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DEVELOPMENT OF
THE IRON AND STEEL INDUSTRY
IN NORTH VIETNAM

DIRECTORATE OF INTELLIGENCE
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DEVELOPMENT OF THE IRON AND STEEL INDUSTRY
IN NORTH VIETNAM*

Summary and Conclusions

North Vietnam is building its first integrated iron and steel facility about 50 miles north of Hanoi at Thai Nguyen. The first blast furnace at that site was completed and put into operation in December 1963 and the second in September 1964. Construction is underway on a third blast furnace and on associated facilities for making and processing steel. The entire project is Chinese in design and manufacture and is quite similar to the many small modern provincial iron and steel plants constructed, or on which construction was started, throughout Communist China during 1958-60. Steel produced in these plants was characterized by its relative high cost and poor quality. When completed late in the 1960's at a claimed cost of US \$160 million, the Thai Nguyen complex will be the largest industrial works in North Vietnam and will give the country a fledgling iron and steel industry -- one of the status symbols among the less developed countries.

Construction of the plant is on a two-stage building program wherein the annual capacity of the first stage, scheduled for completion by the end of 1965, will total about 100,000 tons** of crude steel. During the next several years the plant is scheduled to be expanded to an annual capacity of about 200,000 tons of steel. Recent aerial photography indicates that construction probably is sufficiently advanced to enable the North Vietnamese to complete the first stage by the end of 1965 if Chinese assistance is continued.

Operation of the Thai Nguyen complex will depend to some extent on imports of basic raw materials. Domestic reserves of iron ore are of sufficient grade and quantity to support easily the maximum output planned for the new plant. The country's known reserves of coking coal, however, are quite limited, and future requirements for this material are to be supplied increasingly by Communist China.

Although limited amounts of pig iron and crude steel have been produced in small primitive furnaces over the past several years, virtually no finished steel has ever been produced in North Vietnam. Thus, pending completion of the Thai Nguyen project, the country's small steel-consuming industries, including construction, are dependent almost entirely on imports. Such imports have averaged only about 40,000 tons annually since 1959; so it is apparent that once the steel-producing and processing sections of the new plant are put into

* The estimates and conclusions in this memorandum represent the best judgment of this Office as of 1 October 1964.

** Tonnages are given in metric tons throughout this memorandum.

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operation, the availability of finished steel for industrial consumption will be expanded substantially. Significantly, however, the product mix available from Thai Nguyen almost certainly will be limited to common grades of wire and rod products and light structural shapes. Thus domestic requirements for high-grade rolled steel, particularly flat-rolled products, probably will continue to be met largely through imports.

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I. Production of Iron and SteelA. Small Furnace Program

From 1960 until the Number 1 blast furnace at Thai Nguyen was put into operation in December 1963, North Vietnam produced pig iron estimated at 10,000 to 15,000 tons annually, all from a number of small blast furnaces established near small iron mines throughout the country. These furnaces, ranging in size from 7 to 13 cubic meters, were constructed during 1959-60 with the assistance of Chinese technicians and are similar to the primitive blast furnaces built and subsequently largely abandoned in Communist China during the "leap forward" period of the late 1950's. As in China, the furnaces are relatively inefficient to operate, and the iron produced is of very poor quality.

Available information indicates that possibly 20 small-scale furnaces have been operated sporadically in North Vietnam in recent years, with individual annual output ranging from less than 200 tons up to nearly 3,000 tons. An indication of the variation in the volume of annual output for six furnaces known to have been operating in 1960 is shown in the following tabulation (in tons of pig iron per furnace):

<u>Location</u>	<u>Production in 1960</u>
Hon Gay (20°57'N - 107°55'E)	2,683
Vinh (18°40'N - 105°40'E)	805
Haiphong (20°52'N - 106°41'E)	1,617
Thai Nguyen (21°36'N - 105°30'E)	197
Ham Rong (19°51'N - 105°46'E) (two furnaces)	2,798
Total	<u>8,100</u>

By the end of 1960, two small side-blown converters reportedly were using some of the pig iron produced locally for production of crude steel, but, in the main, the small blast furnaces cater to the needs of local handicraft industries. Although the pig iron produced is used primarily by the North Vietnamese in the manufacture of crude tools and castings for farm implements, limited amounts in the past also have been used in small foundries associated with a plant making agricultural implements and a machine building plant in Hanoi that was supplied by the USSR.

