KAWASAKI STEEL TECHNICAL REPORT
No.36 (July 1987)
Overseas Engineering Operations

History and Features of Kawasaki Steel's Overseas Engineering Operations

Kusuo Furukawa, Masafumi Tanaka, Toyokazu Sakaki

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The body can be viewed from the next page.

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Kusuo Furukawa
General Manager,
Rolling Technology
Dept., Steel Plant Div.,
Engineering & Construction Div. Gr.


Masafumi Tanaka
General Manager,
Iron- & Steelmaking
Technology Dept.,
Steel Plant Div., Engineering & Construction Div. Gr.


Toyokazu Sakaki
General Manager,
Civil Engineering
Dept., Construction
Div., Engineering &
Construction Div. Gr.

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1 Introduction

To describe Kawasaki Steel's movement toward globalization as a steel mill, the company's history since as early as the 1960s was characterized by efforts to secure customers by establishing overseas joint ventures with the purpose of promoting exports in Southeast Asia and Central and South America. For example, in connection with galvanized steel sheet technology, technical assistance and the base material for processing was supplied. Thereafter, however, as the developing nations became progressively more oriented toward the development of the iron and steel industry as a basic national industry, this trend in the company's steel plant construction also had been rising.

Kawasaki Steel exported pelletizing technology to the Philippines in 1964 and three years later, as part of its raw material strategy, established and participated in the operation of a joint company, Pellet Corp. of the Philippines (PCP). Around the same time, Kawasaki Steel also deepened its technical exchanges with mills overseas by supplying electrical steel technology to France, providing guidance in the construction of a steelmaking and rolling plant in Thailand, and other activities. In 1974, when production was discontinued at PCP, Kawasaki Steel established the Philippine Sinter Corp. (PSC), and a sintering plant with an annual capacity of 5 million tons was constructed in Mindanao Island in 1975. PSC was the first engineering project of us in which the company itself performed construction management covering planning, design, construction, and operation. This project was not limited to the construction of the production equipment, but also included the construction of infrastructure such as a 250 000 DWT sea berth (**Photo 1**) for large vessels, enabling marine transportation of huge quantities of iron ore and coal raw materials and sintered ore product. And in the process, the company accumulated know-how in ways of overcoming the difficulties of a construction environment different from that in Japan. Moreover, the fact that the application of long piles in the sea berth at PSC has been reflected broadly in the development of subsequent overseas civil engineering work should not be overlooked.

The construction of a steel works at Companhia Siderurgica de Tubarão (CST; **Photo 2**) in Brazil began in 1978. Based on feasibility studies on commercialization carried out in both Brazil and Italy, Kawasaki Steel

* Originally published in *Kawasaki Steel Giho*, **28**(1996)3, 127-134

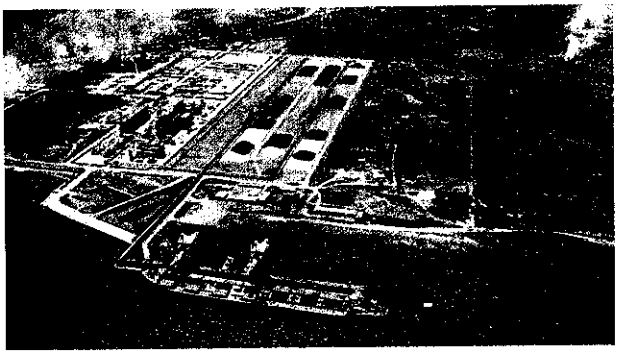


Photo 1 Philippine Sinter Corp.

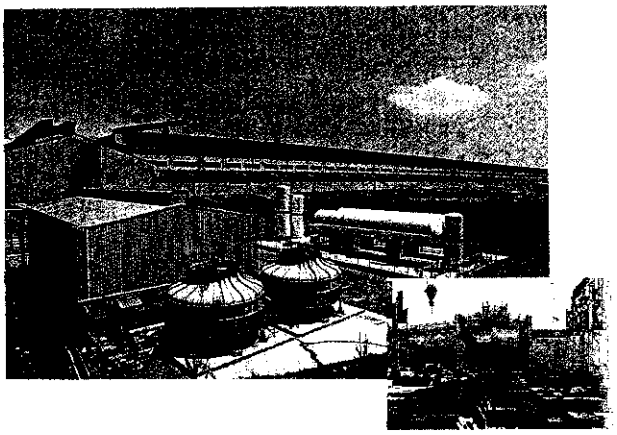


Photo 3 Tung Ho Steel Enterprize Corp.

Photo 2 Companhia Siderurgica de Tubarão

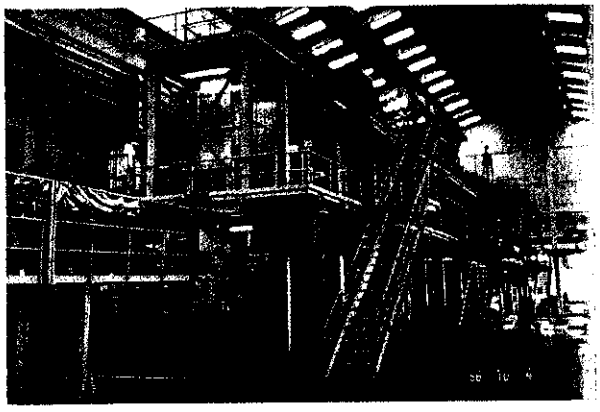


Photo 4 Tong Yi Industrial Corp.

was made responsible for the plant construction, including both construction and operation, in the first phase of this large steel works with an annual capacity of 3 million tons of slab. Here, too, the company was able to accumulate diverse engineering know-how.

