chronic shortage of foreign currencies, the resurgence of inflation has been feared.

A new economic plan was adopted at the Seventh National Congress in 1991, which aims to achieve, while promoting market economy, an annual growth rate of 4-5% in agriculture and 10-12% in industry over a period of 10 years accomplishing GDP in the year 2000 double that in 1990.

At the Eighth National Congress in June last year, an average annual growth rate of 8.2% in GDP from 1991 to 1995 was confirmed, and it was also announced that the country would strive to grow to be an industrial nation by the year 2020.

The production of iron and steel used to be controlled by Vietnam Steel Corporation (VSC), a substructure of the Ministry of Industry, which controls materials industries.

The steel industry today has an imbalance between the upstream process which produces crude steel and the downstream process which manufactures rolled products. The combined North and South annual production by the upstream process is said to be about 300,000 tons while the annual production by the downstream varies from 1,000,000 to 1,500,000 tons. This gap in production capacity seems to have been filled with imported semi-products. It is strongly felt, however, that the construction of an integrated steelworks to resolve this imbalance problem and the introduction of a structure for producing steel products for shipbuilding and automotive applications expected during 2000-2010 are urgent.

The actual production of steel products in 1995 was about 500,000 tons while the domestic demand in the same year was about 1,100,000 tons. The gap amounting to about 600,000 tons was filled with imported steel products.

The domestic demand projection for 2000 is said to be about 3,500,000 tons. The Government of Viet Nam has requested Japan to carry out master-plan planning for the promotion of the steel industry and a pre-feasibility study for the construction of an expected new integrated steelworks in Viet Nam.

To respond to this request, the Japan International Cooperation Agency dispatched a pre-survey mission from June 6 to 15, 1996 to Viet Nam to discuss the details, scope, etc., of the feasibility study based on the background and history to the request. As agreement was reached with the Government of Viet Nam, the agreement document on the scope of work (S/W) of the feasibility study was signed on June 12.

2. Purposes of the study

The purposes of the study are:

(1) to work out a master plan for the promotion of the steel industry, first by obtaining the information on the future outlook (2010) and supply-demand projections based on socioeconomic policies, development plans, and the present state of the steel industry, secondly by examining viable domestic projects and sites from the conditions of domestic resources, site conditions, etc., thirdly by planning an optimum production structure required for the Vietnamese steel industry in 2010 including the revamping of existing works, and lastly by suggesting crucial policies;

(2) to carry out a pre-feasibility study on the priority project selected by the Viet Nam side if a decision is made that the construction of a new steelworks is necessary as a result of the master plan study; and

(3) to transfer the technology of making various polices for the promotion of the steel industry, feasibility study procedures, etc., to the Vietnamese counterparts.

3. Study schedule

This study, following the preparatory work in September 1996, was started by dispatching the first site-study mission and conducted as shown in Figure 1-1.

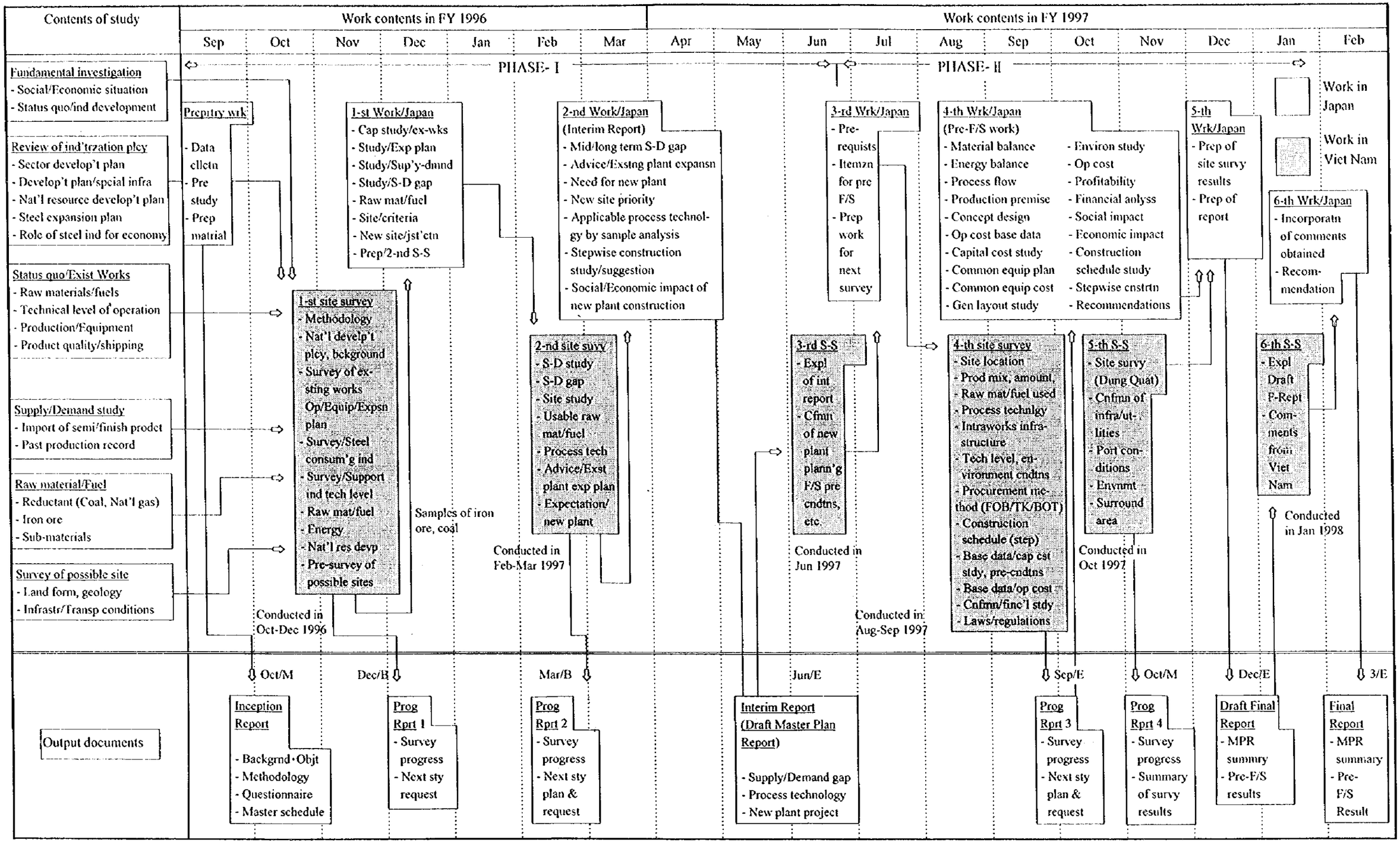


Figure 1-1 Overall Schedule of Master Plan & Pre-Feasibility Study

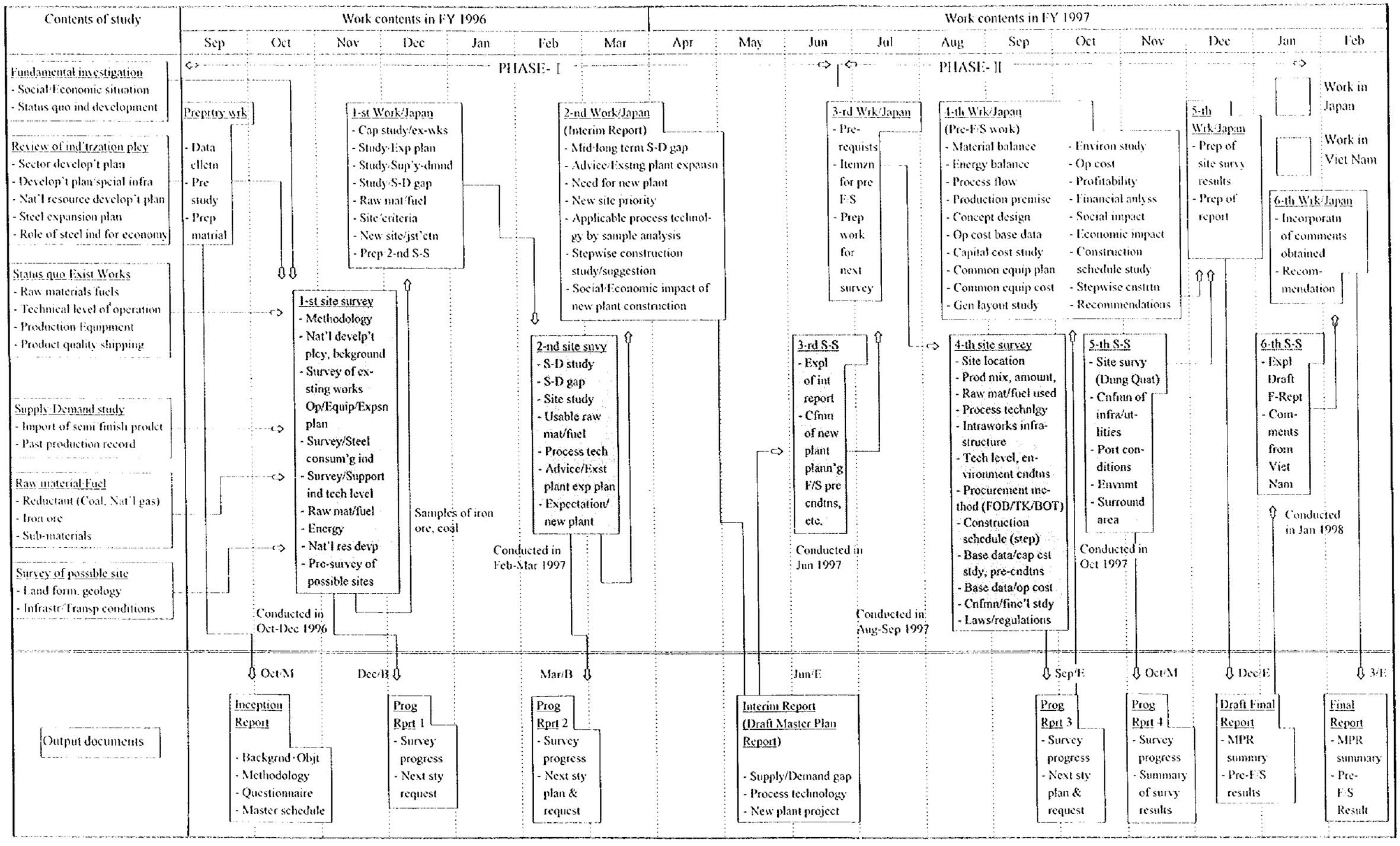


Figure 1-1 Overall Schedule of Master Plan & Pre-Feasibility Study

4. Study organization

The members of the Japanese group organized for this study are shown in Figure 1-2.

The members of the Vietnamese group who cooperated with the Japanese group at site are shown in Figure 1-3.