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B. Construction of the Thai Nguyen Iron and Steel Plant

The plant layout of the small iron and steel complex now being built at Thai Nguyen (see Figure 1) was designed for construction in two stages. The first stage currently is scheduled to have a capacity of 100,000 tons each of pig iron and crude steel annually and to be in operation by the end of 1965. The first stage of construction originally was scheduled for partial completion by the end of 1960. However, the railroad from Hanoi to Thai Nguyen that was used to transport construction materials was not opened to traffic until September 1960, and this delay caused a revision in the construction schedule. Construction of the second stage is planned to raise the total respective capacity for iron and steel to 200,000 tons annually, presumably at some time during the Second Five Year Plan (1966-70). The facilities currently installed or in various stages of construction include a byproduct coke plant, three blast furnaces, a sintering plant, a possible converter shop, rolling mills, a refractory brick plant, and an electric powerplant. Ancillary facilities include new roads and rail lines and other installations for receiving and handling raw materials and for shipping products.

1. Current Status of Construction

Aerial photography during March 1964 indicated that, in general, the facilities at the Thai Nguyen iron and steel complex were about in the midpoint of construction. The only major component that was operating was one blast furnace from which, according to the North Vietnamese press, the first pig iron was poured in December 1963. The status of the major facilities of the new complex is discussed below.

a. Coke Plant

Available data relating to the coke plant indicate that the two byproduct coke batteries, each having 45 ovens, probably will have a combined capacity of about 250,000 to 300,000 tons. The byproduct recovery section is designed to recover chemical elements for production of fertilizer, benzene, naphthalene, dyes, pharmaceutical products, plastics, and asphalt. Although aerial coverage indicates that the plant is nearing completion, the two coke oven batteries in March 1964 were covered by temporary roofs which, along with the absence of smoke or steam, indicated that they were not in operation. As of mid-August, no information had become available to indicate that production of coke had been started. Until the coke plant is completed, most of the coke needed by the one blast furnace operating probably is being shipped in by rail from Communist China.