Kawasaki Steel also constructed a series of electrolytic tinning lines in Southeast Asia, including Malaysia, Thailand, and Taiwan, but more recent engineering business emphasized the sale of software in the supply of state-of-the-art technologies for the CAL, EGL, and CGL in Europe and North America. The company's engineering business expanded to total engineering for steel manufacturing, including both software and hardware, as seen in the construction of an electric furnace H-shape plant in Taiwan (**Photo 3**) and as a large-scale project, the construction of an integrated cold strip mill (**Photo 4**), also in Taiwan. This record of successful projects contributed to the development of human resources in a wide range of fields, not limited to the equipment division, but also to include the fields of civil engineering and building technology. With this talent as a management resource, Kawasaki Steel established overseas engineering operations in the five categories discussed below as one of the distinctive features of the company.

2 Features and Strengths of Kawasaki Steel's Overseas Engineering Operations

Figure 1 summarizes the main categories of overseas engineering which have continued to the present. Historically, five main streams can be seen.

The first is based on steel manufacturing technology at Chiba and Mizushima Works, and is the stream of steel plant technology which can be seen in the growth of the company's overseas engineering opetarions in Southeast Asia, Europe, and North America in the various fields such as iron and steelmaking plant, rolling mill plant, and instrument control plant. This stream covers the full range of operations as a turn-key contractor, which is one of Kawasaki Steel's distinctive features, and has progressively evolved into a system including not only Kawasaki Steel's unique technical know-how in each of the steel manufacturing processes, accumulated in construction, operation, and automation systems for steel works, as well as technical know-how in produc-

tion, material handling, maintenance, and energy control specific to steel works, but also total engineering, encompassing civil engineering and building technology for the related infrastructure, foundations, and structures.

The second stream is civil engineering technology for ports and harbors. The large 250 000 DWT sea berth which was constructed as an auxiliary facility for the sintering plant at PSC, described previously, has become a symbolic civil engineering structure in Southeast Asia. In technologies which use steel pipe piles, Kawasaki Steel has accumulated an extensive record as a marine contractor, including design and construction work, especially in Southeast Asia. In particular, the company made full use of the strengths of its total engineering capability in the construction of the port and harbor facilities at Leyte in the Philippines, for which the order was received in 1982, as can be seen in its participation in international bidding for an ODA project, design using steel pipe and sheet piles, bulk material handling technology, and other areas. Kawasaki Steel then continued its activities in civil engineering for ports and harbors, based on technical results such as a sea berth using long piles in Taiwan and the adoption of plastic-coated pipe pile in the Kota Kinabalu Port project in Malaysia, and added Lahad Datu Port in Malaysia, Manila South Port, a cement berth in Indonesia, and others to its list of completed projects.

The third stream is building and steel structure technologies. Since 1965, H-shape steel makers, including our company, have competed intensely in the development of applications and development of execution techniques in order to expand H-shape sales. However, Kawasaki Steel has been able to develop architectural technologies through the construction of major buildings and steel structures such as converters and power plants in steel works, mainly in Japan. As can be seen in processing techniques for heavy gauge steel frame members exceeding 100 mm in thickness, Kawasaki Steel possessed peculiar technologies as a steel maker. In overseas projects as well, including the buildings of the PSC sintering plant and Tubarão Works, the application of these technologies provided an extensive record of actual results for the subsequent development of engineering operations. Since first supplying the steel frames for plant buildings in Iran in 1976, Kawasaki Steel has sold more than 300 000 t of structural steel, such as the steel frames for a hotel and power plant in Hong Kong and others, to clients in the Middle East, Southeast Asia, and elsewhere. This was brought about by the advanced engineering which Kawasaki Steel possesses as a steel maker. Furthermore, recently, projects have expanded into orders received for plant construction accompanying the move to local processing in China and Southeast Asia.

The fourth stream comprises other various technologies which are characteristic of our company. Kawasaki Steel has supplied pipeline and water works technology, as seen in results in the Manila water works project in 1980, a seabed pipeline in Singapore in 1984, and the Sandakan water treatment plant in Malaysia in 1986; fabrication technology that the company possesses for jacket type production platforms, which was used in the manufacture and export of large-scale jackets such as a jacket for Bombay High in India executed in the 1980s and large jackets for Chevron and Shell in the United States; and in simple steel bridges using steel structure technology in the Middle East and Southeast Asia, which were adopted in ODA (economic assistance) projects for developing nations. The railway construction technology seen in the construction of the Jabotabek railway in Indonesia and the PNR railway in the Philippines had its roots in techniques for constructing railways in our steel works. In other projects, the company also benefited from a unique engineering effort in which it participated from the planning stage onward in the development of an industrial park in the Philippines. However, Kawasaki Steel has now withdrawn from export businesses which involve base material and processed materials such as pipelines, jacket material, and steel frames due to the sharp appreciation of the yen following the Plaza Agreement in 1985.