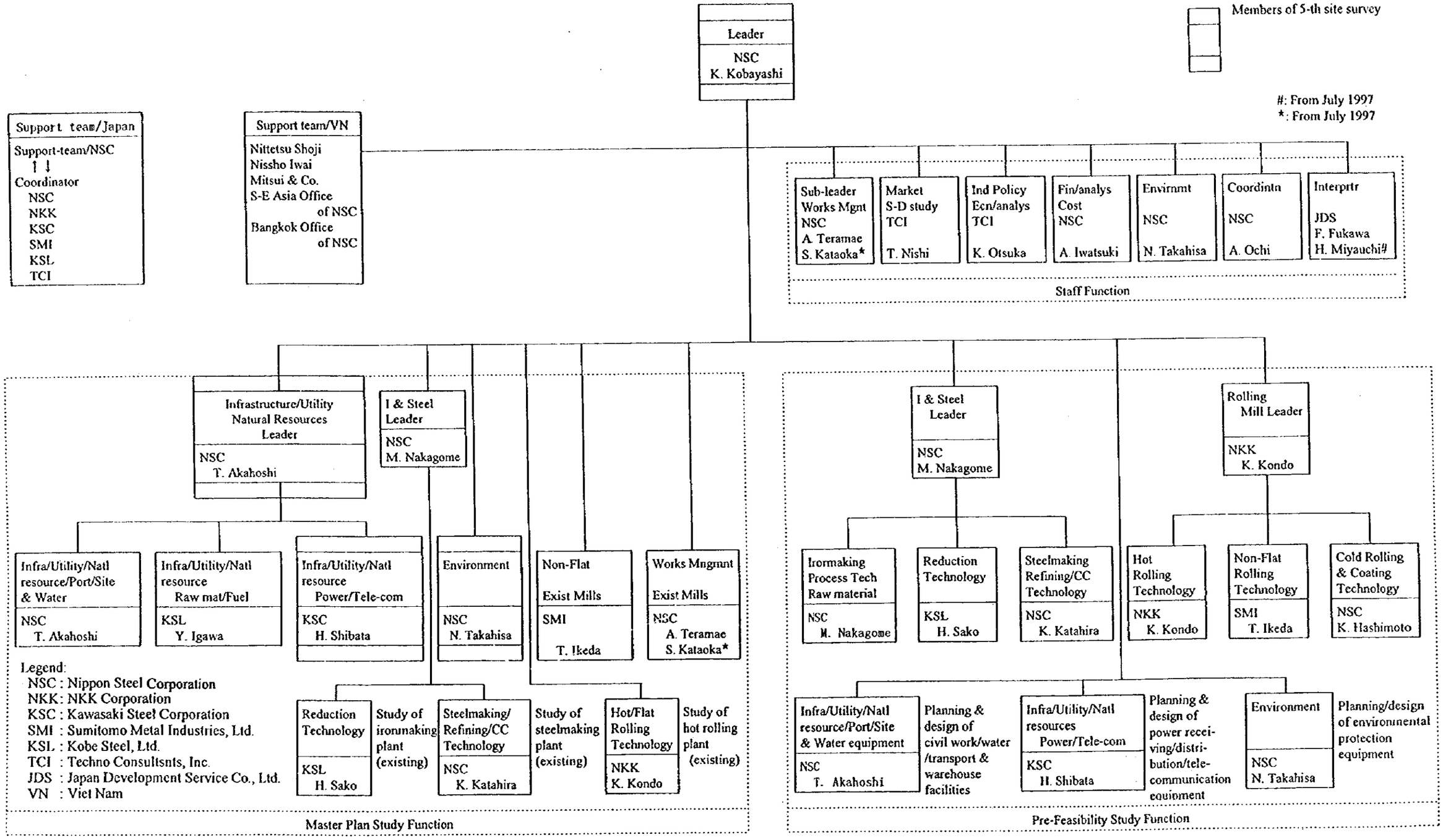


Figure 1-2 Study Members & Its Organization

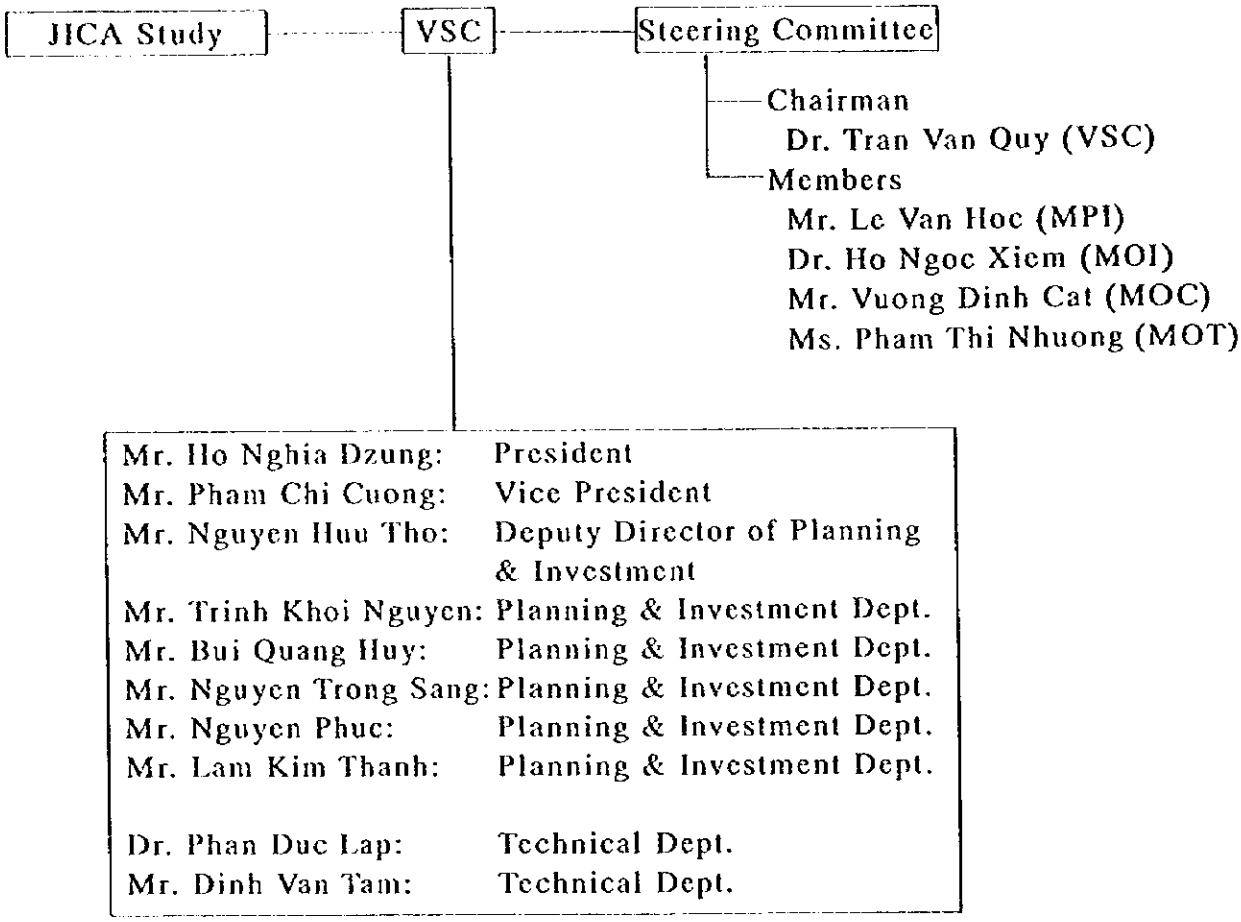


Figure 1-3 Vietnamese counterparts

Chapter II Present Situation of the Steel Industry in Viet Nam

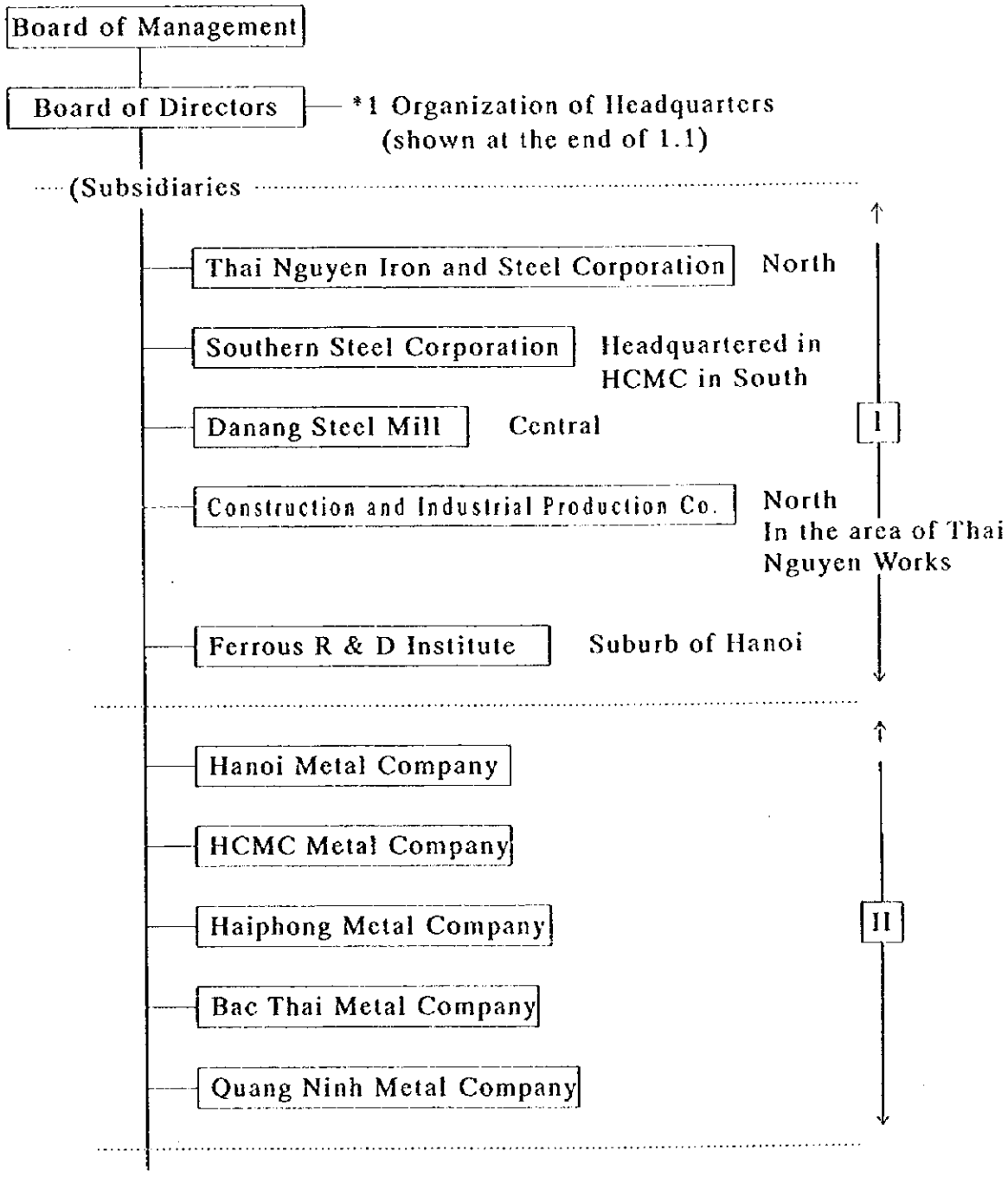
Part 1 Organization and Administration of Viet Nam Steel Corporation

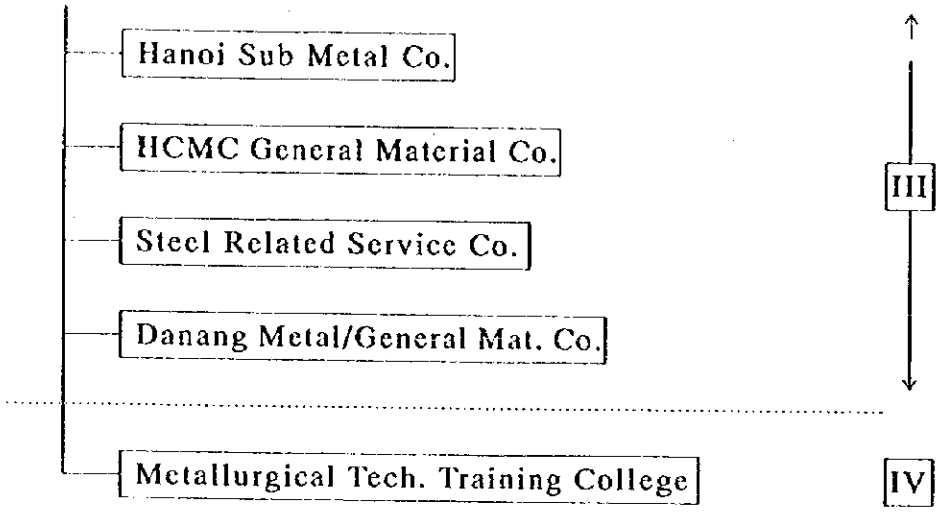
Section 1 Organization and Administration of Viet Nam Steel Corporation

1. Organization and management of Viet Nam Steel Corporation

1.1 Organization of VSC

The organizational structure of VSC is shown below.





VSC, is a large state owned corporation established pursuant to the Decision No. 255/TTg dated April 29, 1995 of the Prime Minister, Decree No. 03/CP dated January 25, 1996 of the Government to approve the statutes and operation organization of the Corporation and business registration No. 109612 dated February 5, 1996 issued by the Ministry of Planning and Investment, empowered to plan policies by itself and propose them to the higher level of administration, and, at the same time, has been required to operate on the independent profit system. In matters of personnel and budget, however, VSC implements steel industry policies in close communication with the Ministry of Industry.

As has been shown above, VSC is largely composed of four subsidiary departments. The main business of Department I is mainly the production of steel products and the construction of equipment related to it.

As the details of each mill are explained in the next section, a brief description of each mill is given here.

The Thai Nguyen Works, the only one integrated works in Viet Nam, has three blast furnaces, actually one in operation whose inner volume is $100m^3$ and turns all hot metal into cold pig-iron to be put in electric arc furnaces together with scrap, and after refining, manufactures reinforcing bars and shapes.

The Southern Steel Corporation (abbreviated as SSC) is a group of EF and rolling mill plants. These plants used to be independent private mills, but have been consolidated for nationalization. Their equipment is aged, and each mill production capacity is low.

