JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MINISTRY OF INDUSTRY
VIETNAM STEEL CORPORATION
THE SOCIALIST REPUBLIC OF VIETNAM

The Feasibility Study on Steel Flat Product Mills (Phase I : F/S on Cold Rolling Mill) IN The Socialist Republic of Viet Nam

FINAL REPORT (SUMMARY)

OCTOBER 2000

Nippon Steel Corporation

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Contents

Summary

JICA Study Team made both the site surveys in Viet Nam and the necessary work in Japan and obtained the following conclusions with regard to " The Feasibility Study on Steel Flat Product Mills (Phase I : F/S on Cold Rolling Mill) IN The Socialist Republic of Viet Nam" .

1. The investigation both on the macro-economic performance and on the market of flat products in Viet Nam and neighboring countries. According to the investigation the demand for cold rolled steel sheets has been predicted to be around 500,000 tons per year in 2005 and around 1,000,000 tons per year in 2010.

2. The study on the product mix and the production capacity appropriate for the planned cold rolling mill was made based on the result of the above market survey. As a result of this, the cold the production of galvanized iron substrates (both annealed and non-annealed) and cold rolled steel sheets for high class use and the production capacity of 205,000 tons (product basis) per year are recommended.

3. The most appropriate production processes for the planned cold rolling mill was studied. The push-pull type pickling line, the combination-type reversing cold rolling mill, the electrolytic cleaning line, the box annealing furnace and the recoiling line have been recommended as the major production processes. The major specifications of the said process equipment have been also given. In addition, the study on the specifications of electricity, instrumentation and process computer and civil and building was made together with the conceptual design of infrastructure. The manning plan for the planned cold rolling mill was also studied, and the required number of employees is expected to be 400 including both the staff engineers and operators and maintenance persons.

4. The construction schedule for the planned cold rolling mill was studied. The period of 24 months is required from the commencement of civil work to the commercial run.

5. The construction cost has been estimated to be around 126 million USD. However, there exists a possibility of reduction in equipment cost depending on the demand and supply conditions of equipment suppliers. In addition to the construction cost the working capital summing up to 2 million USD is to be prepared for the procurement of hot coils and consumable such as lubrications and packing materials and for the manning expense required at the initial stage of commercial operation.

6. The feasibility study on the construction of new cold rolling mill was made. The internal rate of return is expected to be 10.3 % (after tax) for the base conditions, and accordingly this project is considered to be feasible. However, it has been revealed that the free cash flow in normal operation is short every year over 10 years from the start-up of the cold rolling mill. As countermeasures to this cash flow problem the following two items have been recommended ;
   1) Introduction of equity capital of more than 10 million USD
   2) Extension of the period of repayment from 10 years to 12 years

   In addition, the import duty of 5 % on the cold rolled steel sheets has been recommended to secure the profitability.

7. The economic analysis was made to estimate this project from a viewpoint of national and/or social economic influence. It has been concluded that this project has a large value of investment even from a viewpoint of national economy due to the following four positive effects.
   1) Saving of foreign exchange summing up to 170 million USD
   2) Creation of new employment up to 1000 persons
   3) Promotion of industrial development
   4) Promotion of regional development

8. The fund raising for the planned new cold rolling mill was investigated. The fund raising in Viet Nam and the buyer' s credit have been referred to as the possible fund raising methods. However, the condition of foreign loan is expected to be strict compared to that of domestic loan, and accordingly the fund raising in Viet Nam has been recommended.

9. The environmental standard in Viet Nam was investigated, and the environmental impact of the construction of new cold rolling mill was estimated. It has been revealed that there would be no problems or issues with regard to air and water and the noise standard would be satisfied simply by removing the fan of the acid regeneration plant from the boundary.

10. Technical evaluation of sites for the construction of new cold rolling mill was made. Three industrial zones, AMATA, NHON TRACH and PHU MY were surveyed. Considering both the advantages of port facility, transportation of hot coils and room of expansion and the appropriateness for the heavy industry, PHU MY Industrial Zone has been recommended as the site for the new cold rolling mill.

11. The preliminary study on the construction of hot rolling mill, which is planned after the start-up of the cold rolling mill, was made. With regard to the site, PHU MY Industrial Zone has been recommended with the port facility, the distance to the cold rolling mill and the availability of utility taken into consideration. Hot coils for the cold rolling mill, those for general use and heavy plates are to be produced with the annual production amount of 800,000 to 1,000,000 tons recommended for the first stage. The coil box type roughing mill and the conventional type tandem mill have been recommended as the production processes.

Chapter I Background of the Feasibility Study on Steel Flat Product Mills (Phase I : F/S on Cold Rolling Mill) in The Socialist Republic of Viet Nam

1. Background of the Study

Viet Nam, which has been carrying out a program of economic reforms named "Doi Moi", has been aggressively introducing a market economy. Although Asia's economic crisis in 1997 and 1998 did not have great direct impact on Viet Nam, the nation had to revise somewhat downward the estimated rate of the economic growth. In addition, Viet Nam had to revamp the nation's large industry development promoting plans. For example, it was decided to delay the conducting of a detailed study pertaining to developing a master plan for steelmaking including the construction of integrated steelworks, which was carried out by the Japan International Cooperation Agency from June 1996 to March 1998.

Having no facilities to produce steel sheets, Viet Nam now entirely depends on imported supplies thereof. Imports of steel sheets in 1998 exceeded 700,000 tons. Though the rate of Vietnam's economic growth has slowed down, it is considered that the demand for steel sheets increases as the steel-consuming industries develop, accordingly, an establishment of a framework for domestic supply of steel sheets requires urgent attention.

While retaining its master plan as a long-range program, the Vietnamese government formulated a short-to-medium range industry development promoting program to create a small-to-medium framework to produce steel sheets in quantities sufficient to satisfy the nation's current economic and industrial needs. To be more specific, the essence of the program is to construct hot and cold rolling mills with annual production capacities of 600,000 and 250,000 tons respectively. The Vietnamese government has requested a continued technical support from Japan. Accordingly, the Japan International Cooperation Agency dispatched its preliminary investigation team towards the end of November 1999 to conclude an agreement on details of the study, based on which the detailed study described below was carried out.

2. Purpose of the Study

The Study was made for the six purposes summarized below.

(1) To predict the future market (in 2010) for cold rolled steel sheets by investigating the present state of the market and predicting the growth of the nation' s economy and industrial sectors associated with cold rolled steel sheets, and then determine the optimum product mix and production capacity of the cold rolling mill to be planned.

(2) To design a cold rolling mill plant with the product mix and production capacity described above, including a schematic design of infrastructure and carry out a feasibility study to determine the economic viability of the new cold rolling mill.

(3) To conduct a technical evaluation on the possible sites for the new cold rolling mill and select the most appropriate site.

(4) To investigate environmental standards and regulations, gather relevant data pertinent to the selected site, perform an environmental simulation, and give advice on environmental countermeasures.

(5) To give advice on the construction of a hot rolling mill which has a close relationship with the cold rolling mill.

(6) To transfer knowledge on cold rolling technology and cold rolled products and techniques for performing feasibility studies to the parties concerned in Viet Nam through activities mentioned above.

3. Schedule of the Study

The Study, which started with the first site survey following the domestic preparatory work done in February 2000, was carried out as shown in Fig. I-3-1.