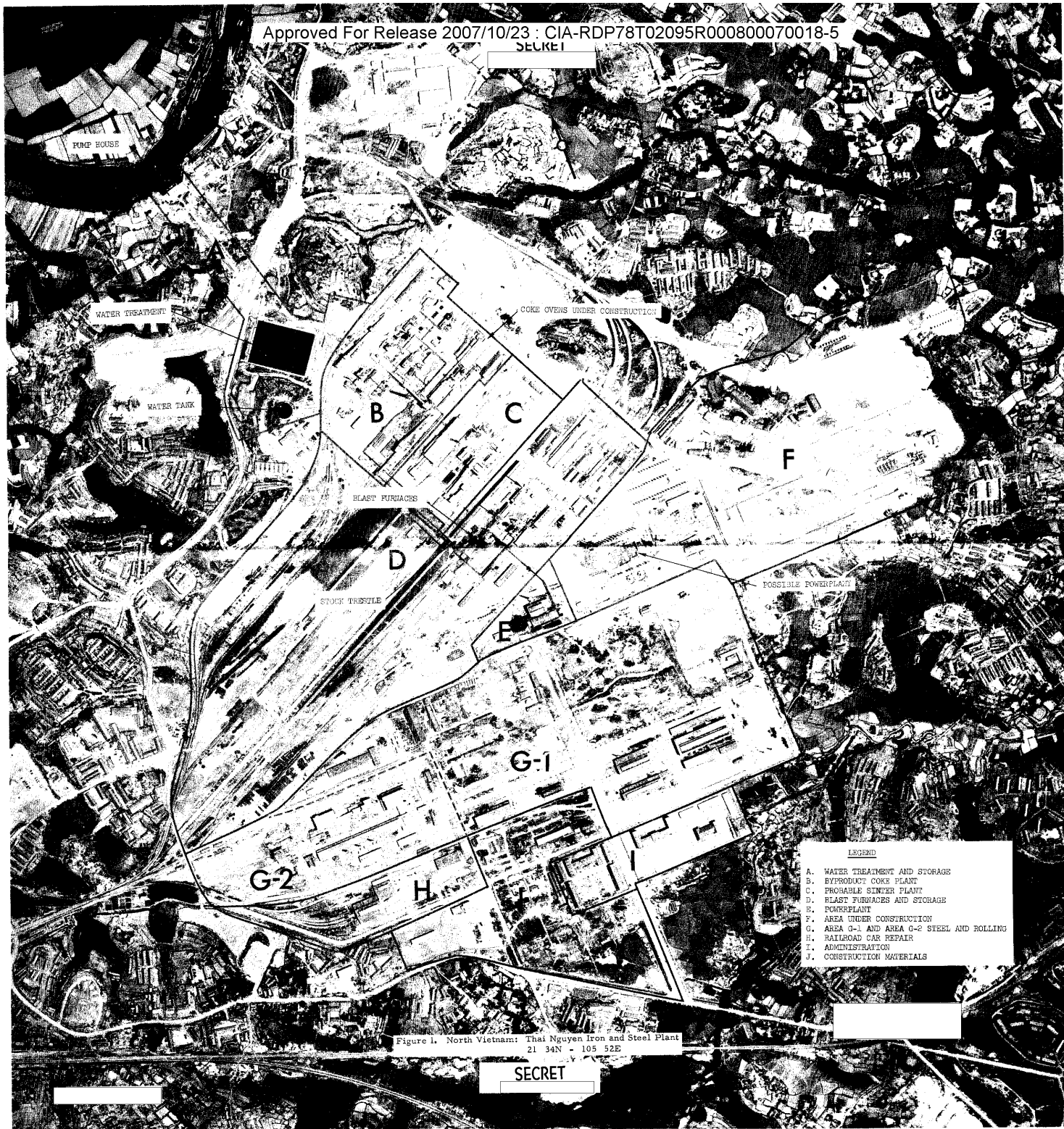
b. Blast Furnaces

Communist press releases indicate that the plant, when fully operational, will have three medium (255-cubic-meter)

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PUMP HOUSE

WATER TREATMENT

WATER TANK

COKE OVENS UNDER CONSTRUCTION

BLAST FURNACES

STOCK TRESTLE

POSSIBLE POWER PLANT

- LEGEND
- A. WATER TREATMENT AND STORAGE
 - B. BYPRODUCT COKE PLANT
 - C. PROBABLE SINTER PLANT
 - D. BLAST FURNACES AND STORAGE
 - E. POWER PLANT
 - F. AREA UNDER CONSTRUCTION
 - G. AREA G-1 AND AREA G-2 STEEL AND ROLLING
 - H. RAILROAD CAR REPAIR
 - I. ADMINISTRATION
 - J. CONSTRUCTION MATERIALS

Figure 1. North Vietnam: Thai Nguyen Iron and Steel Plant
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blast furnaces, each with an estimated annual capacity of about 100,000 tons of pig iron. The aerial photography indicated that one blast furnace was in operation, that the second was nearing completion, and that the third was still in an early stage of construction. The Communists announced that the Number 2 blast furnace was put into operation on 20 September 1964.

c. Facilities for Crude and Finished Steel

The planned annual output of crude steel for the plant, probably to be produced in side-blown converters, is approximately 100,000 tons by 1966 and 200,000 tons by 1970. Press reports concerning the operation of small Chinese plants late in the 1950's indicate that if Thai Nguyen is equipped with side-blown converters, the crude steel produced probably will be both relatively high in cost and poor in quality. Sufficient casting and rolling mill capacity is planned to allow conversion of crude steel into usable finished steel products including wire, rod, structural shapes, and, ultimately, the Communists claim, steel sheet and pipe. Although aerial photography indicates that some buildings in the steel and rolling area are complete or nearing completion, there is no indication that any production activity is being carried out. Early in 1964, as an interim measure until the steel facilities are operational, North Vietnam began selling to Japan pig iron produced at Thai Nguyen.

2. Assistance from Communist China

The development of North Vietnam's small iron and steel industry is being financed largely by Communist China. Under an agreement signed by the latter country and North Vietnam in February 1959, a Chinese credit of US \$75 million was to be used to finance construction of several industrial plants, including starting the first stage of construction at the Thai Nguyen iron and steel plant. A subsequent agreement between the two countries provided for additional assistance for the iron and steel industry of North Vietnam. In January 1961 a long-term credit from China was announced amounting to US \$157 million for construction or expansion of 28 North Vietnamese industrial and transportation enterprises. Under this credit, which was to be used from 1961 to 1967, China is scheduled to provide the necessary aid to insure an output of 100,000 tons of crude steel annually at Thai Nguyen by the end of 1965. The North Vietnamese estimate that the total investment for the entire complex will amount to about US \$160 million.