The Danang Steel Mill is a mini-mill with electric arc furnace of 1.5-ton capacity and a parallel-type bar mill.

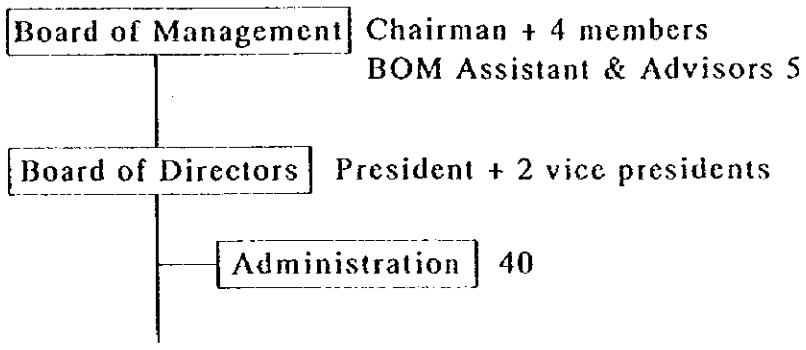
The Ferrous R&D Institute, located in the suburbs of Hanoi, lacks in research equipment, and therefore needs reinforcements.
Although executives are sometimes sent to SSC from the North, the exchange of personnel between the North and South is not frequently realized.

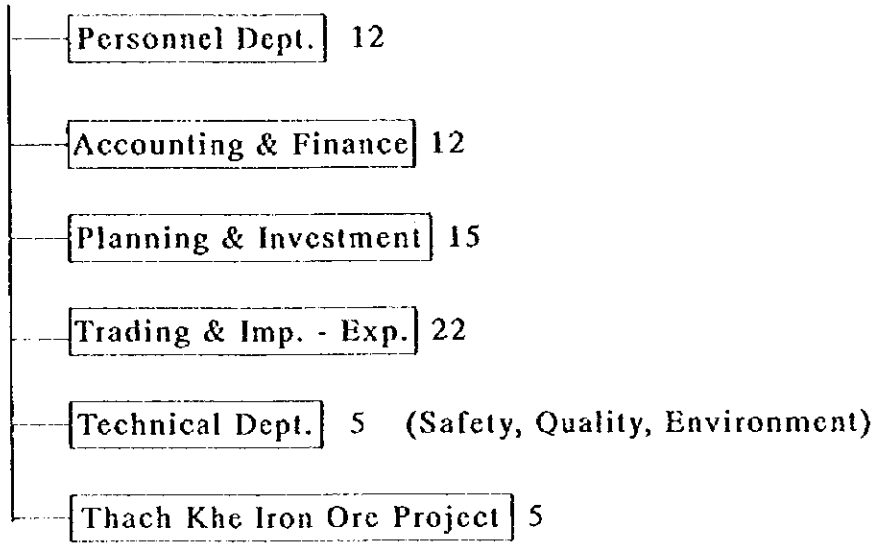
Department II is mainly in charge of the sale of steel products, and is generically called Vina-Metal. This department is also responsible for importing steel products when the domestic demand exceeds production.

Department III is in charge of arranging the procurement of iron and steel raw materials and importing special steels and nonferrous metals except plain carbon steel. This department is also responsible for business diversification.

Department IV is an organization for training workers, and about 1,000 people are registered. The training period is 3 years.

*1 Organization of VSC Headquarters (manned with about 100 people according to the explanation)





(124)

1.2 Joint ventures of VSC

The joint ventures between VSC and foreign capital are shown below.

(1) VSC-POSCO Steel (Production of steel products for building construction)

(2) Vina-Pipe Corporation (Production of weleded-pipes)

(3) Vina-Kyoei Steel Co. (Production of steel products for building construction)

(4) International Business Center

In addition to the above, there are joint ventures between subsidiaries of VSC and foreign capital as shown below.

(1) Southern Steel Sheet Co., Ltd. (Galvanizing and color coating)

(2) Colour Sheet Processing Center NIPPOVINA (Color coated sheet processing for building construction)

(3) NatSteel Vina Company (Production of steel products for building construction)

(4) POSVINA Co., Ltd. (Production of galvanized steel sheets for building construction)

(5) VINGAL INDUSTRIES Co., Ltd. (Galvanizing pipe and processed products)

(6) VINAUSTEEL Ltd. (Production of steel products for building construction)

(7) Tydo Steel Co., Ltd. (Production of steel products for building construction)

(8) Vinanic Steel Processing Company (Coil center)

(9) Long Binh Steel Co., Ltd. (Production of steel structures, cold forming and welding products, etc.)

(10) Sigon Steel Co., Ltd. (Coil center)

1.3 Present state of VSC's management activities

VSC was approved as a nationalized company on January 25, 1996 pursuant to a government ordinance issued on April 29, 1995, and registered as an organization to promote business activities in production and sale of steel and nonferrous metals throughout Viet Nam.

VSC is virtually a holding company of 16 subsidiaries and 13 joint ventures (12 on the above organization chart) with foreign capital.
The main business activities of VSC are as follows.

(1) Exploitation of iron ore and raw materials mines related to the steel industry

(2) Production of steel and other metals, and manufacture of steel products

(3) Trade and services related to steel, metals, iron ore and raw materials, materials (including sub-materials) for steel production, machinery and spare parts for the steel industry

(4) Designing, manufacturing, building and assembling for steel production facilities

(5) Training of personnel, and technical and scientific research for steel production

(6) Hotel business, and other services in accordance with the laws and regulations of the Socialist Republic of Viet Nam

Steel production, the main business of VSC, has been at low levels, as detailed in the following section, at about 300,000 tons in 1996 because crude steel production by the electric arc furnace process suffered from insufficient equipment capacity, scrap shortage and unstable supply of electricity.

On the other hand, the domestic demand for steel products focusing on reinforcing bars was 1,300,000 tons including that for market stocks in 1996, and the domestic production of rolled steel products, except imports and stocks, in 1996 amounted to about 1,000,000 tons. A difference of 700,000 tons from the crude steel production, therefore, was produced from imported billets.

Joint ventures with foreign capital started operation one after another in 1995 and 1996. Among these joint ventures, VSC-POSCO, NatSteel, Vina-Kyoei, and VINAUSTEEL are each re-rolling makers with modern rolling mill equipment. None of them, however, has melting equipment, namely, electric arc furnaces. The total rolling capacity of VSC and joint venture companies is estimated at about 1,500,000 tons/year. If each of these joint ventures should individually import billets and roll them, their production would be excessively large, and the market price of reinforcing bars would drop.

In fact, mills under the control of VSC and SSC as well as joint ventures carried out extensive production cutbacks in 1996. If the equipment and facilities of joint ventures should be fully operated, VSC with obsolete and aged equipment would face the problem of a poor level of

competitiveness in terms of cost and quality. Therefore, the strong leadership of VSC in production adjustment and the modernization of mills under its control by restructuring and consolidation are necessary.

Chapter III Master Plan for the Vietnamese Steel Industry up to 2010

Part 1 Summary of Master Plan

Section 1 Introduction

1. Introduction

The master plan for the Vietnamese Steel Industry up to 2010 was prepared on the basis of the scope of work laid down in the memorandum concerning "the Master Plan Study for the Development of the Steel Industry in Viet Nam", exchanged between the Socialist Republic of Viet Nam and the Japan International Cooperation Agency (JICA) on June 12, 1996, and was submitted as an interim report of the study in June 1997.

This interim report, different in nuance from ordinary interim reports, aimed to describe what the Vietnamese steel industry should be in 2010 in the form of a master plan for the steel industry.

For this purpose, the site study was carried out twice in various fields, i.e., the first site study from October 1996 to December 1996, and the second site study from February 1997 to March 1997 (spending a total of 11 weeks, namely, 7 weeks for the first site study and 4 weeks for the second site study).

The master plan including a phased construction plan for an integrated steelworks was prepared through analysis of the projected data obtained as the result of the study on the present state and future outlook for society and the economy, the present state and future improvement outlook of the infrastructure, the present state and future outlook of natural resource development, including demand for steel products, the production capacity of the existing steelworks, etc., in Viet Nam.

While the trend towards borderless and globalized activities gets increasingly active, it will be highly risky to push too hard the construction of an integrated steelworks which requires huge investments. Even if the Vietnamese steel demand in 2010 would justify in terms of quantity the construction of the integrated steelworks based on the existing production capacity plus added capacity through implementing expansion plans, the way to realize this should be cautiously sought.

In view, however, of political, social and other considerations as a nation in relation to neighboring countries in East Asia, apart from the economic argument for the existence of an individual industry, policies for the steel industry different from the one pursued in this master plan should not be negated.

This report presents the results of the objective study based on given preconditions up to 2010, and therefore does not itself recommend the construction of the integrated steelworks. Careful study, therefore, by the Vietnamese side is recommended in deciding on the questions of whether or not the construction of the integrated steelworks is appropriate, and, if appropriate, when it should be started.

Section 2 Master Plan Outline

1. Master plan outline

The steel production capacity of the existing steelworks, as indicated in Chapter II, can be summarized as below.

Melting capacity: 400,000 t/y
Rolling capacity: 1,500,000 t/y

According to the survey of the existing steelworks, the production of rolled products was about 1,000,000 tons in 1996. This means that a significant quantity of the rolled products were produced from imported billets.

To cope with such shortage of billets, the idea of setting up billet centers has been studied by VSC, and billet production by joint ventures is planned.

For production of flat products in preparation for increased demand for them, VSC has been studying various joint venture projects. These projects, however, are mainly for manufacture of cold-rolled sheets and coils and coated products, and therefore are plans for production on the downstream side.

On the other hand, the total steel demand in 2010 is estimated at 6,400,000 tons, as indicated in Part 2 and Part 3 of Chapter IV, and 3,500,000 tons of which will be the demand for flat products, and 2,900,000 tons for bars, sections, and wire rods.

Figure 2-1 on the next page shows one of the scenarios to address the supply-demand gap for steel products in 2010. In other words, an image of the Vietnamese steel industry in 2010 is shown in the form of the "Master Plan for the Steel Industry".

Details of this scenario are described in appropriate chapters. It should be emphasized, however, that careful study is necessary before starting the construction of the integrated steelworks.

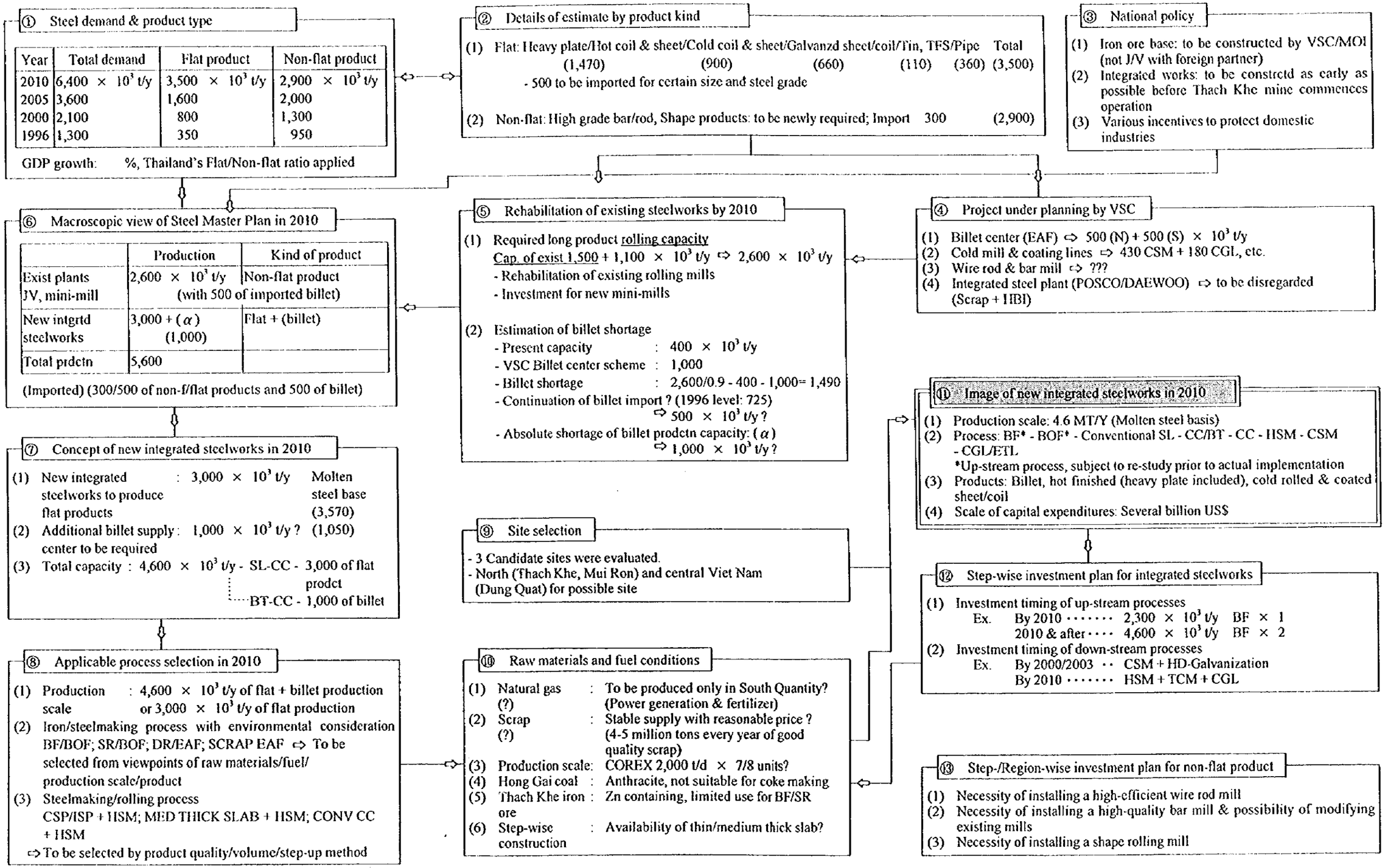


Figure 2-1 Master Plan for the Development of Steel Industry in Viet Nam

Section 3 Necessity for the Construction of a New Integrated Steelworks and Its Capacity

1. Steel product balance in 2005

The material balance and the production flow in the Vietnamese steel industry in 2005 based on the market research are as shown in Figure 3-1. The demand for each type of steel product has provided the basis of calculation for the balance and flow sheets.