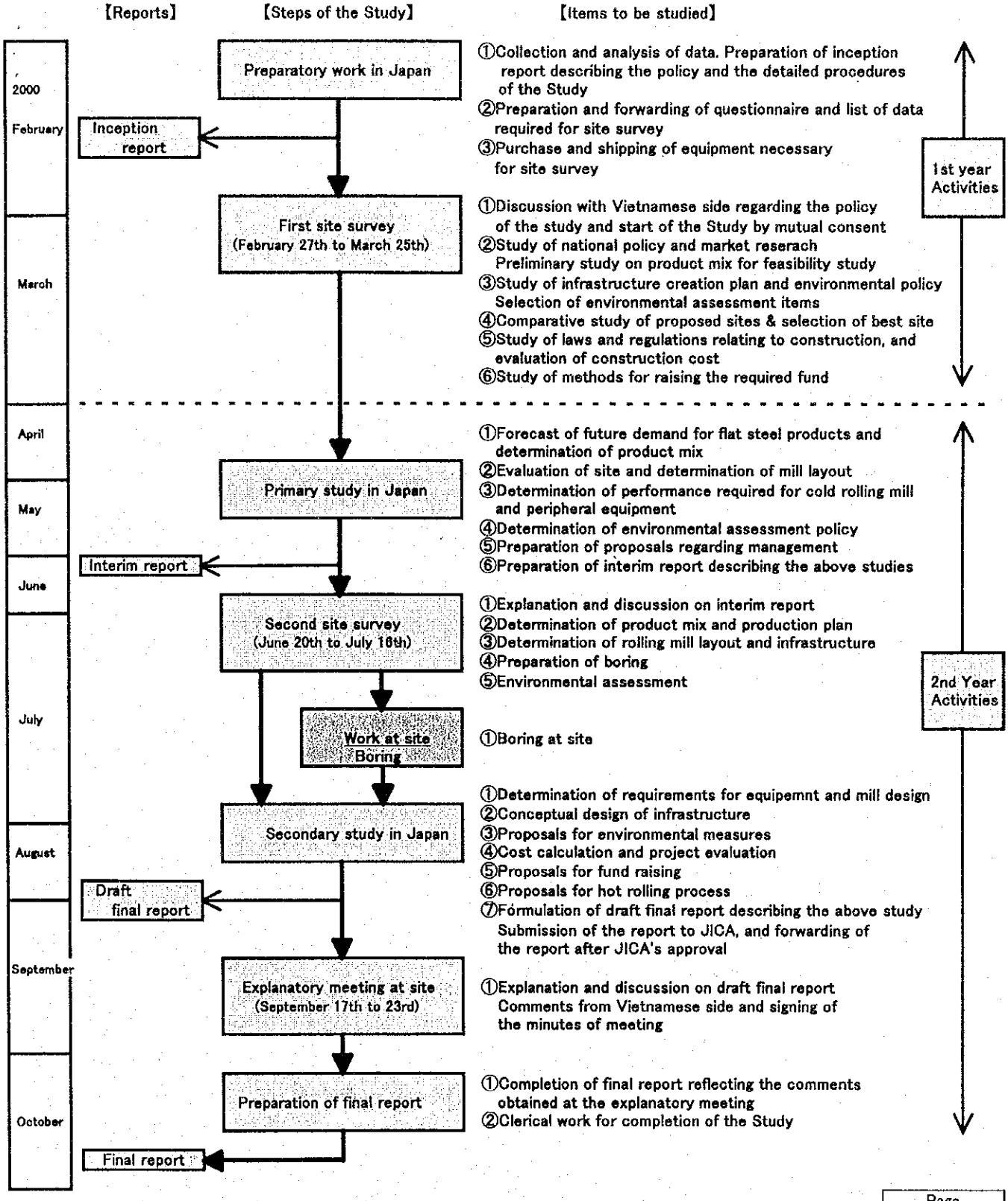


Fig. I-3-1 Flow of Feasibility Study

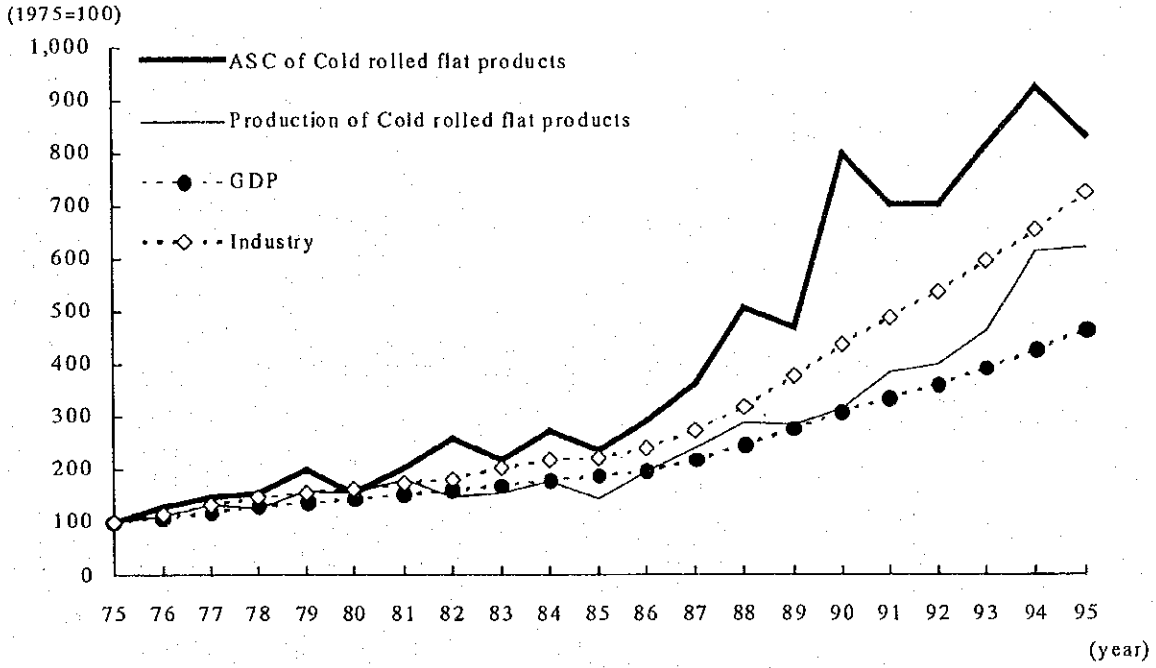
Chapter II Present Situation of Economy in Viet Nam and Projection of Its Growth

1. Outline and Projection of Macro-Economic Performance

1.1 Economic Growth and Demand for Cold Rolled Flat Products

Generally speaking, the demand for cold rolled flat products increases as the economy of a country, especially the industry sector, grows. A correlation can be thought to be here between both. Fig. II-1-1 shows the trends of GDP and the demand for cold rolled flat products in Thailand. A trend of the demand for cold rolled flat products exceeding the growth of the industry sector is clearly seen there.

In forecasting the demand for cold rolled flat products, the perspective of economic growth of the country in question is of prime importance, and so we considered as follows.