The fifth stream is engineering related to construction projects carried out through local corporations. The extremely strong yen has been a great handicap for Japanese companies engaged in overseas engineering operations. In steel plant engineering, the environment is still true that royalties for steel manufacturing technologies and the intellectual value of operations know-how can withstand competition. However, in construction, the increase in labor costs related to construction management and other factors have accelerated the shift to engineering performed by local people, making it necessary to transplant this company's distinctive technologies overseas. In case of Kawasaki Steel, one such move was RIOFIL, which was established in the Philippines in 1990, and this has also become a fundamental policy for business development in other developing nations. RIOFIL has attained a considerable record as a conduit for plant construction by Japanese transplants locating in the Philippines. These projects comprise not only civil engineering and building construction, but also construction in the equipment sector, and continue to serve as precedent for overseas engineering by Philippine engineers using Kawasaki Steel methods.

3 Steel Engineering Division

3.1 Features and Strengths of Steel Engineering

It is one of the distinctive features of Kawasaki Steel that the company is able to execute plant engineering which is backed up by long experience, and incorporates technologies developed and accumulated through the new construction and revamping of steel manufacturing

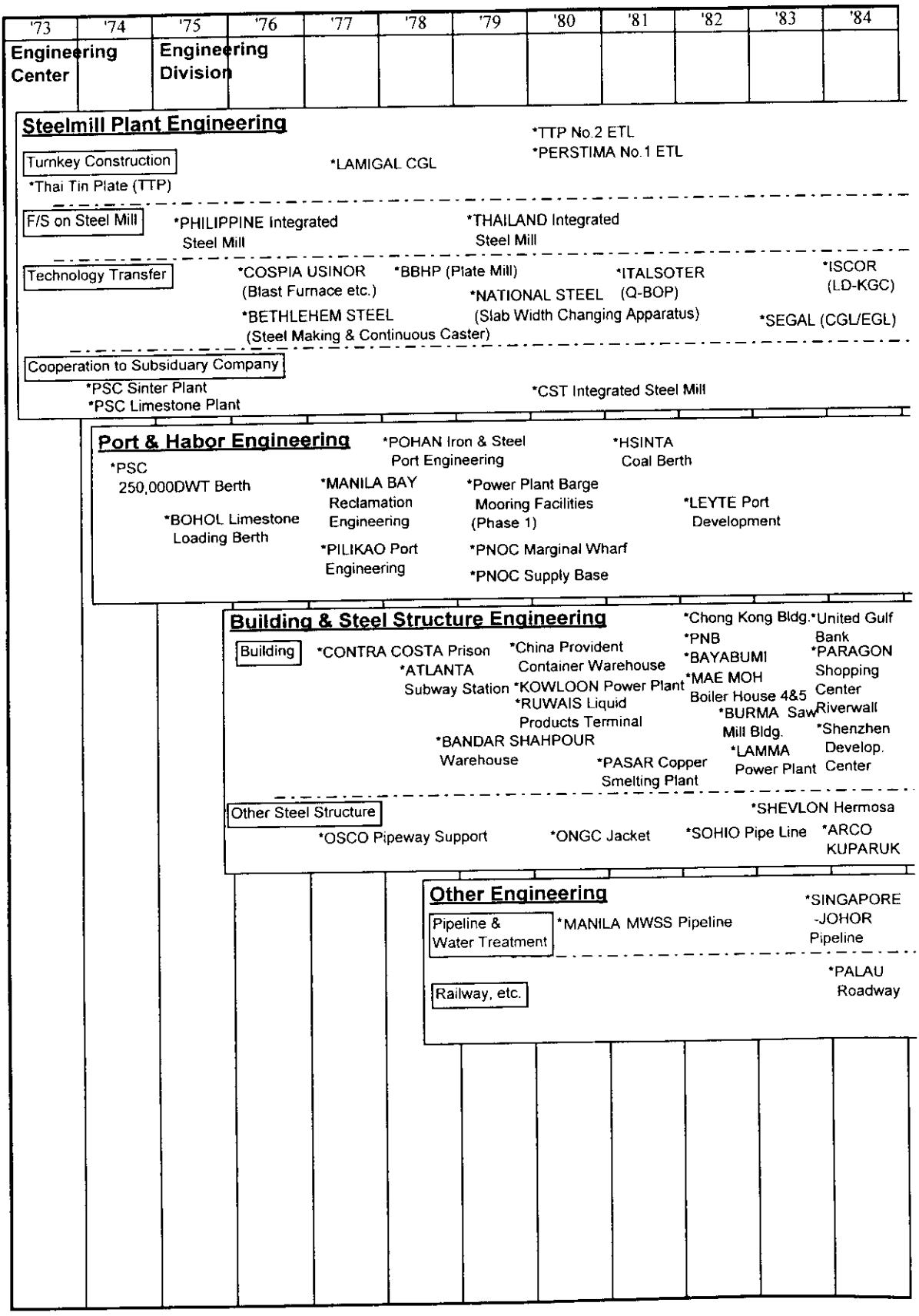
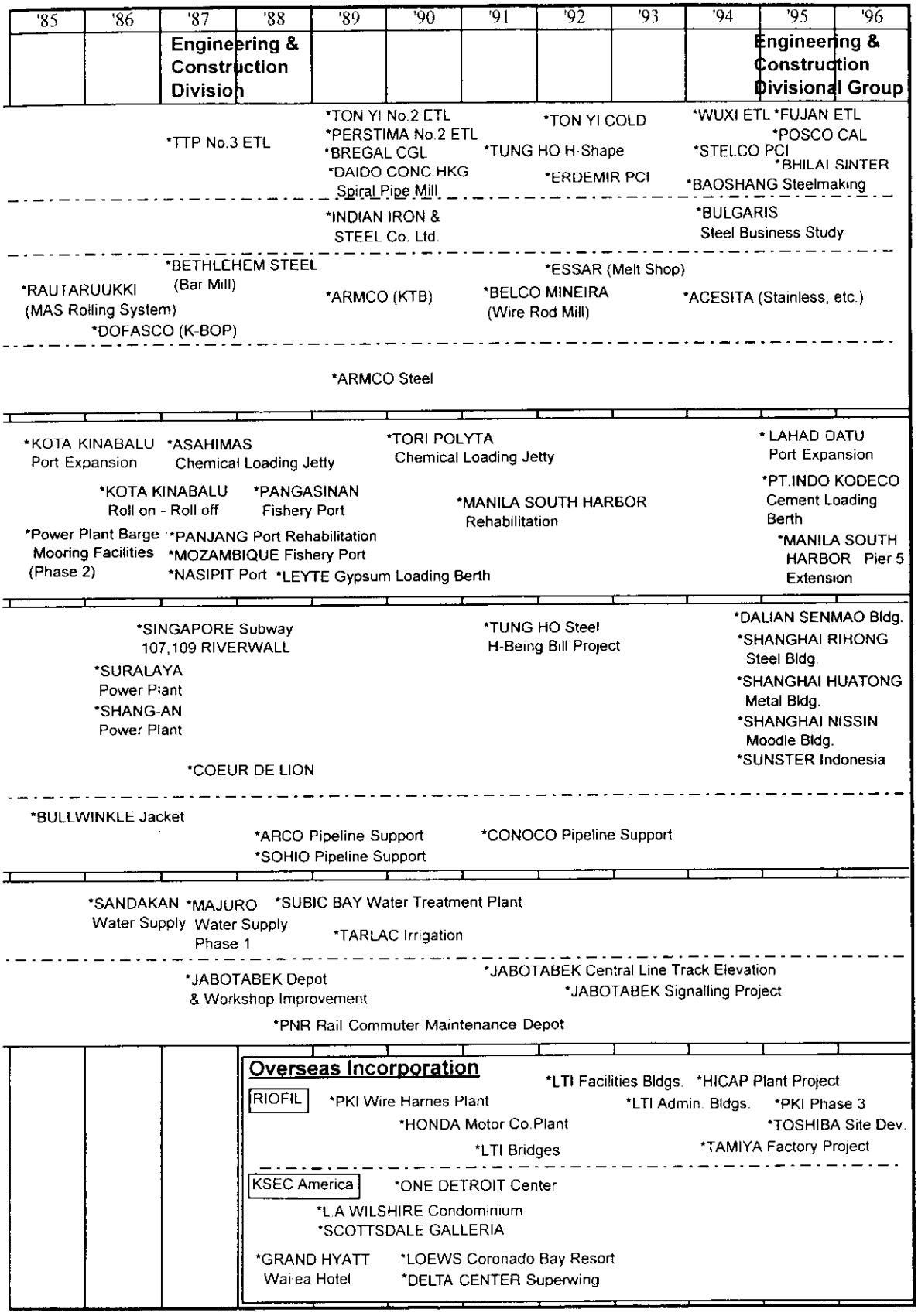