Even after introduction of a hot strip mill and a cold strip mill which will supply material to CGLs, import of special size, stainless steel, and special steel products may have to remain. For plate, hot-rolled, cold-rolled, and galvanized products, import of about 10% of the demand is assumed to remain.

The quantity shown on the "Domestic Supply" line is the domestic production calculated by subtracting the imported quantity from the total demand.

If appropriate yield figures based on Japanese data are applied here, the production by the cold strip mill can be calculated. Likewise, the production by upstream processes can also be calculated. The results of these calculations are shown in Figure 3-1.

Productions by feasible joint ventures have also been taken into account in these calculations.

In Figure 3-1, however, neither iron-making equipment nor steelmaking equipment is shown at this stage as a part of the line equipment for production of flat products. Because huge investments are required for iron-making equipment and steelmaking equipment, the investment timing for them must be carefully studied considering the viability, foreign currency balance in Viet Nam, amount of funds required, etc.

Accordingly, import of semi-products (slabs) is suggested for the production of flat products in 2005.

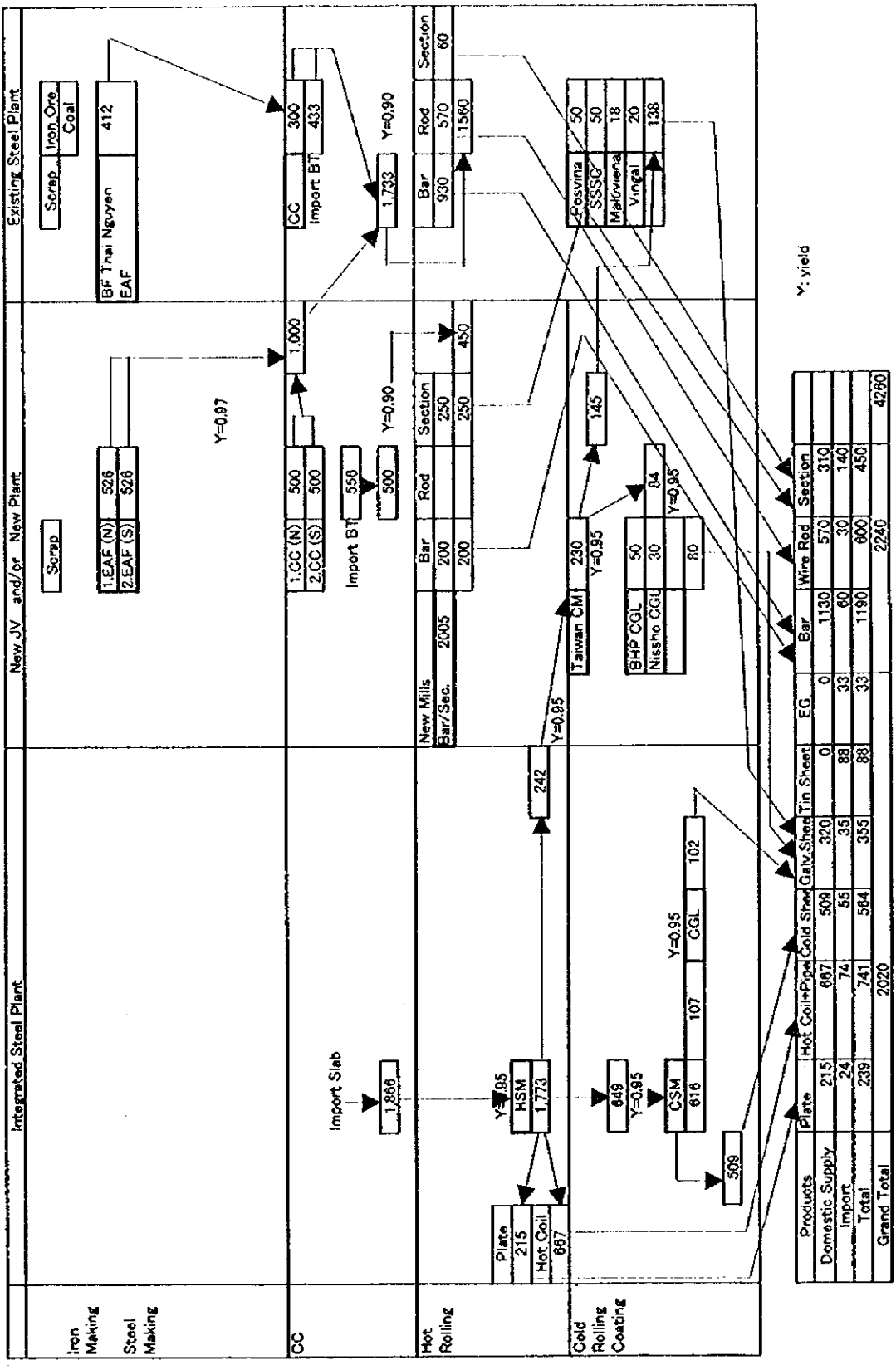
The equipment and their capacities of the new integrated steelworks may well be planned as below.

Hot Strip Mill:	1,800,000 t/y
Cold Strip Mill:	620,000 t/y

CGL: 100,000 t/y

Joint venture projects taken into account are as shown below.

Billet Center (North):	500,000 t/y	(Mitsubishi/NKK)
Billet Center (South):	500,000 t/y	(Vinakyoei)
Cold Strip Mill (South):	230,000 t/y	(Taiwan)
CGL1:	50,000 t/y	(BHP)
CGL2:	30,000 t/y	(Nissho Iwai)
Bar & Section Mill:	400,000 t/y	



Products	Plate	Hot Coil+Pipe	Cold Sheet	Galv.Sheet	Tin Sheet	EG	Bar	Wire Rod	Section
Domestic Supply	215	687	509	320	0	0	1130	570	310
Import	24	74	55	35	88	33	60	30	140
Total	239	741	564	355	88	33	1190	600	450
Grand Total		2020					2240		4260

Figure 3-1 Material balance in 2005 (Master plan)

2. Steel product balance in 2010

A material balance sheet and a production flow sheet for the Vietnamese steel industry in 2010 based on the market study are shown in Figure 3-2.

The concept of the material balance calculation is the same as that described in item 1 above. At this stage, however, both iron-making equipment and steelmaking equipment are entered in the production flow sheet.

The total production of the new integrated steelworks at this stage is projected to exceed 4,600,000 tons/year, which, according to Japanese data and experience, can be considered as justifying the construction of an integrated steelworks furnished with integrated iron- & steelmaking equipment. Financial study, however, must be conducted carefully.

The production line equipment and capacities of the new integrated steelworks in 2010 may well be planned as below.

BF/BOF:	4,600,000 t/y	(New investment)
CC (Slab):	3,400,000 t/y	(New investment)
CC (Billet):	1,050,000 t/y	(New investment)
Hot Strip Mill:	3,200,000 t/y	(Additional investment)
Cold Strip Mill:	1,070,000 t/y	(Additional investment)
CGL:	230,000 t/y	(Additional investment)
ETL:	110,000 t/y	(Additional investment)

Joint venture projects taken into account are as shown below.

Cold Strip Mill (South):	430,000 t/y	(Taiwan, Phase 2 work)
CGL:	100,000 t/y	(Taiwan)
Wire Rod Mill:	325,000 t/y	
Bar Mill:	320,000 t/y	

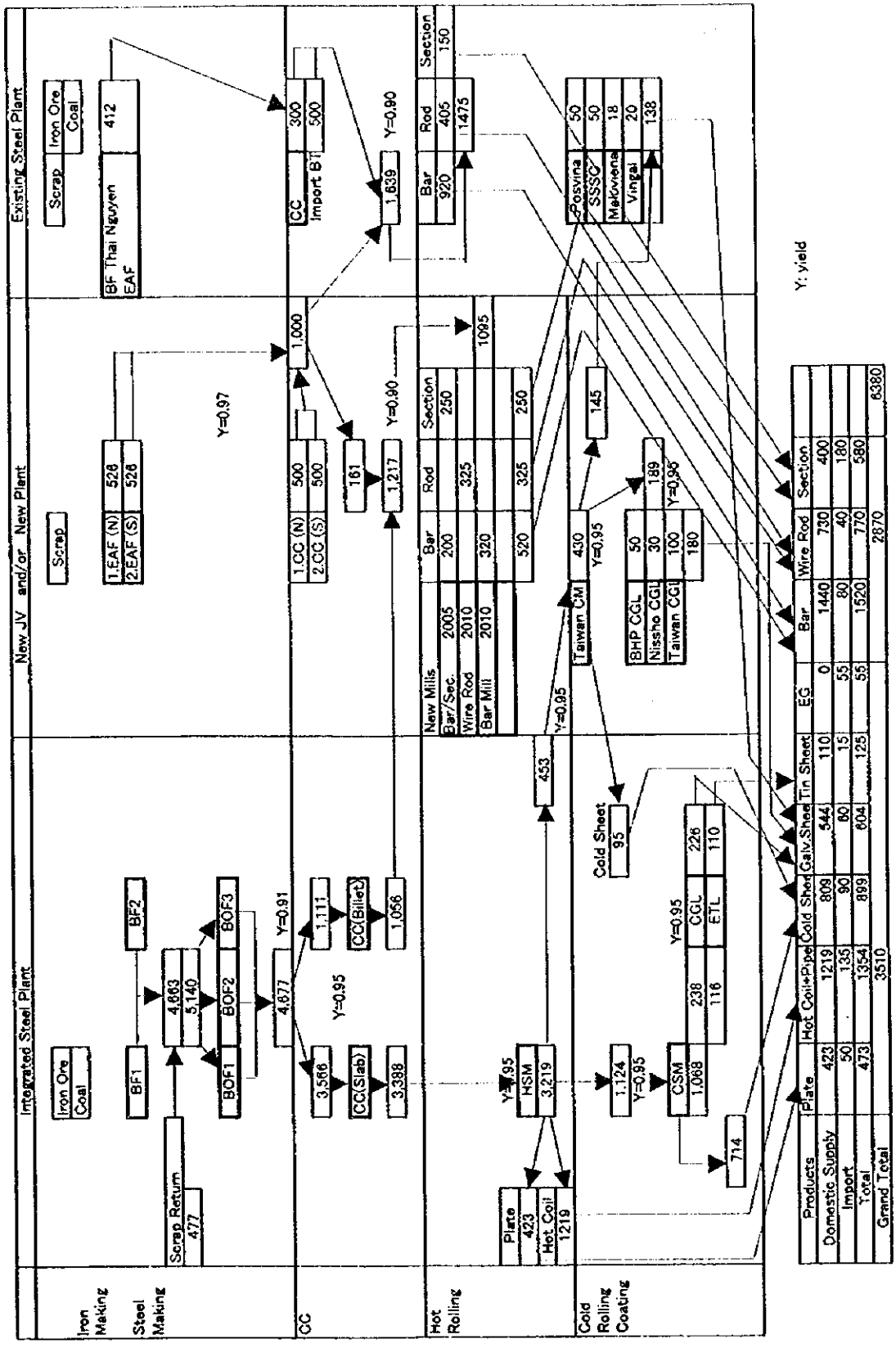


Figure 3-2 Material balance in 2010 (Master plan)

Section 4 Applicable Production Processes for the New Integrated Steelworks

1. Applicable production processes for the New Integrated Steelworks

Of the important items to be considered when planning the construction of an integrated steelworks, the most important are the following items.