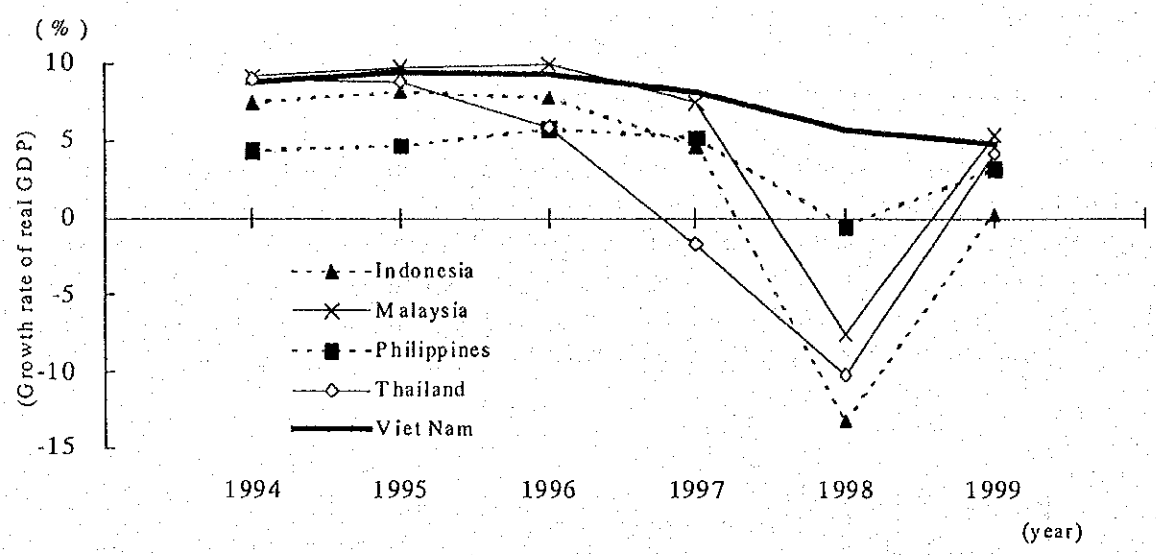


Source: IISI, NESDB

Fig. II-1-1 Supply and Demand of Cold Rolled Flat Products and Real GDP in Thailand

1.2 Outline of Macro-Economic Performance in Viet Nam

Fig. II-1-2 presents the trends of real GDP in ASEAN countries. Table II-1-2 shows nominal GDP of ASEAN countries in 1996 (in billions of U.S. dollars). Fig. II-1-2 tells us that Viet Nam' s economic growth fell temporarily due to the influence of the Asian economic crisis, but the impact of the recession was much smaller than that experienced by other ASEAN countries because of the relatively small scale of Viet Nam' s economy as shown in Table II-1-2, which in turn suggests that the economy has a fair chance of growth in the future.



Source: Indonesia - Thailand IMF
Viet Nam MPI

Fig. II-1-2 Growth Rate of Real GDP in ASEAN Countries

Table II-1-2 Nominal GDP in ASEAN Countries (1996)

(Unit : Billion US dollar)

Indonesia	Malaysia	Philippines	Thailand	Viet Nam
227	101	83	182	25

Source: IMF

1.3 Projection of Macro-Economic Performance

Table II-1-2 shows growth rates of real GDP by sector. The forecast of GDP growth is based on the result of interviews with MPI because the 9th Five Year Plan (2001 to 2005) was just about to be established at the time of the survey, and is expected to reach 6.7% in 2005 and 6.6% in 2010.

Seen by sectors, the growth of the industry sector is estimated to be 9.5% for 2005, and 8.0% for 2010.

Table II-1-2 Growth Rate of Real GDP by Sector

(Unit : % in 1994 prices)

	(actual)					(forecast)			
	1995	1996	1997	1998	1999	2000	2003	2005	2010
Agriculture	5	4.4	4.3	3.5	5.2	4.0	3.3	3.0	3.0
Industry	14.0	14.1	13.1	10.5	9.3	8.9	9.3	9.5	8.0
Services etc.	11.0	10.0	7.1	4.9	2.3	3.7	5.8	7.0	7.0
Total	9.5	9.4	8.2	5.8	4.8	5.5	6.6	6.7	6.6

Source: MPI

Table II-1-3 shows a forecast of nominal GDP per capita in Viet Nam. For the purpose of the comparison of the nominal GDP per capita of those in (in U.S. dollars) ASEAN countries of which a long-term chronological data are available, the real GDP was deflated by GDP deflators to calculate nominal GDP, which was then converted to U.S. dollars using a Dong/U.S. dollar exchange rate. GDP per capita (in U.S. dollars) has been calculated by dividing the number so obtained by the population.

Assuming the growth of GDP deflator returning to 4.9% annually on average for the period from 2000 to 2010 back from the deviated trend of the period from 1995 to 1999, the nominal annual average GDP growth rate will be as high as 11.8%. Further, if we assume that the exchange rate of Viet Nam dong against U.S. dollars depreciates at an annual rate of 1.5% for the period from 2000 to 2010 and the population increases during the same period at an annual average rate of 1.6%, then nominal GDP per capita (in U.S. dollars) of 1999 of 374 U.S. dollars increases to approximately 600 U.S. dollars in 2005, and 900 U.S. dollars by 2010.

Table II-1-3 Forecast of Nominal GDP per Capita in Viet Nam

		1999	2000	2005	2010
GDP at constant 1994 prices (a)	Billion dongs	256,269	270,384	372,726	513,069
GDP deflator (b)	1994=100	156.1	166.2	215.4	264.7
GDP at current prices (c) = (a) × (b)	Billion dongs	399,942	449,469	803,022	1,357,878
Exchange Rate (d)	dongs / US dollars	13,840	14,050	15,148	16,332
Population (e)	Million peoples	77.3	79.4	84.8	92.3
GDP per capita (f) = (c) / (d) / (e)	US dollars	374	400	600	900

Fig. II-1-3 compares the forecast of nominal GDP per capita of Viet Nam of Table II-1-3 to the records of other ASEAN countries. The forecast of nominal GDP per capita of Viet Nam is considered reasonable compared to the actual results shown by other ASEAN countries.