Fig. 1 History of Kawasaki Steel's



overseas engineering operations

equipment in our steels works and related operational technology and the sale of steel products.

This point is one of the great differences between Kawasaki Steel and equipment manufacturers and specialized engineering company which do not possess actual experience in the manufacture and sale of steel.

The requirements of clients for steel plant engineering have changed significantly in recent years, as summarized below.

(1) Client needs have steadily shifted from the construction of single production lines to integrated plants, and clients have come to require total steel manufacturing know-how.
(2) Clients increasingly need plants which use new iron sources and new steel manufacturing methods.
(3) Kawasaki Steel's response has expanded from clients entering the steel business for the first time to clients who already possess experience in the steel business and are in the process of expanding that business.

Kawasaki Steel's engineering services are not limited to "total assurance management for projects through total engineering employing integrated technology which is based on operational experience." It has also become important to offer diversity in the forms in which engineering is supplied, taking into consideration the relationship of a division of work and cooperation that are appropriate for the level of the client's engineers. Joint engineering activities, disclosure of technology, support, joint research, and other activites for this purpose have become necessities.

The steps in a steel plant construction project may be broadly classified as follows.

(1) Study of commercial feasibility
(2) Planning of plant construction
(3) Execution of plant construction
(4) Preparation for the start of operation
(5) Commercial production

The activities of the Kawasaki Steel Engineering Division include the collection and analysis of the information necessary for the client's decision making process in all its aspects and the submission of study results in all these steps, from the feasibility study to commercial production. Moreover, in some cases, the client's requirements are not limited to simple technical support for the decision making process, but also include support from the standpoint of a partner in joint management. An outline of the content and features of the engineering which Kawasaki Steel is capable of providing in each of these steps is presented below.