Under the credits, China has provided extensive assistance in engineering and equipment for the Thai Nguyen complex and has furnished a large number of technicians to install equipment, manage operations, and train indigenous personnel. Also, North Vietnamese operating personnel are known to have been receiving training in Chinese steel mills in 1963-64.

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C. Red River Valley Iron and Steel Plant

Construction of another iron and steel plant, larger than the Thai Nguyen facility, has been considered by the North Vietnamese government. Late in 1960 it was announced that preliminary planning and surveys were to be carried out for construction beginning in 1966 of an iron and steel complex near Yen Bay (21°42'N - 104°52'E) on the Red River in northwestern North Vietnam. The proposed site reportedly has substantial reserves of high-grade iron ore but no known deposits of coking coal. No mention has been made in the Communist press of this plant since 1960, and as of mid-1964 no other evidence had become available that would indicate the North Vietnamese are going ahead with this project.

II. Raw Material Base

Except for coking coal, North Vietnam has available domestically the basic raw materials to meet the needs of its small iron and steel industry. Proved reserves of iron ore are of relatively good quality and sufficient to last at least 50 years at the country's planned rate of producing iron in 1966, and sufficient quantities of limestone and manganese are available for scheduled blast furnace operations. Although indigenous reserves of coking coal are limited, the necessary requirements of this raw material are readily obtainable from Communist China. Scrap requirements for producing steel are nominal in the side-blown converter process and should present no problem.

A. Iron Ore

By world standards, North Vietnam is a very minor producer of iron ore, but output will increase considerably over the next several years to meet planned domestic requirements. From an estimated output of 66,000 tons in 1963, North Vietnamese forecasts indicate production of at least 300,000 tons of iron ore by 1966. Although such an increase will be substantial for North Vietnam, output in the latter year will continue to be quite small, equal, for example, to less than 10 percent of production in North Korea in 1963. Estimates of production of iron ore in North Vietnam during 1960-63 are as follows (in tons):

1960	25,000
1961	25,000
1962	30,000
1963	66,000

The deposits of iron ore are scattered throughout North Vietnam, but many are in inaccessible areas, and others are not sufficiently large to warrant exploitation. At present the principal proved reserves are in the Thai Nguyen - Bac Kan area, approximately 5 miles

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east-northeast of the Thai Nguyen iron and steel complex; the Red River area in the northwestern part of the country; and on the island of Ke Bao in the coastal area of the Hong Quang Autonomous Zone. Mines serving local industry are widely scattered along the coast in Hoa Binh (17°52'N - 106°25'E), Phu Tho (17°15'N - 106°45'E), Tuyen Quang (21°49'N - 105°13'E), Thanh Hoa (19°48'N - 105°46'E), Nghe An (19°15'N - 105°10'E), Ha Tinh (18°20'N - 105°54'E), and elsewhere.

The deposits at Thai Nguyen - Bac Kan are the most important known source of iron ore in North Vietnam and will be the primary supplier to the new Thai Nguyen iron and steel plant. These deposits contain possibly 100 million tons of magnetite and hematite ores, which are direct shipping-grade ores that average about 60 percent iron. In December 1963, production in this area began at the Trai-cau mine, which is the only modern mechanized mining and dressing facility for iron ore in North Vietnam (see Figure 2*). Production from this mine is expected to exceed 300,000 tons of ore annually.

Deposits in the Red River valley are not being mined as yet, but they contain possibly 10 million tons of high-grade hematite and magnetite ores which, officials claim, average 65 to 68 percent iron. The reserve area extends from south of Bao Ha (22°11'N - 104°21'E) in Yen Bay Province north along the Red River into Lao Kay Province. Geological surveys of this region carried out since 1958 suggest that the iron ore reserves there are significant and may prove to be the most extensive in North Vietnam.

The Ke Bao mine contains possibly 1 million tons of limonite ore that averages about 45 percent iron. Reopened in 1959 with an annual output of more than 14,000 tons, this mine at present is the second most important supplier of iron ore in North Vietnam.