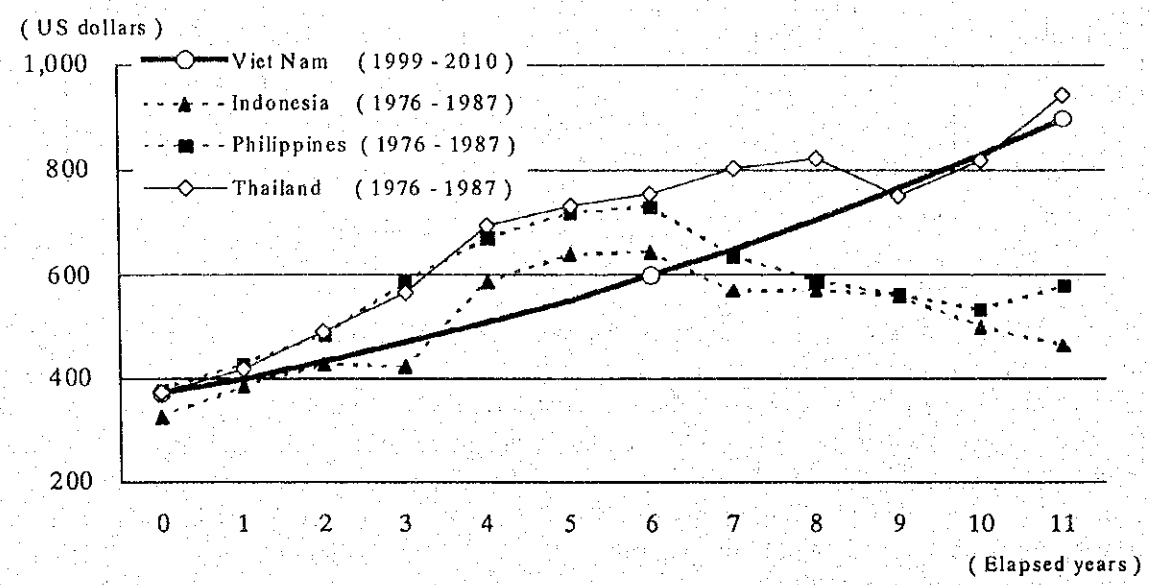


Fig. II-1-3 Nominal GDP per Capita in ASEAN Countries

2. Outline and Projection of Each Industrial Sector

2.1 General

Cold rolled flat products are used not only by a construction sector, but also by manufacturing sector as well. We have examined the status of manufacturers of GI sheets as major users of cold rolled flat products and other industries of future potential growth including the manufacturing industries of motorbikes, automobiles and home appliances in Viet Nam. Whereas our survey was conducted by interviewing the users and government authorities, it would certainly be desirable if the public statistics of steel and related products were be improved to allow us to conduct forecasting work on a continuous basis.

Table II-2-1 shows the forecast of production and assembly of demand sectors of cold rolled flat products.

Table II-2-1 Forecast of Production and Assembly of Demand Sectors

	(actual)					(forecast)				
	1995	1996	1997	1998	1999	2000	2003	2004	2005	2010
GI sheets (1,000 tons)	61	80	90	100	120	140	210	230	250	500
Motorbikes (1,000pieces)	55	40	97	376	437	450	500	550	600	900
Automobiles (1,000pieces)	0.0	10.8	14.9	5.9	8.5	12.0	15.0	20.0	24.0	30.0
Passenger cars (1,000pieces)	0.0	5.1	6.8	2.7	4.4	5.5	7.0	10.0	11.0	18.0
Commercial vehicles (1,000pieces)	0.0	5.7	8.1	3.2	4.1	6.5	8.0	10.0	13.0	12.0
Home appliances										
Air-conditioners (1,000pieces)				7	32	80	100	120	140	200
Refrigerators (1,000pieces)			33	110	130	195	231	260	300	450
Washing machines (1,000pieces)				20	200	250	300	350	400	600

Chapter III Projection of Demand for Cold Rolled Flat Products

1. Present Situation of Supply and Demand of Cold Rolled Flat Products

Table III-1-1 shows the import of steel products. As all of the cold rolled flat products used in Viet Nam are currently imported, the total supply volume equals the volume of the import. The import of cold rolled flat products in 1999 was 291 thousand tons, occupying 25.4% of the total import of steel products.

Table III-1-1 Imported Steel Products in Viet Nam

(Unit : 1,000 tons)

	1998	1999
Steel products	846	1,144
Plate	234	292
Sheet & Coil	342	564
Hot rolled	166	273
Cold rolled	176	291
Coated steel	100	103
Tinplate	25	26
Galvanized sheet	27	16
Color	48	62
Silicon sheet	9	7
Stainless sheet	22	42
Construction	11	13
Section	53	47
Machinery steel	22	26
Spring steel	0	0
Steel wire	11	14
Others	43	36

Source: General Customs Office, VSC

2. Projection of Demand of Cold Rolled Flat Products in Viet Nam

2.1 Steel Demand for GI Manufacturers

Table III-2-1 shows the steel demand for GI manufacturers. Production of GI sheets has been quoted from Table II-2-1. The ratio of GI substrates as a raw material of GI sheets is estimated as approximately 85%, the steel demand for GI manufacturers is estimated to reach 213 thousand tons for 2005, and 425 thousand tons for 2010.

Table III-2-1 Steel Demand for GI Manufacturers

(Unit : 1,000 tons)

	1999	2000	2003	2004	2005	2010
Production of GI sheets (a)	120	140	210	230	250	500
GI substrate (b) = (a) × 0.85	102	119	179	196	213	425

2.2 Steel Demand for Motorbike Industry

Table III-2-2 shows the steel demand for the motorbike industry. The number of motorbikes assembled in the country is quoted in Table II-2-1. The demand for steel products has been calculated as the number of motorbikes multiplied by the steel consumption per unit and the localization rate. The steel demand for the motorbike industry is estimated as 8,000 tons for 2005, and 14,000 tons for 2010.

Table III-2-2 Steel Demand for Motorbike Industry

		1999	2000	2003	2004	2005	2010
Assembly of motorbikes (a)	1,000 pieces	437	450	500	550	600	900
Steel consumption per unit Cold rolled sheet & coil (b1) Galvanized sheet (b2)	kg / piece	 18 7	 18 7	 18 7	 18 7	 18 7	 18 7
Localization rate (c)	%	25.0	25.0	45.0	50.0	55.0	64.0
Cold rolled sheet & coil (d) = (a) × (b1) × (c)	1,000 tons	2	2	4	5	6	10
Galvanized sheet (e) = (a) × (b2) × (c)	1,000 tons	1	1	2	2	2	4
Total demand (f) = (d) + (e)	1,000 tons	3	3	6	7	8	14

2.3 Steel Demand for Automobile Industry

Table III-2-3 shows the steel demand for the automobile manufacturing industry. The number of automobiles assembled in Viet Nam is that given in Table II-2-1. The steel demand has been calculated as the said number of automobiles multiplied by the steel consumption per unit and the localization rate. The steel demand for the automobile industry is estimated as 3,000 tons for 2005, and 8,000 tons for 2010.

However, the production level of most automobile manufacturers remains at Completely-Knocked-Down-2 (CKD2) meaning that the automobile industry of Viet Nam is performing the assembling of automobiles starting from welding and painting of imported components to the assembling process, without the pressing process. It would not be realistic, therefore, to include the steel demand for the automobile industry in the steel demand to be met by the new CRM, at least till 2005.

Table III-2-3 Steel Demand for Automobile Industry

		1999	2000	2003	2004	2005	2010
Assembly of automobiles							
Passenger cars (a1)	1,000 pieces	4.4	5.5	7.0	10.0	11.0	18.0
Commercial vehicles (a2)		4.1	6.5	8.0	10.0	13.0	12.0
Steel consumption per unit							
Passenger cars							
Cold rolled sheet & coil (b1)		173	173	173	173	173	173
Surface treated sheet (b2)	kg / piece	186	186	186	186	186	186
Commercial vehicles							
Cold rolled sheet & coil (b3)		247	247	247	247	247	247
Surface treated sheet (b4)		249	249	249	249	249	249
Localization rate							
Passenger cars (c1)	%	5.0	5.0	10.0	20.0	20.0	60.0
Commercial vehicles (c2)		10.0	10.0	20.0	30.0	30.0	60.0
Cold rolled sheet & coil (d) = (a1) × (b1) × (c1) + (a2) × (b3) × (c2)	1,000 tons	0	0	0	1	1	3
Surface treated sheet (e) = (a1) × (b2) × (c1) + (a2) × (b4) × (c2)	1,000 tons	0	0	0	1	2	5
Total demand (f) = (d) + (e)	1,000 tons	0	0	0	2	3	8

2.4 Steel Demand for Home Appliance Industry

Table III-2-4 shows the steel demand for the home appliance industry. The number of home appliances assembled in Viet Nam is the same with that given in Table II-2-1. The demand for steel products is calculated as the number of units assembled multiplied by the steel consumption per unit and the localization rate.