(1) Stable supply routes for raw materials and fuels
(2) Production quantities and types of products to be produced

In short, study must be made to determine what types of products should be produced in what quantities using what raw materials and fuels by means of what processes and equipment.

The production quantities and types of products to be produced in (2) above have been determined by market study and the results are shown in Section 3.

The main raw material for the production of steel products is iron which comes from iron ore or steel scrap. In case of steel scrap, the stable supply of large electric energy is necessary to melt, and in the case of iron ore, the economical and stable supply of reducing materials (coal, natural gas, etc.) to remove combined oxygen from iron ore for producing steel products.

Shown in Figure 4-1 is a comprehensive table of items requiring study.

This table shows that the BF-BOF process alone remains to be the only applicable process for future study among various other processes, judging from the raw material and fuel situations in Viet Nam and the envisaged production scale (4,600,000 tons/year).

The result of the study on an applicable process from molten steel stage to hot rolling is shown in Figure 4-2. What should be kept in mind, however, is that the construction of the integrated steelworks will start with the rolling mill, namely, a downstream process. This mean that until the upstream process is completed, semi-products, i.e., slabs, need to be imported. It will be unrealistic to import thin slabs 100 mm or less thick for use by the CSP or the MSP. In view of the upstream process to be constructed in the future, the CBM and the CVM are two options, and in consideration of construction cost, the CBM must be selected.

Determining factors / Process alternatives	Raw materials/fuels conditions				Production scale	Product quality			Energy & utility supply		Capital cost expenditure	Maturity of technology	Applicable process
	Scrap	Iron ore	Coal	Natural gas	4.6 mt/y	Non-flat for construction	Non-flat for mechanical use	Flat product	Electricity	Water			
Scrap-based EAF	Not easy to procure	-	-	-	Large capacity of EAF is existing worldwide.	No serious problem	Quality scrap & secondary refining are required.	Not suitable for high grade quality	Stable & low cost supply is essential.	No serious problem	Low	Established as proven technology	Not applicable due to less availability of good quality scrap.
BF - BOF	-	Thach Khe ore is not usable. Ore must be imported	No coking coal available. Coal must be imported	-	Suitable for large scale production.	No problem	No problem	No problem	-	No serious problem	High	Established as proven technology	Applicable.
Smelting reduction (COREX) (2,000 t/day)	-	Thach Khe ore quality to be studied	Domestic coal quality to be studied	-	2,000 t/d/module, 7 modules are required.	No problem	No problem	No problem	-	No serious problem	High	Established as proven technology But, scale-up of plant capacity is required	Not applicable due to small production capability of plant module.
Gas-based D-R (MIDREX)	-	Thach Khe ore quality to be studied.	-	Availability in North & Central regions is uncertain. Gas price is uncertain.	No problem	No problem	No problem	No problem	Stable & low cost supply is essential.	No serious problem	Medium	Established as proven technology	Not applicable due to uncertain availability of natural gas.
Coal-based D-R (Small scale)	-	Thach Khe ore quality to be studied	Domestic coal quality to be studied	-	Many units of rotary kiln are required.	No problem	No problem	No problem	Stable & low cost supply is essential.	No serious problem	High or medium	Established as proven technology	Not applicable due to small production capability of plant module.

Note: Key factors giving serious problem.

Problematic items, to be solved with investment.

Figure 4-1 Summary of Study for Applicable Process - Iron & Steelmaking

Determining factors / Process alternatives	Raw materials/fuels conditions: Scrap	Iron ore	Coal	Natural gas	Production scale: 4.6 mt/y	Product quality: Non-flat for construction	Non-flat for mechanical use	Flat product	Energy & utility supply: Electricity	Water	Capital cost expenditure	Maturity of technology	Applicable process
Scrap-based EAF	Not easy to procure	-	-	-	Large capacity of EAF is existing worldwide.	No serious problem	Quality scrap & secondary refining are required.	Not suitable for high grade quality	Stable & low cost supply is essential.	No serious problem	Low	Established as proven technology	Not applicable due to less availability of good quality scrap.
BF - BOF	-	Thach Khe ore is not usable. Ore must be imported.	No coking coal available. Coal must be imported	-	Suitable for large scale production	No problem	No problem	No problem	-	No serious problem	High	Established as proven technology	Applicable.
Smelting reduction (COREX) (2,000 t/day)	-	Thach Khe ore quality to be studied	Domestic coal quality to be studied	-	2,000 t/d/module, 7 modules are required.	No problem	No problem	No problem	-	No serious problem	High	Established as proven technology But, scale-up of plant capacity is required.	Not applicable due to small production capability of plant module.
Gas-based D-R (MIDREX)	-	Thach Khe ore quality to be studied	-	Availability in North & Central regions is uncertain. Gas price is uncertain.	No problem	No problem	No problem	No problem	Stable & low cost supply is essential.	No serious problem	Medium	Established as proven technology	Not applicable due to uncertain availability of natural gas.
Coal-based D-R (Small scale)	-	Thach Khe ore quality to be studied.	Domestic coal quality to be studied.	-	Many units of rotary kiln are required.	No problem	No problem	No problem	Stable & low cost supply is essential.	No serious problem	High or medium	Established as proven technology	Not applicable due to small production capability of plant module.

Note: Key factors giving serious problem

Problematic items, to be solved with investment.

Figure 4-1 Summary of Study for Applicable Process - Iron & Steelmaking

Determining factors / Process alternatives	Slab conditions: Thickness	Width	Surface conditioning	Cooled slab	Production capability: With one furnace operation	With two furnace operation	With 3-4 furnace operation	Up-stream process	Available products	Flexibility for small-scale production	Operating cost	Capital cost expenditures	Number of operating mills	General comments	Applicable process
CSP (Compact strip production) (Original ISP Included)	Approx. 50 mm	1,000 - 1,550 mm	Impossible	Scrap-down	t/y 800,000 (max)	t/y 1,600,000 (max)	N/A	Scrap - EAF (DRI)	Very limited (Mainly commercial quality)	Very difficult to accept small orders. Production of commercial quality without orders.	No significant difference with other processes.	Low (Up-stream plant cost is low: EAF/TSC.)	Many mills Nucor: (Scrap/EAF) Hambo: (Scrap/EAF) POSCO #1: (EAF)	Suitable for production of commercial grade mainly for construction use in large market such as USA, etc.	Not to be adopted for Viet Nam's integrated steelworks.
					Production capability is low.										
MSP (Medium slab process) (Modified ISP Included)	Approx. 100 mm	900 - 1,550 mm	Impossible	Scrap-down	t/y 1,000,000 (max)	t/y 2,000,000 (max)	N/A	Scrap - EAF (DRI)	Limited (High grade is difficult due to no slab conditioning.)	Difficult to accept small order. Production of commercial quality without orders.	No significant difference with other processes.	Low/Medium (Up-stream plant cost is low: EAF/MSC.)	Few mills (Only few mills under operation, construction or planning) (BHP America Trico, Siam, POSCO #2)	Suitable for small production of medium class product in medium or large markets. This process is still under development.	Not to be adopted for Viet Nam's integrated steelworks.
					Production capability is low.										
CBM (Compact coil box mill)	Approx. 200 mm	650 - 1,550 mm (600 - 1,900)	Possible	Usable	t/y 1,000,000 (ave)	t/y 2,000,000 (ave)	t/y 3,000,000 (max)	BF - BOF (DRI/EAF)	Almost all products (High quality steel is possible.)	Possible to accept small orders (charging cold or warm slabs into reheating furnace).	No significant difference with other processes.	Medium (Up-stream plant cost depends on processes: EAF of BF, etc.)	Many mills (BHP, STELCO TOKYO, Sahaviria, TATA)	Suitable for small production of various grades of products in small, medium or large markets.	To be adopted for Viet Nam's integrated steelworks.
					Production capability is medium.										
CVM (Conventional 3/4 HSM)	Approx. 200 - 300 mm	650 - 1,900 mm (600 - 2,400)	Possible	Usable	t/y N/A	t/y 3,000,000 (ave)	t/y 6,000,000 (max)	BF - BOF	All products (Highest quality is possible.)	Possible to accept small orders (charging cold or warm slabs into reheating furnace).	No significant difference with other processes.	High (Up-stream plant cost is high: BF process.)	Numerous mills (Most HSMs in Japan and developed countries)	Suitable for large production of all kinds of products in large markets.	To be considered for Viet Nam's integrated steelworks taking into account the future expansion.
					Production capability is high.										

Note: Not favorable; Subject to further study

Figure 4-2 Applicable Process - Continuous Slab Casting/Hot Strip Mill

Determining factors / Process alternatives	Slab conditions: Thickness	Width	Surface conditioning	Cooled slab	Production capability: With one furnace operation	With two furnace operation	With 3-4 furnace operation	Up-stream process	Available products	Flexibility for small-scale production	Operating cost	Capital cost expenditures	Number of operating mills	General comments	Applicable process
CSP (Compact strip production) (Original ISP Included)	Approx 50 mm	1,000 - 1,550 mm	Impossible	Scrap-down	t/y 800,000 (max)	t/y 1,600,000 (max)	N/A	Scrap - EAF (DRI)	Very limited (Mainly commercial quality)	Very difficult to accept small orders. Production of commercial quality without orders.	No significant difference with other processes.	Low (Up-stream plant cost is low. EAF TSC.)	Many mills Nucor (Scrap EAF) Hambo (Scrap EAF) POSCO #1 (EAF)	Suitable for production of commercial grade mainly for construction use in large market such as USA, etc.	Not to be adopted for Viet Nam's integrated steelworks.
					Production capability is low.										
MSP (Medium slab process) (Modified ISP Included)	Approx 100 mm	900 - 1,550 mm	Impossible	Scrap-down	t/y 1,000,000 (max)	t/y 2,000,000 (max)	N/A	Scrap - EAF (DRI)	Limited (High grade is difficult due to no slab conditioning.)	Difficult to accept small order. Production of commercial quality without orders.	No significant difference with other processes.	Low-Medium (Up-stream plant cost is low. EAF MSC.)	Few mills (Only few mills under operation, construction or planning) (BHP America Frico, Siam, POSCO #2)	Suitable for small production of medium class product in medium or large markets. This process is still under development	Not to be adopted for Viet Nam's integrated steelworks.
					Production capability is low.										
CBM (Compact coil box mill)	Approx 200 mm	650 - 1,550 mm (600 - 1,900)	Possible	Usable	t/y 1,000,000 (ave)	t/y 2,000,000 (ave)	t/y 3,000,000 (max)	BF - BOF (DRI/EAF)	Almost all products (High quality steel is possible.)	Possible to accept small orders (charging cold or warm slabs into reheating furnace).	No significant difference with other processes.	Medium (Up-stream plant cost depends on processes: EAF of BF, etc.)	Many mills (BHP, STELCO TOKYO, Sahaviria, TATA)	Suitable for small production of various grades of products in small, medium or large markets.	To be adopted for Viet Nam's integrated steelworks.
					Production capability is medium.										
CVM (Conventional 3/4 HSM)	Approx 200 - 300 mm	650 - 1,900 mm (600 - 2,400)	Possible	Usable	t/y N/A	t/y 3,000,000 (ave)	t/y 6,000,000 (max)	BF - BOF	All products (Highest quality is possible.)	Possible to accept small orders (charging cold or warm slabs into reheating furnace).	No significant difference with other processes.	High (Up-stream plant cost is high. BF process.)	Numerous mills (Most HSMs in Japan and developed countries)	Suitable for large production of all kinds of products in large markets	To be considered for Viet Nam's integrated steelworks taking into account the future expansion.
					Production capability is high.										

Note: Not favorable; Subject to further study

Figure 4-2 Applicable Process - Continuous Slab Casting/Hot Strip Mill

Part 2 Steel Demand Projection

Section 1 Present Situation of Supply and Demand of Steel Products

1. Steel supply

Quantity of steel products supplied to Vietnamese market in 1992-1996 is shown in Table 1-1.

Table 1-1 Total steel supply to market

(Unit: 1,000t)

	Company	1992	1993	1994	1995	1996
Domestic products	VSC	190	230	270	370	450
	JVs	0	0	0	0	400
	Other companies	30	50	90	120	150
	Sub total	220	280	360	490	1,000
Imported products		320	540	630	610	300
Total supply		540	820	990	1,100	1,300

Source: VSC, JV companies

2. Steel demand

Total steel demand in Viet Nam in 1992-1996 is summarized in Table 1-2.