3.1.1 Feasibility study

Kawasaki Steel is prepared to make the trial calculations of the construction cost and manufacturing cost, study the technical parameters for environmental assessments, and provide market analysis data and other information necessary in the feasibility sutdy. Here, Kawasaki Steel can demonstrate its total technical capabilities particularly clearly, because engineering based on long term experience in the production and sale of steel is required in this stage.

3.1.2 Planning of plant construction

Kawasaki Steel can provide support to the client in every phase of the planning of plant construction, including planning of the plant as a whole, drafting of the construction schedule, technical support in connection with equipment procurement, and preparation and control of the construction budget.

Here, the engineering contractor must guarantee that the plan can actually be realized, but abundant experience in construction gives Kawasaki Steel significantly higher reliability.

3.1.3 Execution of plant construction

The fundamental stance of Kawasaki Steel's support is to guarantee that the project is completed as planned, but in a more comprehensive and positive sense, Kawasaki Steel provides total assurance management. (This means that we assure three items in an integrated manner: Assurance of the completion of the construction within the term required for management reasons, assurance of the performance of the equipment which comprises the plant, and assurance of the quality of the product manufactured by the plant.) To shorten the construction period, it is essential to execute the civil and building engineering and the equipment engineering simultaneously and in parallel. Specifically, the greatest strength of the Kawasaki Steel Engineering Division is its ability to perform "total integrated engineering," in which the division of engineering work is clearly defined and carried out simultaneously and in parallel, with an organic linkage of the engineering data in the respective fields of equipment, civil engineering, and construction.

3.1.4 Preparation for start of operation

The thoroughness of the preparatory work which must be performed before the start of operations determines the success or failure of a project. For this reason, Kawasaki Steel Engineering Division provides to draw up hiring and training plans for the manpower required for plant operation, provides classroom and on-the-job training (OJT), supply operational know-how, and provides training plans for operators and other personnel in the test run and tune-up plan.

In particular, the fact that Kawasaki Steel can dispatch operators with a wealth of experience in the actual operation of our steel works to provide operational guidance offers the client important benefits in training efficiency.

3.1.5 Commercial operation

To avoid the equipment deterioration (and obsolescence) which begins with the completion of construction and start of operation, it is essential to establish equip-

ment maintenance technologies. In the broad sense, equipment maintenance technology is a part of operating technology. Together with providing support for the construction of a long-term training system for improving proficiency in this field, Kawasaki Steel can also dispatch personnel to provide long-term training. The fact that personnel can be dispatched for long-term training even in the area of equipment maintenance technology can make an important contribution to the client's achieving an early return on investment.

Although sales competition is not limited to the steel industry, it is important to achieve a good balance of the three plant performance indicators of product quality, production cost, and quick delivery.

The point which requires the most careful study in plant construction is to verify the stability of production capacity, reliability of product quality, minimization of production costs, and shortening of delivery (period required to produce products) in a total evaluation of how the plant will perform after the start of operation.

The client (and in this, we are no exception) can be distracted by the desire to adopt the most advanced technologies aggressively in every area of operation, considering the distinctiveness and superiority of the project in the market. The management viewpoint, however, must consider the balance of technical superiority and construction costs, as well as the fact that the adoption of advanced technology will increase the difficulty of operation. From this viewpoint, priority should be given to adopting completed technologies and ensuring operational stability.

Kawasaki Steel's greatest strength in plant engineering is that it can correctly evaluate not only the performance of equipment as such, but also the quality of the products which can be produced using that equipment, from the technical specifications of the equipment. In other words, in selecting the steel manufacturing technologies which should be adopted, Kawasaki Steel can establish and design the optimum (necessary and sufficient) equipment specifications for realizing the product quality that is required by the market which is targeted by the project concerned.

In short, it can be said that the fundamental and qualitative difference between Kawasaki Steel's plant engineering and that of equipment makers and engineering firms is "engineering that starts from the equipment user's standpoint."

3.2 Iron- and Steelmaking Technology

Kawasaki Steel's ironmaking engineering began with the construction of the sintering plant at PSC, which started operations in the Philippines in 1977. PSC was constructed on a full-turn key base, and the results of the project have been used in Kawasaki Steel's current sintering and yard engineering without interruption. The subsequent construction of Companhia Siderurgica de Tubarão (CST) in Brazil, as the construction of a full-scale integrated steel works on a full turn key base, made the greatest possible use of the experience in blast furnace, sinter plant, and mill constructions cultivated at Chiba and Mizushima Works to achieve a clear success. Since the blow-in of CST's No. 1 blast furnace in 1983, the blast furnace has achieved a long life of more than 13 years and is continuing to operate smoothly at present.