The lack of painting facilities at factories forces the home appliance makers to use imported pre-coated steel sheets, thus no cold rolled flat products are used at the moment. It is said that installation of painting facilities will only reasonably pay when the production reaches a level of 1,000,000 pieces of home appliances. Accordingly, it would not be realistic to include the steel demand for the home appliance industry in the steel demand to be met by the new CRM, at least till 2005.

Table III-2-4 Steel Demand for Home Appliance Industry

		1999	2000	2003	2004	2005	2010
Assembly of home appliances							
Air-conditioners (a1)	1,000 pieces	32	80	100	120	140	200
Refrigerators (a2)		130	195	231	260	300	450
Washing machines (a3)		200	250	300	350	400	600
Steel consumption per unit							
PCM							
Air-conditioners (b1)	kg / piece	15	15	15	15	15	15
Refrigerators (b2)		20	20	20	20	20	20
Washing machines (b3)		11	11	11	11	11	11
Localization rate							
Air-conditioners (c1)	%	40.0	40.0	40.0	40.0	50.0	70.0
Refrigerators (c2)		40.0	40.0	40.0	40.0	50.0	70.0
Washing machines (c3)		40.0	40.0	40.0	40.0	50.0	70.0
Total demand (PCM)							
(d) = (a1) × (b1) × (c1)	1,000 tons	2	3	4	5	6	13
+ (a2) × (b2) × (c2)							
+ (a3) × (b3) × (c3)							

2.5 Forecast of Steel Demand of Cold Rolled Flat Products by Total of Demand Sectors

The demand for cold rolled flat products in 1999 is shown in Table III-2-5. The total demand for 1999 is considered to be 291 thousand tons as quoted from Table III-2-1, of which the demand of 102 thousand tons for GI substrates has been put aside and the remaining 189 thousand tons have been estimated as demand for cold rolled sheets & coils. Further, considering the result of our interview survey, a portion corresponding to 9% or 17 thousand tons of the demand for cold rolled sheets & coils has been determined as demand for high classed cold rolled sheets & coils, with the remaining 172 thousand tons considered as cold rolled sheets & coils for conventional use.

Table III-2-5 Distribution of Demand for Cold Rolled Flat Products in 1999

(Unit : 1,000 tons)

	1999
Total demand	291
GI substrate	102
Cold rolled sheet & coil	189
High class	17
Conventional use	172

Table III-2-6 shows a forecast of demand for cold rolled sheets & coils. As the users of cold rolled sheets & coils are diverse, the demand for the same has been estimated based on the growth rates of the related industries in GDP. According to an example in Thailand of Fig. II-1-1, as the growth rate of cold rolled flat products in Thailand exceeded the growth of the industry in GDP, the demand for cold rolled sheets & coils was calculated as the volume of demand for those of the previous year multiplied by the ratio of growth of the industry sector in GDP plus an adjustment factor comprising a ratio representing an average deviation between the growth of demand for cold rolled flat products in Thailand and the growth rate of the industry sector.

Also, the distribution of cold rolled sheets & coils of high class and for conventional use was estimated on the basis of composition of demand of 1999.

TableIII-2-6 Demand Forecast of Cold Rolled Sheet & Coil

(Unit : 1,000 tons)

	1999	2000	2003	2004	2005	2010
Revised growth rate		8.8	11.2	11.2	11.1	11.4
Cold rolled sheet & coil	189	206	283	315	350	600
High class	17	19	26	29	32	55
Conventional use	172	187	257	286	318	545

Table III-2-7 shows the steel demand for new CRM by the total of demand sectors. The demand for cold rolled sheets & coils of high class has been determined as the balance of the figure calculated in Table III-2-6 less the steel demand for the motorbike industry of Table III-2-2. The steel demand for

the automobile industry and the home appliance industry which are non-existent yet as of 1999 has been counted as the demand for high classed cold rolled sheets & coils first in 2010. The demand for GI substrates has been quoted from Table III-2-1.

Based on the above assumptions, the steel demand for new CRM has been estimated as 563 thousand tons by 2005, and 1,046 thousand tons by 2010.

TableIII-2-7 Forecast of Steel Demand for New CRM by Total of Demand Sectors

(Unit : 1,000 tons)

	1999	2000	2003	2004	2005	2010
Cold rolled sheet & coil	189	206	283	315	350	621
Conventional use	172	187	257	286	318	545
High class	17	19	26	29	32	76
Motorbikes	3	3	6	7	8	14
Automobiles	-	-	-	-	-	8
Home appliances	-	-	-	-	-	13
Others	14	16	20	22	24	41
GI substrate	102	119	179	196	213	425
Maximum demand for new CRM	291	325	462	511	563	1,046

2.6 Forecast of Steel Demand Derived from GDP per Capita

Fig. III-2-1 presents a forecast of steel demand based on GDP per capita. The curve in the figure was created by an regression equation method using the least square equator applied to the ASC per capita of cold rolled flat products in ASEAN countries and GDP per capita, with Indonesia excluded due to large deviation from other samples. The curve gives an ASC per capita of cold rolled flat products of 6 kg and 12 kg when GDP per capita reaches U.S. dollars 600 and U.S. dollars 900 respectively.

Assuming that GDP per capita in Viet Nam would reach 600 U.S. dollars in 2005 and 900 U.S. dollars in 2010 as was assumed in Table II-1-3, the ASC of cold rolled flat products would be approximately 530 thousand tons in 2005 and 1,080 thousand tons in 2010.