Table 1-2 Total steel demand

(Unit: 1,000t)

Year	1992	1993	1994	1995	1996
Demand	540	820	990	1,100	1,300

Steel demand by steel type in 1996 is summarized in Table 1-3.

Table 1-3 Steel demand by steel type in 1996

(Unit: 1,000t)

Non-flat steel		Flat steel	
Steel type	Demand	Steel type	Demand
(1) Bar	470	(1) Plate	58
(2) Wire rod	300	(2) Hot rolled coil/sheet	48
(3) Rolled section	140	(3) Cold rolled coil/sheet	65
		(4) Welded section	0
		(5) H-D galv.	128
		(6) EG galv.	11
		(7) Tin plate	40
		(8) Welded pipe	40
Total	910 (70%)	Total	390 (30%)

Section 2 Projection of Future Steel Demand in Viet Nam (Macroscopic Projection)

1. General

In general, when the steel demand (Apparent steel consumption/capita) in a country exceeds a certain level, it shows a clear relation with its GDP/capita figure. At present both indexes in Viet Nam are not high enough to show this relation, so steel demand projection was carried out in relation to the projected GDP growth rate.

2. Projection of GDP growth rate

The actual and expected GDP growth rate until 2000 is shown in Table 2-1.

Table 2-1 GDP growth rate

(Unit: %/y)

Five-year Plan	Planned GDP growth rate		Actual GDP growth rate	
	Total GDP	Manufacturing Industry	Total GDP	Manufacturing Industry
1991-1995 Five-year Plan	5.5 – 6.5	7.5 - 8.5	8.2	13.3
1996-2000 Five-year Plan	9 – 10	14 - 15	-	-

Source: General statistical office

Through discussion with the governmental agencies and VSC, the GDP growth rate after 2000 is considered to be 8-9% p.a. during 2001-2005 and 7-8% p.a. during 2006-2010. These figures are used for the projection of GDP growth rate after 2000.

3. Projection of steel demand

For projection of steel demand, two cases are taken:

1) Base case (most probable case)
The Growth rate of steel consumption for 1996-2000 is assumed to be 16%/y. After the year 2000, it is projected to be lower than those of the preceeding years and is assumed to be 12%/y on average from 2001 through 2005. When annual production quantity comes to a certain level, the growth rate usually declines, and the growth rate will drop further again to 9%/y on average during 2006-2010.
2) Optimistic case (maximum case)
In this case, average growth rates are set to be 10-25% higher than those of the Base case.

In Table 2-2 and Figure 2-1 the projection of steel demand up to 2010 for both cases are shown. By this projection, steel demand in 2010 will be

1) Base case : about 6.4 million ton/y
2) Optimistic case : about 8.3 million ton/y

Table 2-2 Projection of steel demand up to 2010

Case	Average growth rate (%/y)			Steel demand (1,000t)			
	1996-2000	2001-2005	2006-2010	1996	2000	2005	2010
1) Base case	16	12	9	1,300	2,350	4,150	6,380
2) Optimistic case	20	15	10	1,300	2,700	5,200	8,340

4. Projection of flat products quantity

With the modernization and industrialization of a country, the ratio of flat products demand to the total steel demand of the country rises. In most industrialized countries including Thailand, these ratios are ranging around 50 to 60%, and in Viet Nam it is assumed it will go up to 55% in 2010. In Table 2-3 the projection of the flat products ratio and its quantities are summarized.

Table 2-3 Projection of flat products ratio and its quantity

Subject	1996	2000	2005	2010
Flat products ratio (%)	30	37	46	55
(1) Base case (1,000t)	390	870	1,910	3,510
(2) Optimistic case (1,000t)	390	1,000	2,390	4,590

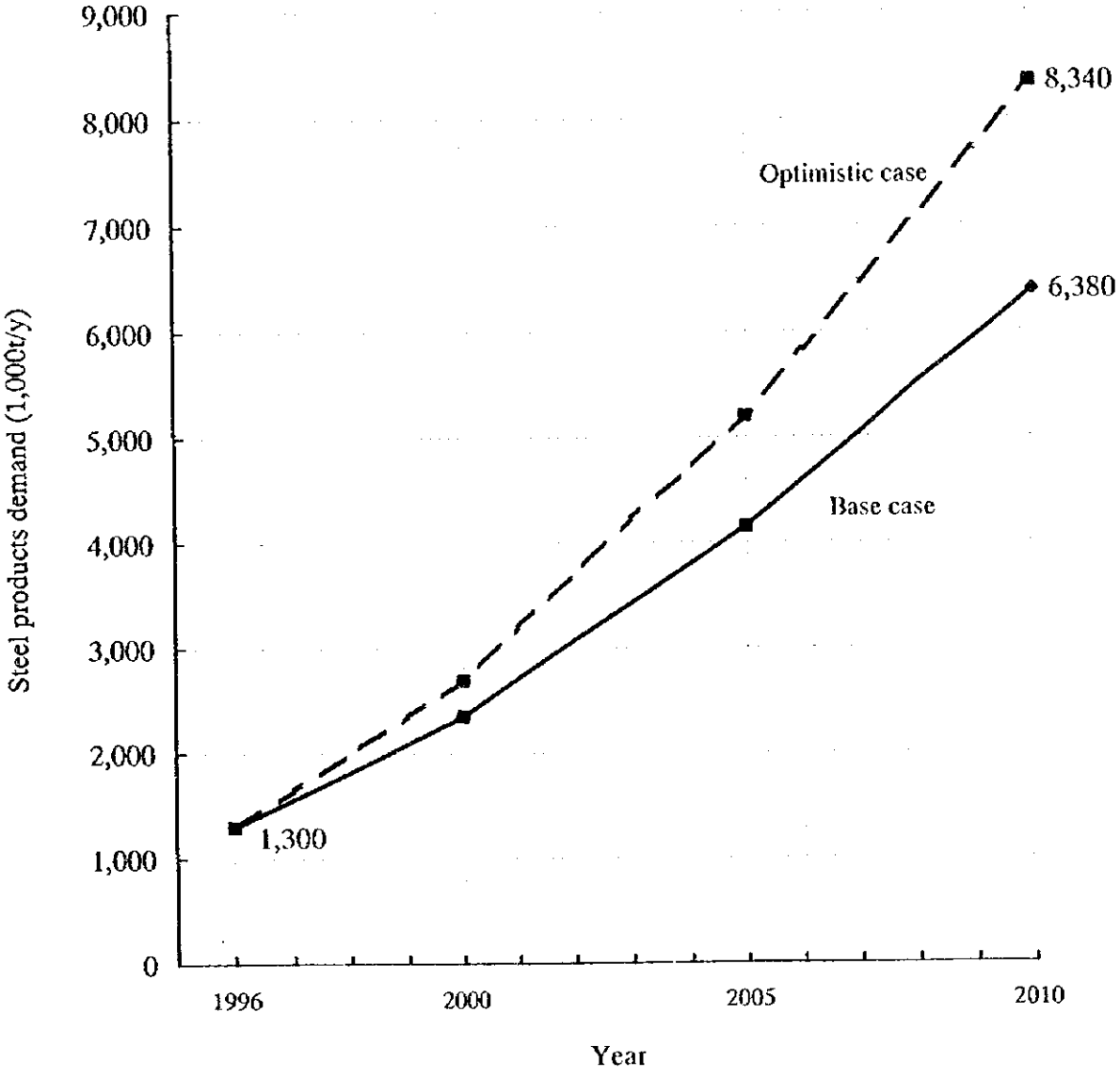


Figure 2-1 Macroscopic projection of steel products demand

Section 3 Steel Demand by Industrial Sub-sector (Microscopic Projection)

1. Steel demand by industrial sub-sector (Microscopic projection)

The microscopic projection in terms of steel demand quantity, steel type, steel grade, size, etc. for the following industries was conducted with certain adjustments by macroscopic projection for some industries:

- Building construction
- Infrastructure
- Capital investment field
- Shipbuilding industry
- Automobile industry
- Household appliances
- Can industry
- Containers
- Machine tool

Section 4 Projection of Steel Demand by Steel Type

1. Projection of steel demand by steel type

Based on the macroscopic and microscopic survey of the present and future industrial structure in Viet Nam, as well as the case of neighboring countries, future demand by steel type in Viet Nam is projected as shown in Table 4-1 as the Base case.

Table 4-1 Demand projection for Base case

(Unit: 1,000t)

Product		1996	2000	2005	2010
Non-flat products	Bar	470	770	1,190	1,520
	Wire rod	300	440	600	770
	Section	140	270	450	580
	Sub total (% of non-flat steel)	910 (70%) (1,010)	1,480 (63%) (1,640)	2,240 (54%) (2,490)	2,870 (45%) (3,180)
Flat products	Plate *	58	93	239	473
	Hot coil/sheet **	48	195	501	994
	Cold coil/sheet	65	177	454	899
	Galvanized sheet	139	228	388	659
	Tin plate	40	65	88	125
	Welded pipe	40	112	240	360
	Sub total (% of flat steel)	390 (30%) (430)	870 (37%) (970)	1,910 (46%) (2,120)	3,510 (55%) (3,900)
Grand total ***		1,300 (1,440)	2,350 (2,610)	4,150 (4,610)	6,380 (7,080)

* : Plate : thickness ≧ 6.0mm
** : Hot coil/sheet : thickness < 6.0mm
*** : Figures in parenthesis show crude steel base.

Present area-wise steel demand ratio is as follows, and is assumed to be unchanged in 2010.

North area	Central area	South area	Total
30%	5%	65%	100%

Source: VSC

Part 3 Technical Suggestion of Site Selection

Section 1 Survey for Mui Ron and Dung Quat

1. Purpose of the additional survey for infrastructure and utility in Dung Quat

Purpose of the additional survey is to cut down investment cost concerning infrastructure and utility for Dung Quat site, based on carrying out the following.

1) To confirm the site conditions such as area allowed for the construction of the new integrated steelworks.
2) To share the port facilities such as breakwater and dredging with the Dung Quat port master plan by another JICA Master Plan team.

Dung Quat site is studied from the following points.

1) The difference of infrastructure conditions such as port, water supply, access to the electricity source, etc. between Mui Ron and Dung Quat should be compared. Then the influence of such differences is evaluated from viewpoint of impact on the new integrated steelworks.
2) General layout drawings for the both site are prepared.

2. Facts and findings newly recognized, changed from the last investigation through Dung Quat additional site survey

1) Location of the oil refinery
The location of the oil refinery is determined at the west-south region of the site and its related storage facilities are to be located at the east-south at the site.

2) Location of the new integrated steelworks
It was confirmed by the authority that about two(2) km of coastal line from the breakwater at the river mouth to the southern direction would possibly be utilized by the steelworks, while about one(1) km of sea surface from the coastal line could also be utilized by the steelworks by reclaiming the port. The western region of the site could be utilized for the steelworks without any restriction.