B. Coking Coal

Limited resources of coking coal of unknown quality will make it necessary for North Vietnam to depend increasingly on imports to cover the country's requirements for metallurgical coke. Of the total quantity of about 300,000 tons of coke needed annually, when all blast furnaces are completed and operating, only a small part can be produced from domestic coal; consequently, Communist China has agreed to supply the remaining requirements for coal. The estimated production of coke for 1958-63 in North Vietnam is as follows (in tons):

1958	43,700	1961	55,700
1959	49,700	1962	108,000
1960	55,700	1963	108,000

* Following p. 8.

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The most important producer of coking coal in North Vietnam is the Phan Me mining area (21°42'N - 105°43'E) whose output for many years has supplied a major part of the coke produced from domestic coal. Most of the coke probably is produced in small beehive or native ovens. Early in the 1950's, known reserves in this area were estimated to be 1.5 million tons of coking coal, an amount equivalent to only about 6 years' supply for the modern byproduct coke batteries at Thai Nguyen when they are completed and operating at full capacity. In addition, the coal seams at Phan Me are underground and are difficult to work and, in view of the small reserves, are seriously threatened by exhaustion.

The North Vietnamese, with East German assistance, have been conducting experiments in coking anthracite coals, in which process they claim some success in developing methods that may enable the domestic iron and steel industry to use some of North Vietnam's abundant reserves of this type of fuel. There is little likelihood, however, that much anthracite ever will be used for this purpose.

III. Current Supply and Consumption of Steel

Until the new facilities for producing and rolling steel are put into operation at Thai Nguyen, North Vietnam's planned requirements for rolled steel products will continue to be met almost entirely by imports. Domestically operated steel-processing facilities consist of several small foundries and metalworking shops, most of which were built under the French and the Japanese and can provide only a small fraction of the country's total requirements for finished steel. Although information concerning imports of finished steel in 1963 and 1964 is too fragmentary for an adequate analysis, available trade data for 1959 through 1962 indicate imports averaging about 40,000 tons annually. North Vietnamese imports of finished steel, made up primarily of sheets, plates, and structural shapes, for 1959-62 are shown in the following tabulation (in thousand tons):

<u>Origin</u>	<u>1959</u>	<u>1960</u>	<u>1961</u>	<u>1962</u>
All sources	<u>49.7</u>	<u>45.4</u>	<u>33.0</u>	<u>36.3</u>
Bloc	<u>24.9</u>	<u>26.2</u>	<u>27.6</u>	<u>31.8</u>
USSR	12.4	15.4	24.6	29.8
North Korea	N.A.	3.5	N.A.	N.A.
Communist China	8.7	N.A.	N.A.	N.A.
East Germany	N.A.	0.3	N.A.	N.A.
Poland	3.8	7.0	3.0	2.0
Non-Bloc	<u>24.8</u>	<u>19.2</u>	<u>5.4</u>	<u>4.5</u>
Japan	9.1	15.6	4.7	3.3
France	7.4	1.2	N.A.	1.0
Hong Kong	3.6	2.0	0.6	0.2
Belgium-Luxembourg	0.9	0.4	N.A.	N.A.
West Germany	3.8	N.A.	0.1	N.A.

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Figure 2. North Vietnam: Trail-cau Iron Ore Mine and Concentration Plant
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IV. Prospects

On the assumption that Communist China will continue its extensive assistance in engineering and equipment, prospects for achieving the goals for production in iron and steel set by North Vietnamese planners appear to be relatively good. Adequate raw materials are available to the steel industry, and aerial coverage of the site of the Thai Nguyen plant indicates that, when construction is fully completed, the complex will be of sufficient size to sustain the planned annual output estimated to be 200,000 tons of crude steel by 1970. Although a precise breakdown of the scheduled products in finished steel is not available, it is likely that domestic output will go a long way toward meeting the planned requirements of the country for common grades of bars, wire, and light structural shapes. However, the range of finished steel products that will be provided by the new Thai Nguyen plant almost certainly will be so restricted that North Vietnam will require continued imports of a variety of steel products such as heavy structural shapes, plates, sheets (including tinplate and galvanized sheet), and, to the extent that they are needed, various types of alloy steels.

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