In the area of ironmaking software sales, at the same time as the construction of CST, the Engineering Division also provided COSIPA in Brazil with the relining engineering, which contributed to the modernization of the steel works operated by COSIPA. In the supply of blast furnace design know-how, other software contracts have included the epoch-making supply of blast furnace (BF) design guidance to Shanghai Baoshan General Iron and Steel Works in China (1986), the technical assistances of BF operation for ASOMINAS and ACESITA in Brazil (1994), and for the BF blow-off operation at Baoshan Works No. 1 BF (1995), etc. Through all these projects, the high level of Kawasaki Steel's BF design and operational technologies have been proved by winning an excellent evaluation. In 1984, Kawasaki Steel supplied the GO-STOP system for blast furnace operation to RAUTARUUKKI in Finland. This technology, up graded by a further addition of AI (artificial intelligence) technology, was subsequently purchased by steel mills in Europe and elsewhere through a licensing arrangement with RAUTARUUKKI. In addition to the blast furnace, the operating technologies for sinter plants and coke ovens have also been provided to steel mills in Brazil and other countries.

In the ironmaking hardware business, the Engineering Division has supplied complete BF and sintering plants, as the recent contract to construct the new sintering plant with BHILAI in India. Based on the experience and proven technologies, Kawasaki Steel has also supplied a wide variety of individual equipment, such as the pulverized coal injection (PCI) systems for the blast furnace, BF stave coolers, casting machines for pig iron and ferro alloy, and ignition burners for sintering machines, which have won the confidence of customers. Among these, demand for PCI has grown in response to a world-wide shortage of coke. The project have been succesfully completed at Baoshan (1987) in China, ERDEMIR (1992) in Turkey, and STELCO (1995) in Canada, and additional orders are expected in the future.

In the field of steelmaking, the business started with the software products in which the technologies and/or operational know-how developed and matured in Kawasaki Steel's steelmaking shops were provided as a form of technical transfer or the fact-finding, occasionally along with the key facilities, to the overseas steel industries. The examples range from hot metal treatment to casting; Q-BOP operation to ITARSODAR, K-BOP blowing technologies to New Zealand Steel and DOFASCO, hot metal desulfurization to CST, sublance

and dynamic control system in converter furnaces to SSAB and others, technical assistance work for the construction of new casters, individual casting technology such as slab width changing, slab marker, and mold flux. Such software sales including the refractory have been continuing with garnering the customers' good reviews.

Noteworthy steelmaking hardware sales are LD-KGC (bottom agitation with inert gas in converter) and KTB (oxygen gas top blowing in vacuum degasser) processes, both of which were solely developed by Kawasaki Steel. The LD-KGC process which can be adopted easily onto the existing converter furnaces with high benefits has been introduced into 10 overseas companies (23 furnaces). In addition to the excellent reputation of equipment itself, the superior operational guidance which are hardly available from the equipment manufacturers have been highly assessed, resulting in the increase in equipment supply orders. Under the background of increasing needs for the mass production of ultra low carbon Al-killed steel sheets, the KTB process which was developed for the very purpose followed the suit. Due to the effectiveness in vacuum decarburization with heat compensation, 22 units of reference records including the system supplied by Vacmetal, the licensee of KTB equipment, have been achieved worldwide. As with the LD-KGC, the KTB process has won the superb reputations through the combined technologies of the efficient equipment and operational guidance for it.

The recent feature of sales is, in addition to the single purpose equipment, an increase in orders for the total steelmaking mill which covers from the basic design of facilities to the supervision services for operation. At Tung Ho Industrial Corp. in Taiwan who is achieving the successful performance, Kawasaki Steel provided customer with the total engineering work including civil and building for an electric arc furnace (EAF) and H-shape rolling mills, EAF facilities, and supervisory services for construction and start-up of operation. The EAF operated at Tung Ho is the same type of arc furnace which had been introduced into Daiwa Steel Corp., one of the subsidiaries of Kawasaki Steel, and licensed by CLECIM.

Another recent project which is now under the construction at Shanghai is the total engineering (including the supervisory service for erection and start-up operation) and equipment supply to No. 2 Steelmaking Shop of Baoshan Steel (Group) in China. The hot metal pretreatment system which enables the improvement in efficiency of converter refining process with a remarkable cost reduction has been or is now introduced into CSC in Taiwan, Baoshan Steel in China, and Kwang Yang Works of POSCO in Korea.

Based on enormous experiences in the construction and operation of steel works at both Chiba and Mizushima Works, Kawasaki Steel has sufficient capability to conduct the total engineering for the steel plant. Equipment design including the civil and construction engineering as well as equipment supply and installation work can be conducted taking into account the operability and customers' requirements. As for the hardware supply, regardless of its scheme such as full turnkey base or equipment supply and supervisory services, Kawasaki Steel is taking order to respond to any project from all the aspects covering feasibility study (investment evaluation), design and engineering work, manufacturing and procurement of equipment, commissioning and test-run, and start-up operation, so as to satisfy the clients with supplying the best facilities with a competitive price from the global perspective.

3.3 Rolling Technology

In the field of rolling, Kawasaki Steel's engineering business began with software (technology supply). However, in the past 25 years, hadrware jobs has steadily increased mainly as a result of construction of a number of ETL plants overseas, and sales of the continuous annealing line (CAL) provided a particular high level of technology which was developed in our works and subsequently sold to a number of mills overseas. Rolling technology business has developed to the point where hardware + software jobs (equipment + technology supply) now represents a comparatively large share of engineering operations. This section will therefore briefly introduce the main hardware + software jobs for which the Kawasaki Steel has received orders in the last five years.