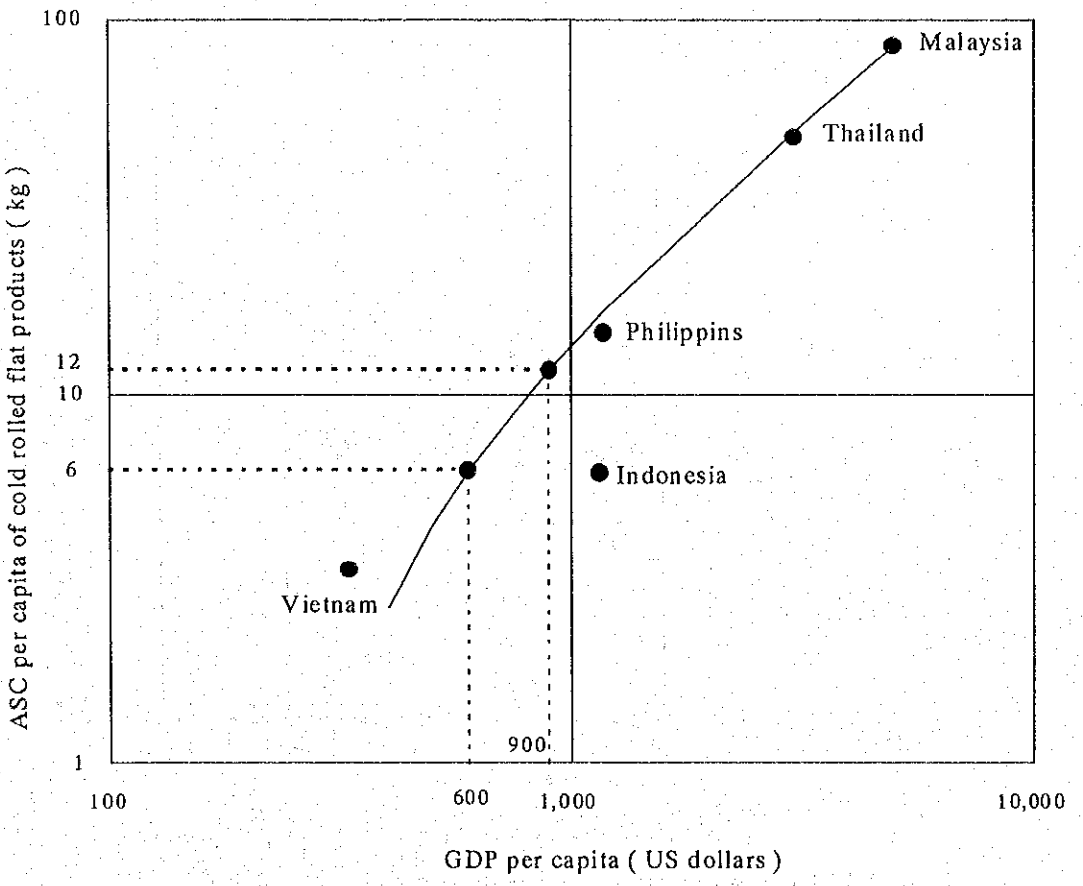


Fig. III-2-1 Forecast of Steel Demand based on GDP per Capita (A)

Fig. III-2-2 presents a result of the estimation of steel demand based on another method using GDP per capita. The ASC per capita of cold rolled flat products increases as GDP per capita grows. As the consumption per capita is estimated to reach 7 kg and 9 kg when GDP per capita reaches U.S. dollars 600 and 900 respectively as indicated by an average of the smoothed results of the neighboring countries. As we assume Viet Nam will grow to the same level of GDP per capita, the ASC per capita of cold rolled flat products will be approximately 590 thousand tons in 2005, and 1,110 thousand tons in 2010.

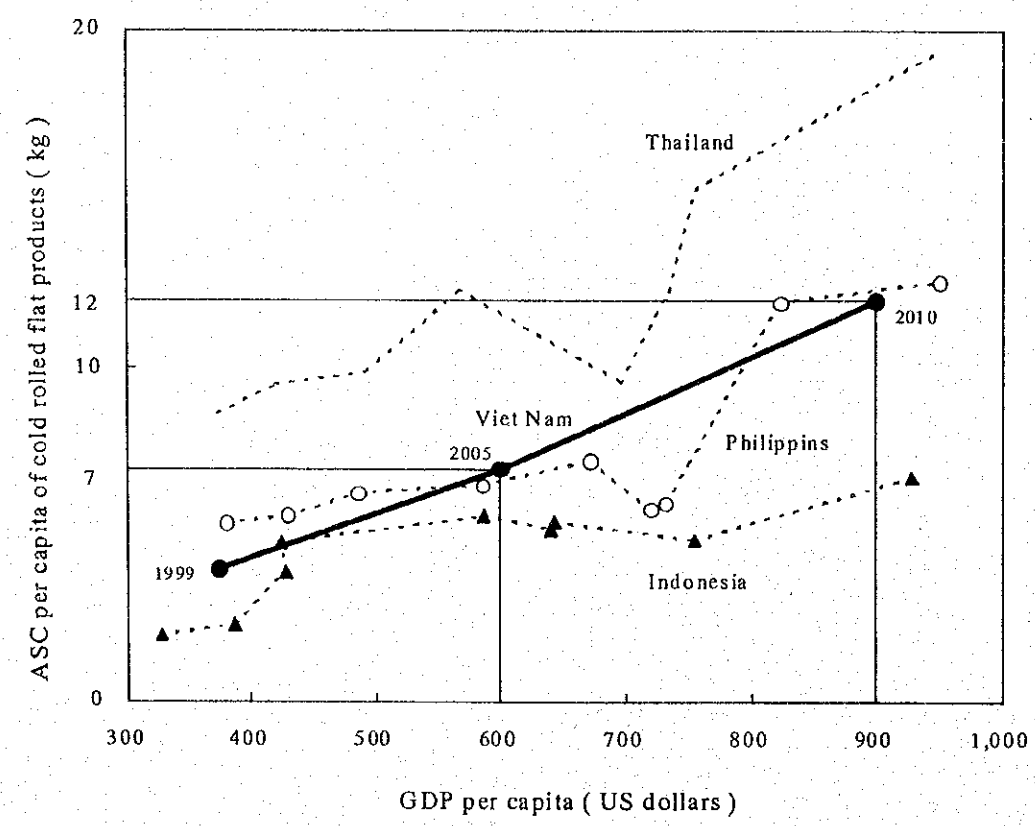


Fig. III-2-2 Forecast of Steel Demand based on GDP per Capita (B)

2.7 Conclusion

Fig. III-2-3 presents a forecast of steel demand for new CRM. The Figure shows the steel demand for new CRM by the total sectors of Table III-2-7 and the steel demand estimated on the basis of GDP per capita of Fig. III-2-1 and Fig. III-2-2. The three methods employed produced similar numbers, indicating the forecast numbers are reasonable.

For the purpose of this paper, we would like to use the result obtained by the total of demand sectors quoted afresh in Table III-2-8 as a forecast of steel demand for new CRM considering the breakdown of the demand by usage.