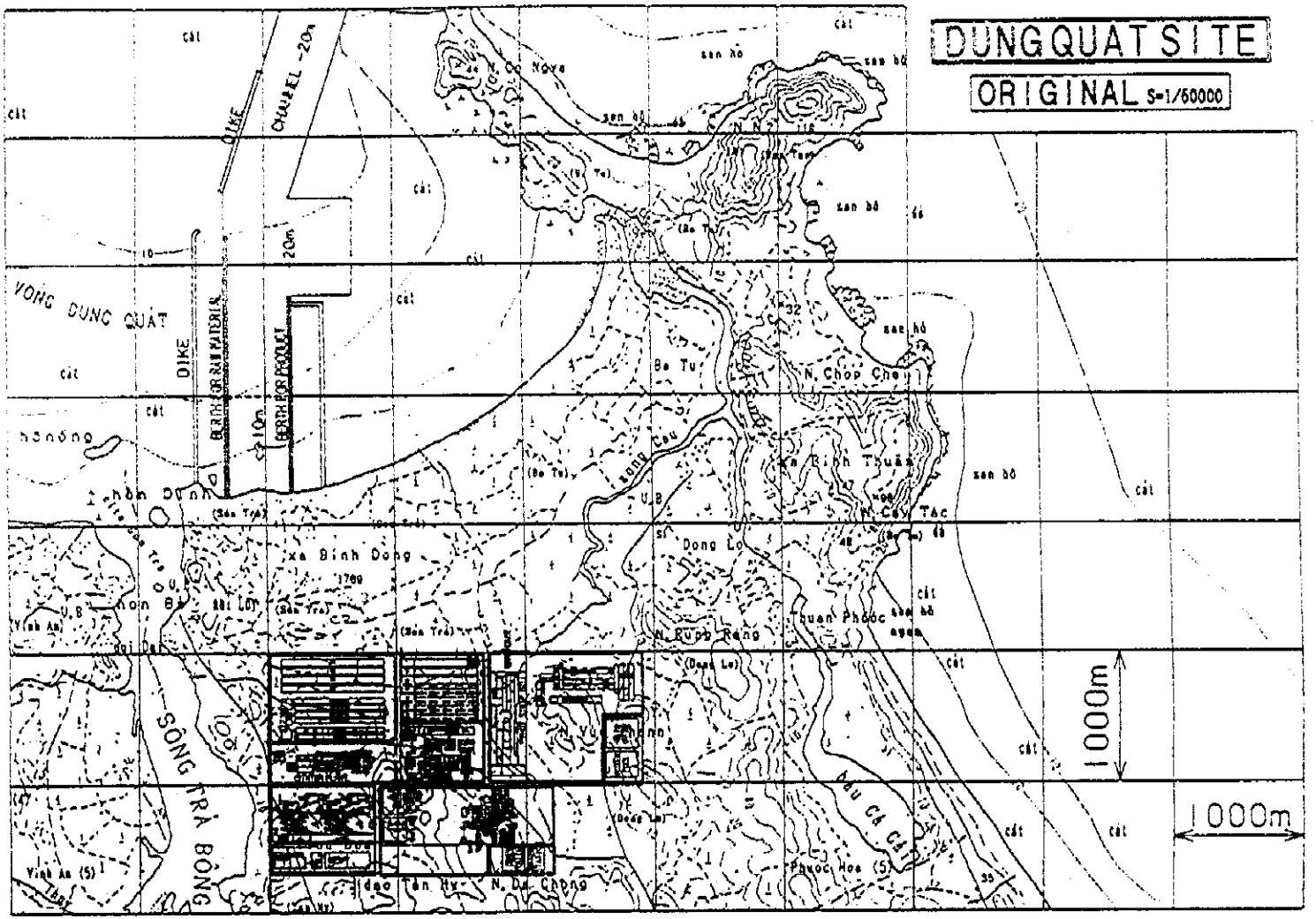
3) Construction of reservoir
New reservoir is required. However its construction cost is not required for water consuming industry.

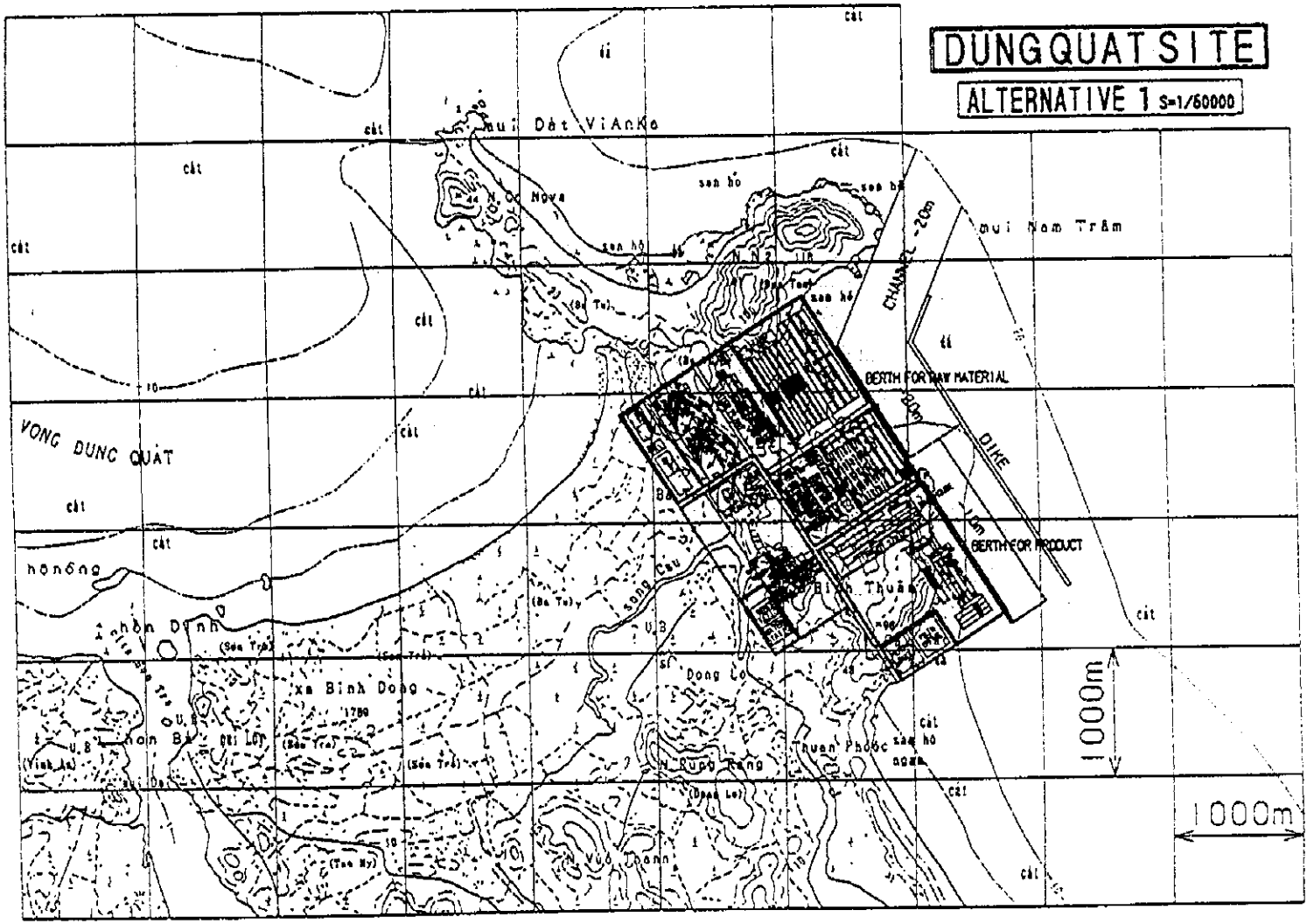
3. New layout for Dung Quat

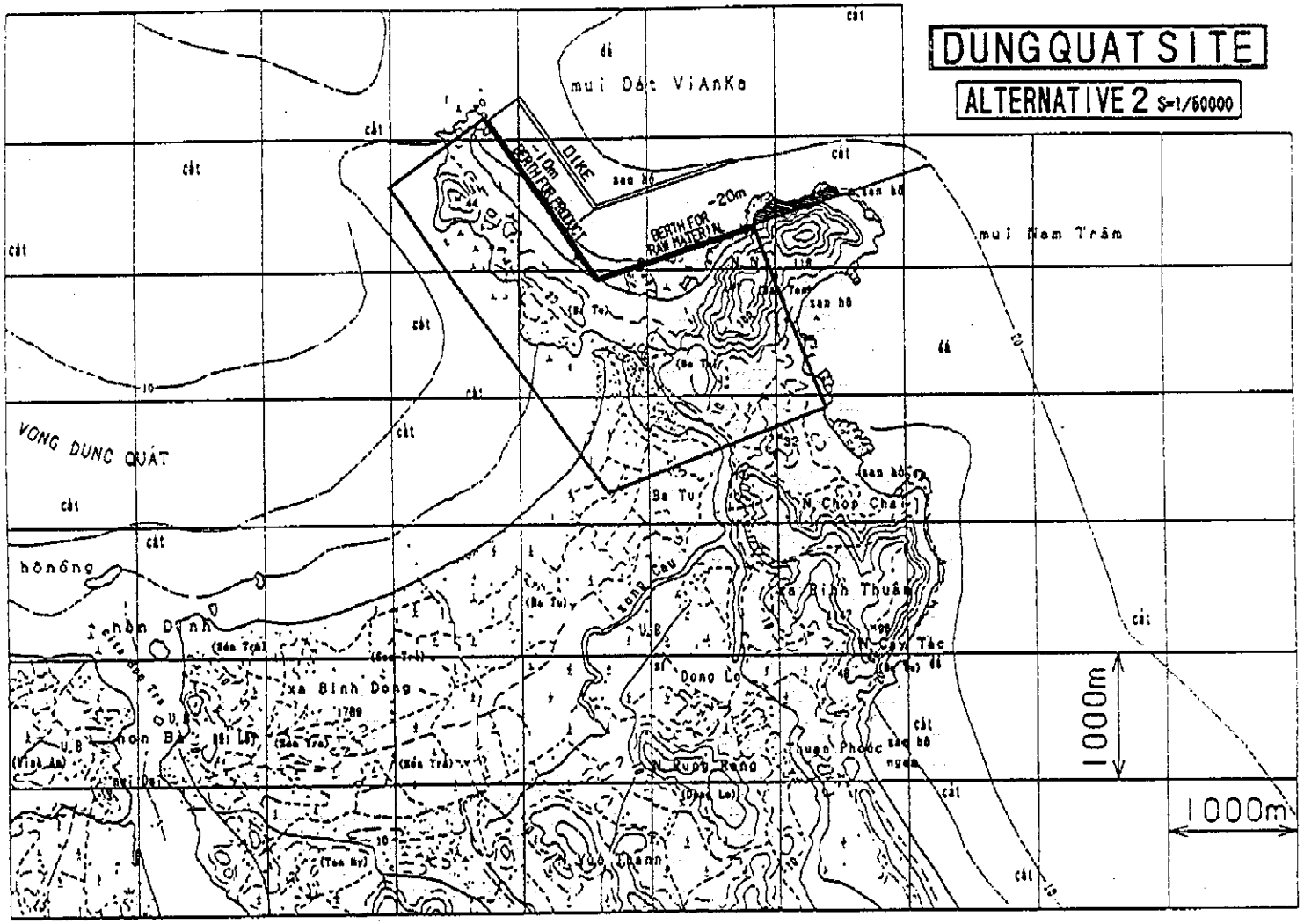
3.1 Layout drawings submitted by JICA team for the study

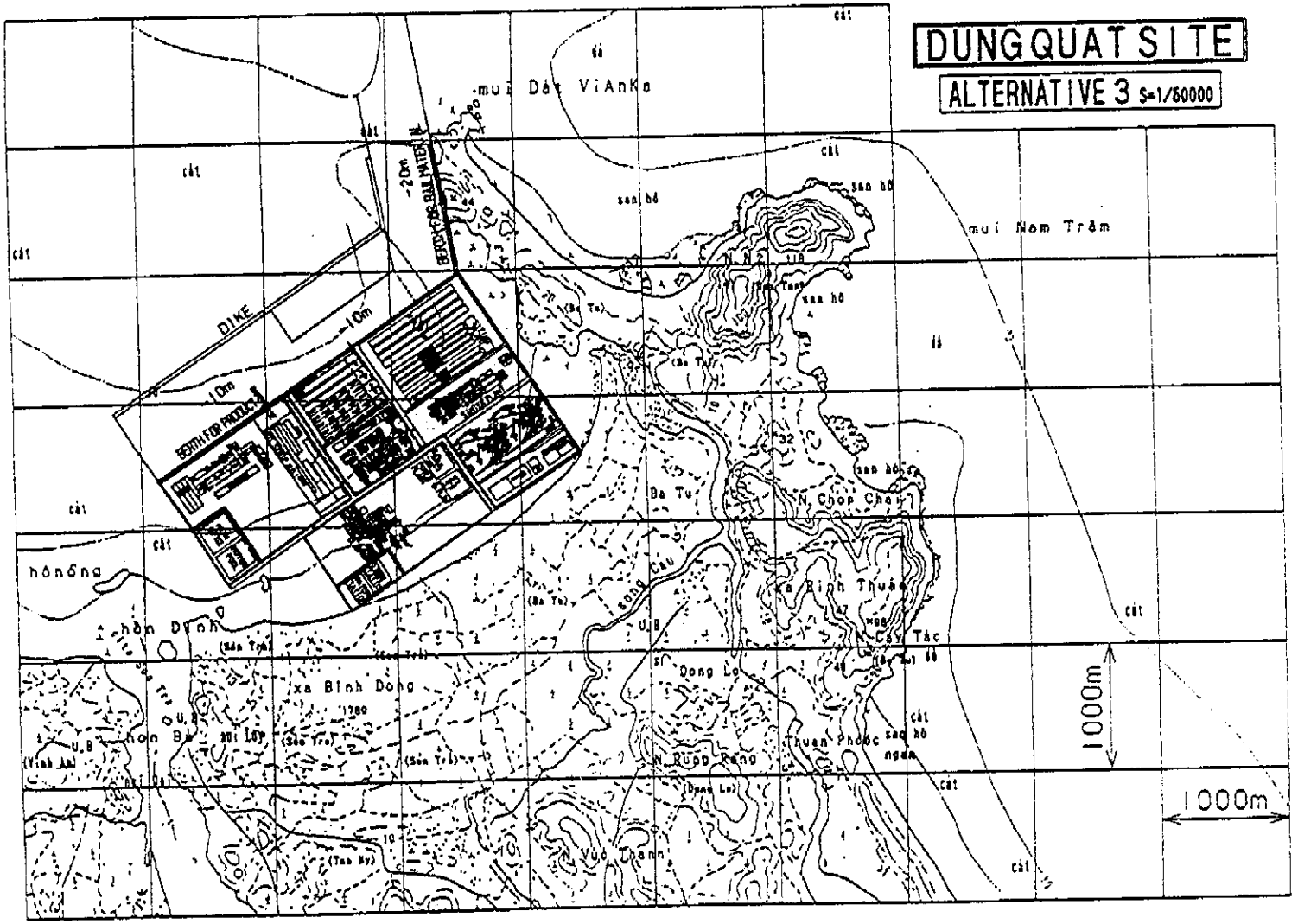
JICA team submitted the following four(4) layout drawings at Dung Quat site for the study of the Authority as attached hereto:

(1) Dung Quat(Original)
(2) Alternative 1
(3) Alternative 2
(4) Alternative 3


DUNGQUAT SITE
ORIGINAL S=1/60000
VONG DUNG QUẤT
DIKE
CHANNEL -20m
20m
10m
EARTH FOR PROJECT
xa Binh Dong
Be Tu
N. Chop Cho
Dong Lo
Quan Phuoc
N. Rung Rang
Phuoc Hoa (5)
N. Da Chong
SÔNG TRÀ BÔNG
1000m
1000m


DUNG QUAT SITE
ALTERNATIVE 1 S=1/60000
Mui Dat Vi An Ke
Mui Nam Tram
CHANNEL -20m
BERTH FOR RAW MATERIAL
DIKE
-15m
BERTH FOR PRODUCT
VONG DUNG QUAT
Binh Thuan
Xa Binh Dong
Thuan Phuoc
1000m
1000m


DUNG QUAT SITE
ALTERNATIVE 2 S=1/50000
mui Dất ViAnKa
OIKE
-10m
BERTH FOR PRODUCT
-20m
BERTH FOR RAW MATERIAL
mui Nam Trâm
VONG DUNG QUẤT
hônông
Ba Tu
N. Chop Chai
xa Binh Thuân
Dong Lo
xa Binh Dong
1000m
1000m

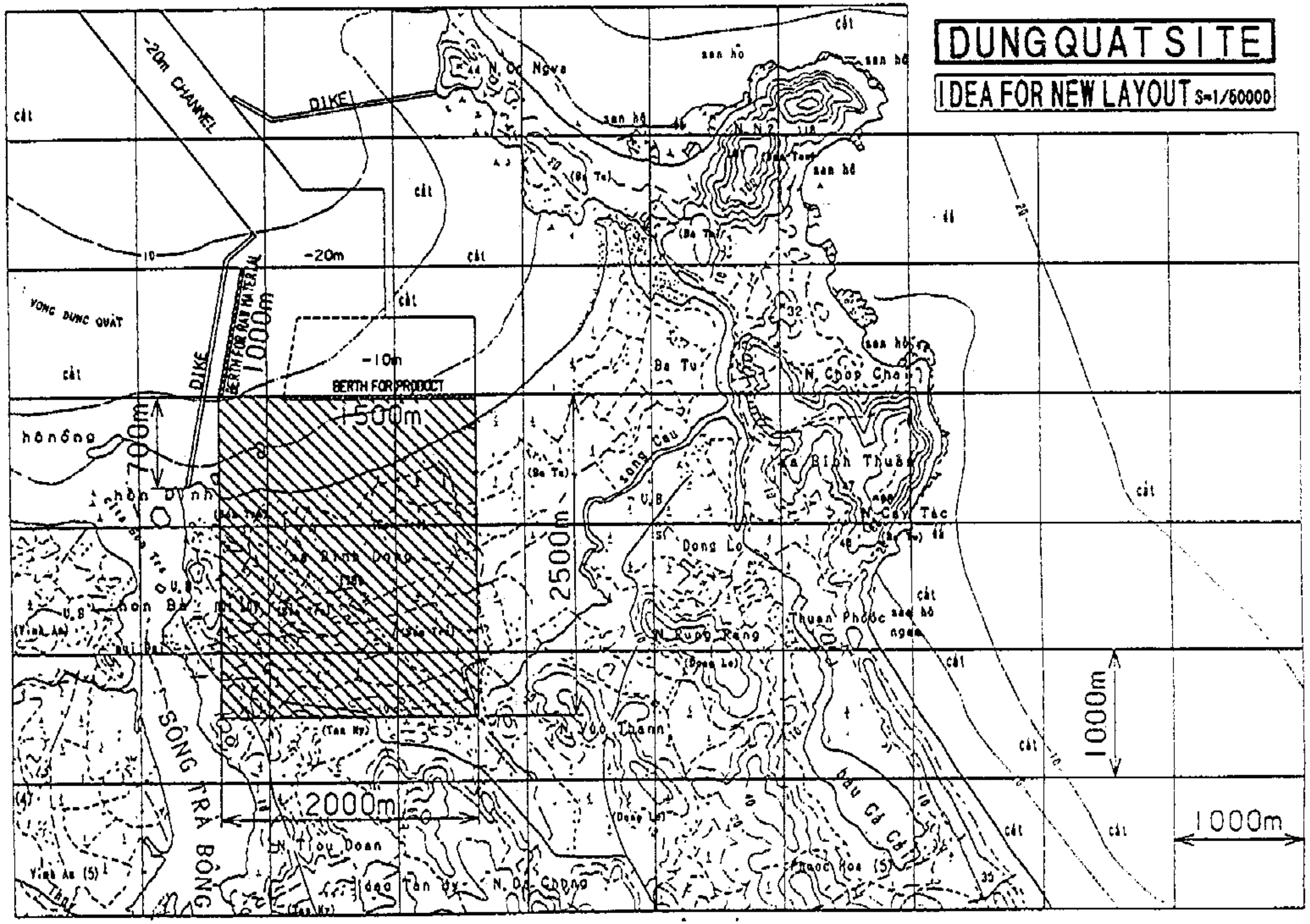

DUNG QUAT SITE
ALTERNATIVE 3 S=1/50000
mui Dat ViAnKa
mui Nam Tram
DIKE
10m
-20m
BERTH FOR PRODUCTS
BERTH FOR BULK MATERIALS
Ba Tu
N. Chop Chai
Binh Thuan
N. Cay Tac
Dong Lo
Rupp Rang
Thuan Phuoc
xa Binh Dong
hon Dinh
1000m
1000m

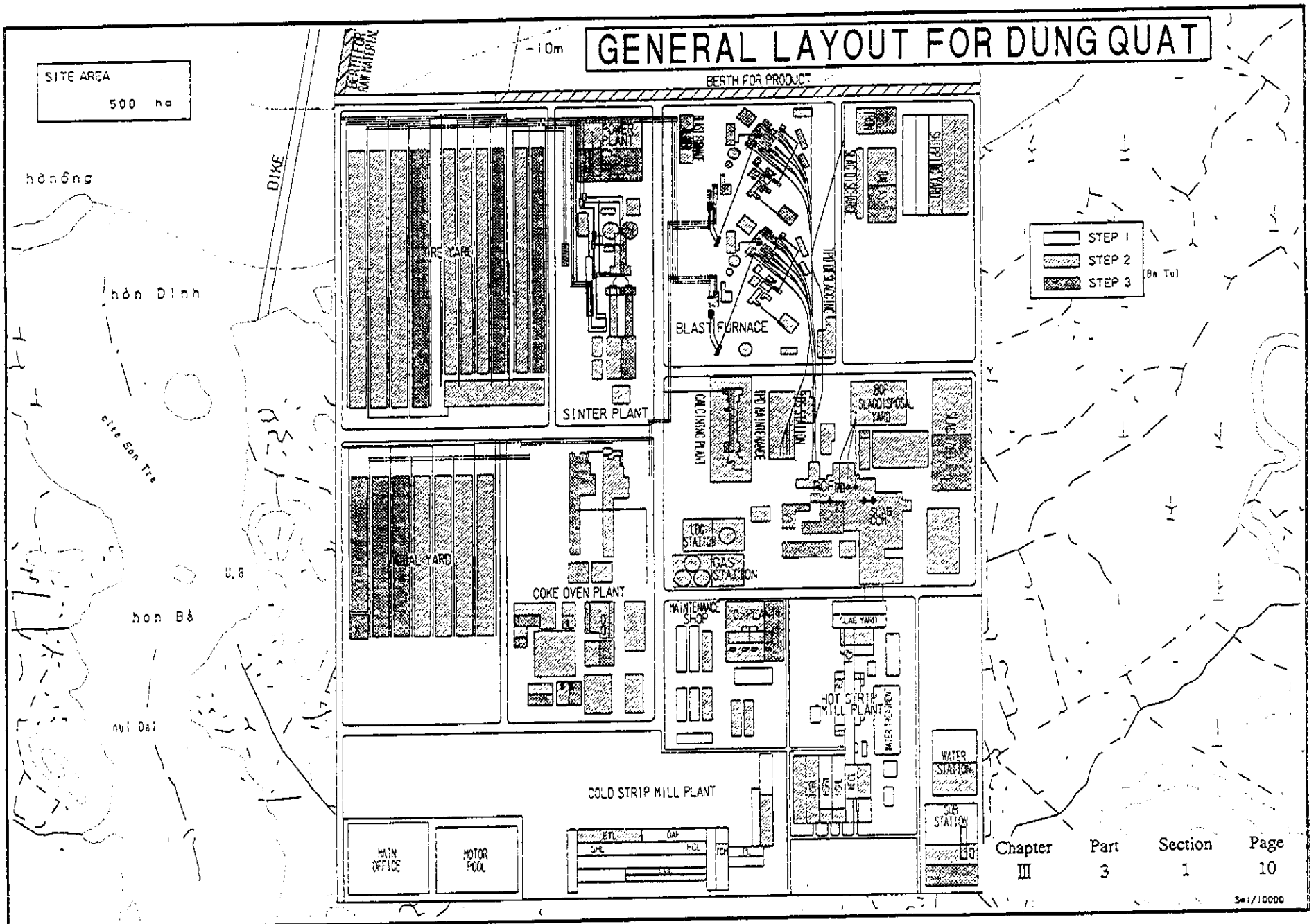
3.2 The results of alternative layouts based on discussions with Authority

(1) Alternative 1: Interferes with the oil refinery facilities
(2) Alternative 2: Also interferes with the oil refinery facilities
(3) Alternative 3: Requires full length of coastal line of Dung Quat port, making it difficult to plan other industrial facilities at the port area.
(4) The original : Requires the elevated construction cost for raw material berth and product berth of the steelworks

3.3 New layout for Dung Quat

New layout for Dung Quat based on the new site conditions is shown on the next page.


DUNG QUAT SITE
IDEA FOR NEW LAYOUT S=1/50000
-20m CHANNEL
DIKE
DIKE
BERTH FOR RAW MATERIAL
1000m
-20m
-10m
BERTH FOR PRODUCT
1500m
700m
2500m
2000m
1000m
1000m
VONG DUNG QUAT
hôn Ông
hôn Dinh
SÔNG TRÀ BÔNG
N. Ông Nova
Ba Tu
N. Chop Chai
Binh Thuân
N. Cây Tác
Dong Lo
Thuan Phuoc
N. Rung Rang
N. Tiou Doan
N. Ong Chong
Bau Cà Cái
Phuoc Hoa (5)
cát
san hô


GENERAL LAYOUT FOR DUNG QUAT
SITE AREA
500 ha
-10m
BERTH FOR OUR MATERIAL
BERTH FOR PRODUCT
DIKE
hòn ông
hòn Dinh
cửa Sơn Trà
hon Bà
núi Dài
FIRE SCAPE
SINTER PLANT
BLAST FURNACE
COKE OVEN PLANT
COLD STRIP MILL PLANT
HOT STRIP MILL PLANT
MAINTENANCE SHOP
MAIN OFFICE
MOTOR POOL
WATER STATION
SUB STATION
GAS STATION
STEP 1
STEP 2
STEP 3
(Ba Tu)
Chapter
III
Part
3
Section
1
Page
10
S=1/10000