First, one prominent project was the order received on a full turnkey base for a complete TMBP plant (annual capacity is 600 000 t) for Ton Yi Industrial Corp. This plant comprises the PL-TCM, CAL, ECL, BAF, TPL, CPL, and other equipment. This construction was completed in a short period of two and a half years, in spite of the large scale of the project, and the plant has been operating smoothly since startup in October 1995. It would be no exaggeration to say that Kawasaki Steel's total engineering capability in steel manufacturing has begun to bloom by this project and then Kawasaki Steel was also an another advance on account of obtaining the large amount of valuable know-how.

Second, after starting up a seventh ETL in 1990, company's interest turned toward the mainland China market. As the fruit of several years of effort, an ETL was started up in July 1996 in Jiangsu Wuxi and is now in smooth commercial operation. And another ETL started operation around the end of 1996 in Fujian.

Other successful projects include a pickling line for CSI in the United States and a CGL for BREGAL in Germany.

Based on the recent results described above, Kawasaki Steel expects to build a record of projects in hot and cold rolling, plate, bar and wire rod material, shapes, and surface-treated steel (EGL, CGL, CCL), including other technologies developed in its works, in addition to the CAL and ETL.

As mentioned previously, Kawasaki Steel has shifted its business away from activities centered mainly on the sale of individual technologies (software), and has increased the weight of overseas projects involving full turnkey orders received for complete plants including hardware, resulting in strengthening its total engineering capability. In the developing nations, there is a strong desire for self-sufficiency in steel production, and Kawasaki Steel is expected to assist in the supply of production technologies for high-grade steels such as coated products, stainless steel, electrical steel, and others, as well as in other areas. The main hardware + software projects in the field of rolling in the last 3 years are shown in **Table 1**.

3.4 Plant Civil and Building Technologies

Through the extension of the company's experience in steel works construction from domestic plants in Chiba and Mizushima to overseas development, represented by the projects at Tubarão and in the Philippines, Kawasaki Steel civil and building engineers have accumulated know-how in large construction projects. As an engineering business, this field is now one of the company's strengths.

The design of a steel plant involves the design of complex machine foundations and the design of heavy steel structures and buildings. In addition, the speed of equipment design and civil and building construction are closely related, making shorter construction work possible. It can therefore be said that design control performed in line with the many changes which occur as construction progresses, together with execution control at the site, are important engineering functions for schedule control.

The execution of construction through a technical group with capabilities in civil works, building, water works, and railways in the company organization can be considered a technology, and is also a strength not available from other companies. For example, in the cold rolling plant project at Ton Yi in Taiwan, which was completed in 1995, Kawasaki Steel's Ton Yi project team performed construction management through equipment plus civil and building technology.

4 Port and Harbor Engineering Division

As discussed previously, a large-scale 250 000 DWT sea berth was successfully constructed as part of the PSC sintering plant construction project on Mindanao Island in the Philippines. The structural design using long piles and the results of executing that design became the starting point for Kawasaki Steel's port and harbor engineering. In particular, in the Philippines (**Photo 5**), Taiwan, Malaysia, and Indonesia, off-shore execution techniques (**Photo 6**) for steel pipe piles were central to later port and harbor construction projects. The company's proprietary technologies for plastic-coated (polyethylene-coated) corrosion-resistant steel pipe piles and bearing capacity control for steel pipe piles have become distinctive know-how which is available only from Kawasaki Steel. **Figure 2** shows the record of usage of steel pipe piles in port and harbor construction overseas. In recent years, increased spans were seen in port and harbor construction technology. An example is the order received and carried out continuously in 1990 for repair work on a series of existing wharfs at Manila South Port. It can be said that only Kawasaki Steel is engaged in this type of port and harbor engineering as a business, and it is a division not seen at other mills.

Table 1 Main projects in the field of rolling in the last 3 years

Project name	Start of operation	Main line	Scope of work	Capacity (t / year)	Feature
CSI-Pic Project	Nov. 94	Picking line	FOB + SV	800 000	Under complex contract formation with American engineering company and equipment suppliers, produced equipment and provided technical assistance service.
TY-TMBP Project	Oct. 95	PL-TCM CAL, ECL, BAF TPL, CPL, etc.	Full turn key	600 000	Largest cold rolling plant project for which Kawasaki Steel has received an order. Completed in very short construction period of about 2.5 years, followed by very smooth start-up. Long term dispatch of operation and maintenance supervisors after construction.
Jiangsu TOCEKA ETL Project	May. 96	Tinning line	FOB + SV	150 000	The first ETL which Kawasaki Steel constructed in China. Kawasaki Steel participated in the whole engineering for construction of plants.
Fujian TOCEKA ETL Project	Nov. 96	Tinning line	FOB + SV	150 000	The ninth ETL which Kawasaki Steel constructed overseas. The specifications of line and layout are almost the same as that of Jiangsu ETL.