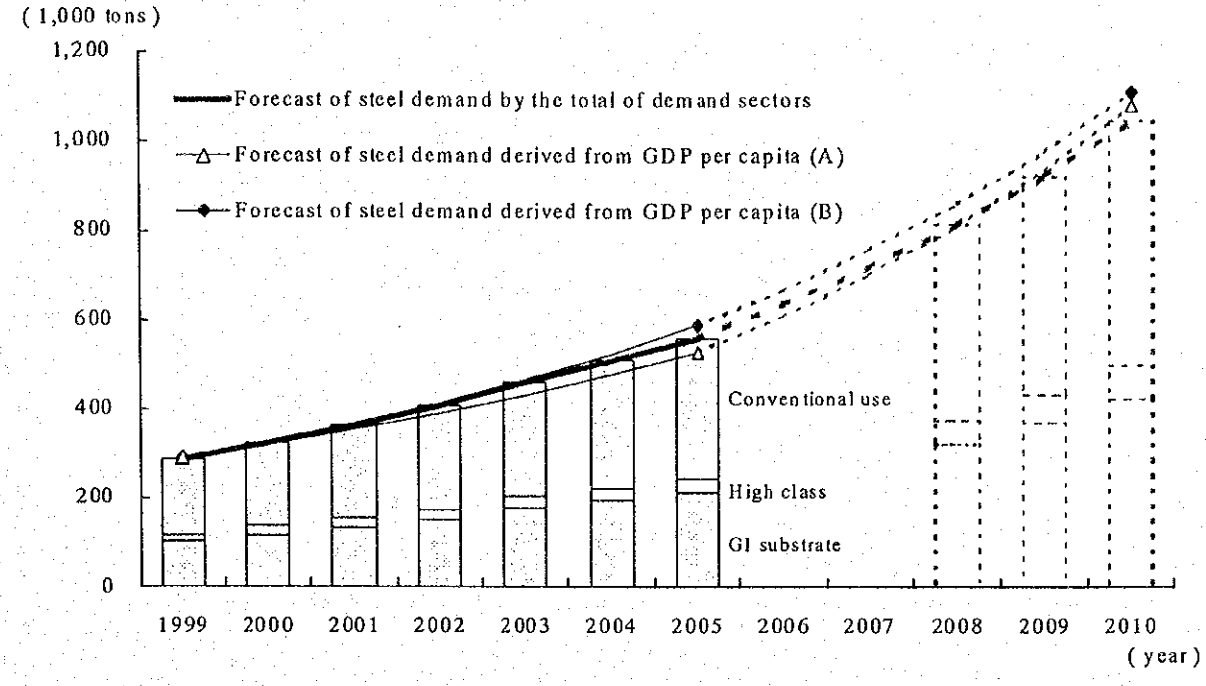


Fig. III-2-3 Forecast of Steel Demand for New CRM

Table III-2-8 Forecast of Steel Demand for New CRM

(Unit : 1,000 tons)

	1999	2000	2003	2004	2005	2010
Cold rolled sheet & coil	189	206	283	315	350	621
Conventional use	172	187	257	286	318	545
High class	17	19	26	29	32	76
GI substrate	102	119	179	196	213	425
Maximum demand for new CRM	291	325	462	511	563	1,046

Chapter IV Product Mix and Production Capacity for New Cold Rolling Mill

1. Result of Investigation on Size Mix and Grade Mix of Cold Rolled Steel Sheets and Galvanized Iron Substrates in Vietnamese Market

In general, production capacity of cold rolling mill complex varies depending upon strip thickness, width and grades. This necessitates the work of defining the thickness, width and grades of the products for designing the cold rolling mill complex. Accordingly, an investigation on the thickness, width and grades of Vietnamese market was made and the necessary information was collected.

(1) Cold rolled steel sheets for manufacturing (CRS)

Through the market study, CRS market is found to be classified in two groups, namely conventional use and high class use. Under the present condition CRS for conventional use is imported mainly from CIS countries such as Russia and so on, while that for high class use mainly from Japan, Korea and Taiwan. Accordingly, the size mix of both conventional use and high class use has to be investigated in order to clarify the size mix of CRS as a whole in Viet Nam.

Characteristics of CRS for conventional use can be summarized as follows;

a) Thickness is more than 0.4 mm.
b) Width is basically 1,000 mm and 1,250 mm.
c) Grade is all Commercial Quality (CQ).
d) Total amount consumed in Viet Nam is estimated to be about 145,000 tons/year.
e) Customers of the coil centers and trading companies surveyed are local traders, pipe manufacturers, furniture manufacturers for domestic use, bicycle manufacturers, repairers of motorcycle and so on.

Characteristics of CRS for high class use can be summarized as follows;

a) Width is under 1,250 mm.
b) Grade is all Commercial Quality (CQ).
c) Total amount consumed in Viet Nam is estimated to be about 17,000 tons/year.
d) Customers of the coil center surveyed are furniture manufacturers for export, motorcycle manufacturers, switch panel manufacturers and so on.

(2) Galvanized iron substrate (GIS)

Under the present condition, GIS is mainly imported from Japan, Korea, Taiwan and Thailand. The import of GIS from CIS countries such as Russia is rather limited due to thin thickness of GIS. GIS can be classified in two groups, namely " annealed (CQ)" and " not-annealed(Full Hard)" . Accordingly, the size mix of both CQ and Full Hard has to be investigated in order to clarify the size mix of GIS as a whole in Viet Nam.

Characteristics of GIS can be summarized as follows;

a) Thickness of GIS is more than 0.15 mm .
b) Width of GIS is under 4 feet.
c) Grades are Full Hard and Commercial Quality (CQ).
d) Total amount consumed in Viet Nam is estimated to be about 102,000 tons/year. (GIS base)

(3) Pickled and Oiled sheet (P/O)

Under the present condition P/O is not imported regularly, which indicates the existence of only a limited market for this product in Viet Nam.

2. Basic Idea for Defining Product Mix and Production Capacity

It is quite important to define the product mix and production capacity in planning or designing the new cold rolling mill complex. The following preconditions for the work of defining the product mix and production capacity are set based on the result of market survey, the detail of which is described in IV-1.

(1) CRS for both conventional use and high class use and GIS of both CQ and Full Hard are selected as the possible products for the new cold rolling mill complex.

(2) The demand for cold rolled steel sheets in Viet Nam is estimated to be around 500,000 tons/year in 2004, when the new cold rolling mill complex is expected to start its operation. To be least affected by the variation in demand and also to minimize the initial investment cost the new cold rolling mill complex with a production capacity of 250,000 tons/year is to be studied in this FS. This capacity of 250,000 tons/year coincides with the idea of the Vietnamese side at the time of this FS.

(3) Judging from the prediction of demand increase of major customers for the cold rolled steel sheets, it is unlikely that a considerable change in the demand for the size mix for CRS and GIS occurs at the time of the start-up of the new cold rolling mill complex. Accordingly, the size mix described in IV-1 is adopted for this FS.

(4) With regard to grade mix the following preconditions are set ;
   1) For GIS, the proportion of Full Hard and CQ of the the present market is adopted for this FS. Namely, 64.9 % of GIS is considered to be Full Hard and 35.1 % CQ.
   2) At the moment the grade of CRS is all CQ. Considering the upper allowance of the BAF capacity, however, the proportion of CQ, DQ and DDQ in the new cold rolling mill complex is assumed to be 85%, 10% and 5% respectively.

In general, the production capacity of cold rolling mill complex is dominated by that of the cold rolling mill, which is the main equipment of the complex.

One (1) stand reversing cold rolling mill of combination type, which is used both for rolling and skin pass, is widely adopted for the cold rolling mill complex with a production capacity level of 250,000 tons/year. The said mill type, namely one (1) stand reversing cold rolling mill of combination type is adopted in this FS.

3. Recommend Product Mix and Production Capacity of New Cold Rolling Mill Complex

(1) Basic ideas for cases to be considered

To decide the product mix and production capacity of the new cold rolling mill complex the following four cases are studied. The result of the study is shown in Table IV-3-1.

1) Case 1

An emphasis is laid on the expected profit.
CRS for high class use (hereinafter described as CH), GIS of Full Hard (hereinafter described as GH) and GIS of CQ (hereinafter described as GS) are to be produced.

2) Case 1-1

All of four grades of cold rolled steel sheets are to be produced in this case. This case is studied responding to the request from Vietnamese side.
CRS for conventional use (hereinafter described as CC), CH, GH and GS are to be produced.

3) Case 2

An emphasis is laid on the production quantity.
Only CRS, namely CH and CC are to be produced.

4) Case 3

An emphasis is laid on the reduction of the initial investment.
Only GH is to be produced.

(2) Calculation of production capacity for each case

For the above-mentioned four cases, production capacity was calculated in the following manner ;

1) Case 1

a) Firstly, considering the demand predicted, together with some safety allowance, for the year 2004 when the new cold rolling mill complex is to start its operation, the production amount of CH is assumed to be 21,000 tons/year. The time required for the production of CH at each process is calculated based on the real operating indices.

b) For all the time excluding that required for the production of CH, GIS is to be produced. The proportion of GH and GS is assumed to be those obtained at the market survey.

2) Case 1-1

a) Firstly, the production amounts of CH and CC are assumed to be 20,000 tons/year and 50,000 tons/year respectively. The time required for the production of CH and CC at each process is calculated based on the real operating indices.

b) For all the time excluding that required for the production of CH and CC, GIS is to be produced. The proportion of GH and GS is assumed to be those obtained at the

market survey.

3) Case 2
   a) Firstly, considering the demand predicted, together with some safety allowance, for the year 2004 when the new cold rolling mill complex is to start its operation, the production amount of CH is assumed to be 21,000 tons/year. The time required for the production of CH at each process is calculated based on the real operating indices.
   b) For all the time excluding that required for the production of CH, CC is to be produced.

4) Case 3
   a) For all the time available GH is to be produced. The production amount is calculated based on the real operating indices.

The production amount calculated and the required equipment for each case is shown in Table.IV-3-1.
The production flows for CASE 1 is shown in Fig. IV-3-1. The yield for each process is assumed based on the operational result of the similar process being in operation in Japan.

(3) Evaluation of each case

The evaluation of each case is made from the viewpoints of production capacity, required initial investment cost, number of grades to be produced and profitability. The result of the evaluation is also shown in Table.IV-3-1.

For Case 1 a relatively high initial investment cost is expected as this case covers three grades of GH, GS and CH. The production capacity reaches 205,000 tons/year, a little less than the planned value. However, higher profitability is expected as all the grades to be produced in this case have good profit.

For Case 1-1 an additional investment cost is required compared to Case 1. This is because the amount of products which require annealing increases due to the production of CC, thus necessitating an additional BAF equipment. The production capacity increases up to 220,000 tons/year, still a little less than the planned value. The profitability is lower compared to Case 1 as only a small profit is expected for CC.

For Case 2 the production capacity reaches 281,000 tons/year, more than the planned value. However, this case has a disadvantage of producing only CRS.

For Case 3 the production capacity reaches 211,000 tons/year. This case also has a disadvantage of producing only GH although the investment cost required is rather small. According to the demand prediction of GH, the market of only around 200,000 tons/year is expected for GH at the time of the start-up of new cold rolling mill complex, indicating an unstable operation of Case 3 which depends totally on GH.

Considering the following two points Case 1 is adopted for this FS although it falls short of the production capacity of 250,000 tons/year originally planned.

1) Any single grade market is not large enough to satisfy, in terms of quantity, the mill capacity of the new cold rolling mill complex. In other words, the new cold rolling mill complex has to produce GIS together with CRS.
2) Emphasis of production is to be laid on GH, GS and CH which can lead to a high profitability.

Table IV-3-1 Case Study of Product Mix

Case	Production Capacity (Products base)	Required Equipment	Initial Investment	Number of Grades	Profitability	Evaluation
1	GH: 120 ktons/year GS: 64 ktons/year CH: 21 ktons/year CC: 0 ktons/year (Total:205 ktons/year)	PL RCM ECL BAF SPM RCL	(○) (base)	○	○	○
1-1	GH: 100 ktons/year GS: 50 ktons/year CH: 20 ktons/year CC: 50 ktons/year (Total:220 ktons/year)	PL RCM ECL BAF SPM RCL	(△) (+2 M US$) compared to Case 1	○	△ compared to Case 1	△
2	GH: 0 ktons/year GS: 0 ktons/year CH: 21 ktons/year CC: 260 ktons/year (Total:281 ktons/year)	PL RCM ↓ BAF SPM RCL	not evaluated	×	not evaluated	×
3	GH: 211 ktons/year GS: 0 ktons/year CH: 0 ktons/year CC: 0 ktons/year (Total:211 ktons/year)	PL RCM ECL ↓ ↓ RCL	not evaluated	×	not evaluated	×

○ : good △ : fair × : poor

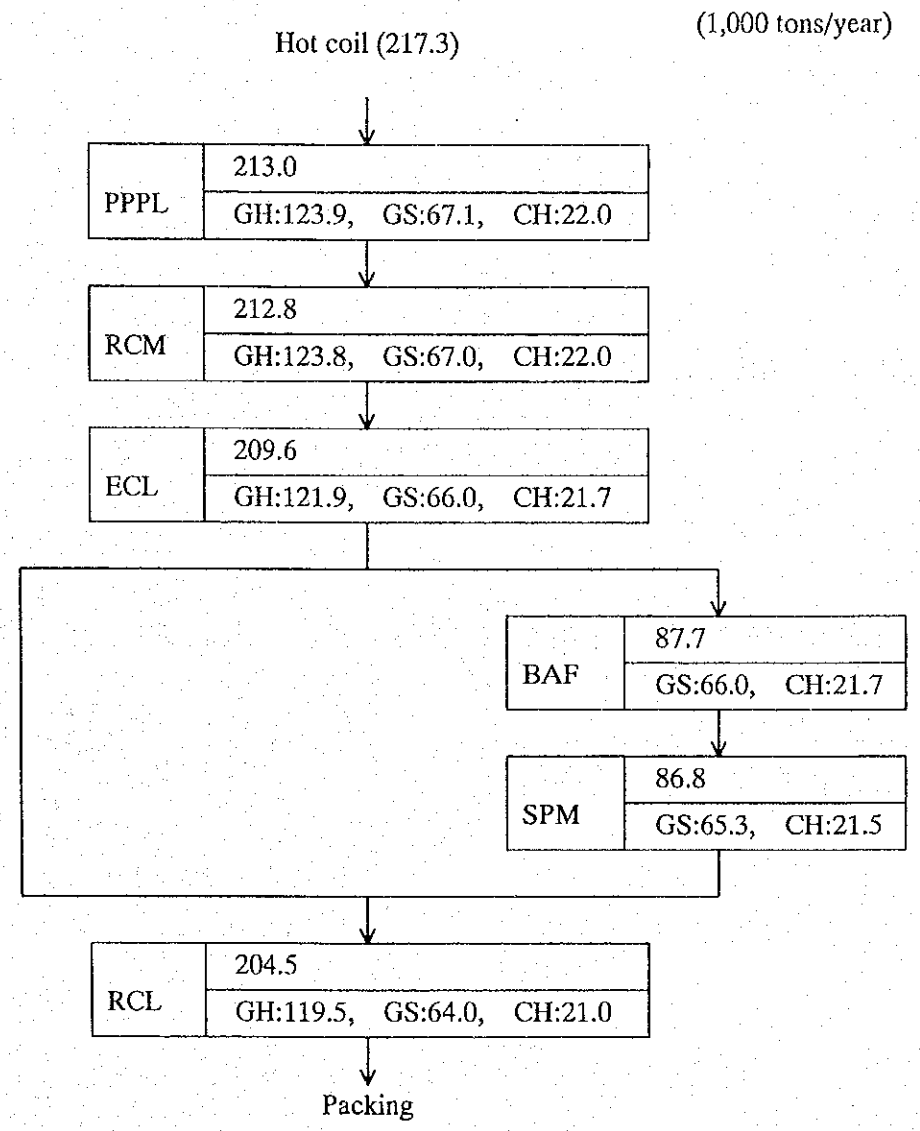


Fig. IV-3-1 Production Flow of CASE 1