Photo 5 Leyte port development

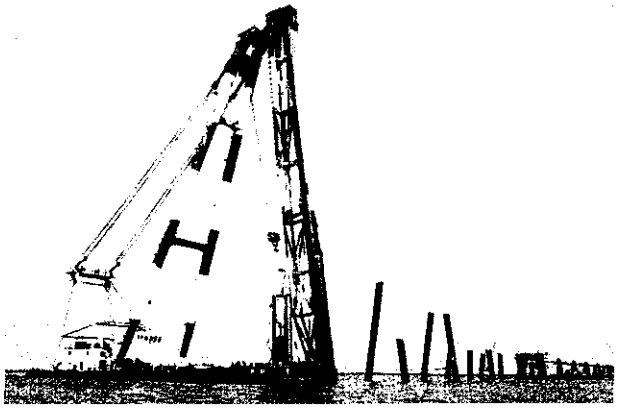


Photo 6 Offshore pile driving

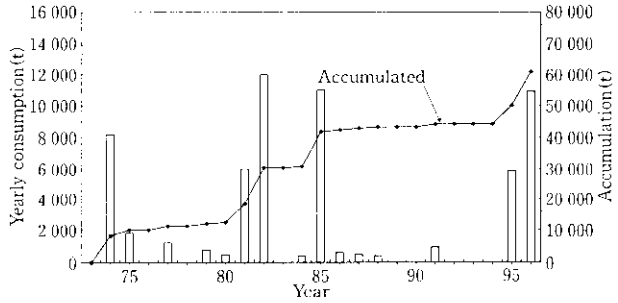


Fig. 2 Steel pipe pile consumption in overseas project

5 Building and Steel Structure Engineering

In the construction technology for steel plants, a high level of steel structure technology is normally required, for example, in large-span factory buildings and steel frames for multi-level plants. At Kawasaki Steel, this type of engineering also extended over a wide range which included architectural environment technologies, beginning with lighting and ventilation, the creation of towns around the steel works, and others. These technologies for design, fabrication, and erection, mainly in connection with heavy steel frames, form an accumulation of know-how which is available only to a steel maker. The company's overseas business development in this area therefore began with steel frames.

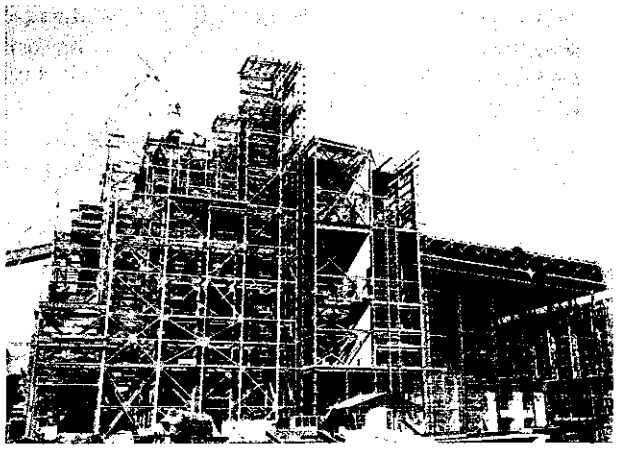


Photo 7 Suraraya power plant

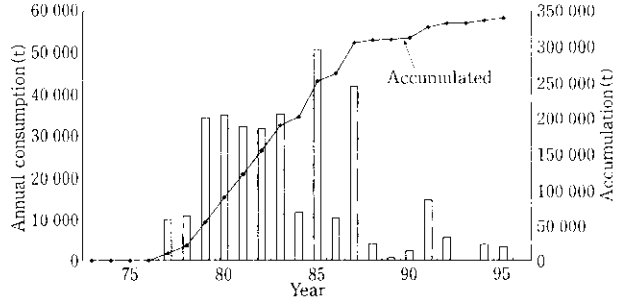


Fig. 3 Structural steel consumption in overseas project

As can be seen in the steel frames supplied for an electric arc furnace and continuous caster shop at NISIC (1976), OSCO (1977), and a warehouse for BANDAR SHAHOUR (1978) in Iran, the Shangri-la Hotel (1978) in Hong Kong, CSC plant(1979) in Taiwan, and LAMMA power plant (1983), Shenzhen Development Center (1985) in China, and the Suraraya Power Plant (1985; **Photo 7**) in Indonesia, Kawasaki Steel has supplied diverse types of steel structures and frames. **Figure 3** shows the past record of structural steel supplied by Kawasaki Steel, which exceeds 300 000 t. In these projects, Kawasaki Steel supplied high-accuracy, high-quality steel structures, and also performed schedule control through guidance in erection methods. Although this kind of business later reduced on account of the appreciation of the yen, an increasing number of orders involving the local processing and construction of structural steel has been received recently, including the orders for the plant buildings at the Ton Yi Cold Rolling Mill and construction of a high-rise steel frame building in Shanghai, China.

6 Conclusion

20 years have passed since the creation of Kawasaki Steel's Engineering & Construction Division. Looking back on the history of Kawasaki Steel's overseas business activities, this report has discussed the fact that the company began with the purpose of exporting materials as a steel maker and a perspective which was based on a strategy of capital investment by overseas siting as a manufacturing industry. In its overseas engineering operations, the Engineering Division developed personnel through the opportunities presented by these overseas moves, and as a result, was able to secure the necessary human resources. The basic business purpose of engineering operations is to establish competitiveness in the market by investing in human resources and thereby to grow. In this respect, overseas sites are also sites for developing personnel. Kawasaki Steel's engineers have acquired international common sense and the ability to live in different cultures, and can now be expected to make great progress as they meet the challenges of increasingly composite and total technologies and the localization of production.

This report has briefly described the features of Kawasaki Steel's overseas engineering operations by discussing five major categories and the respective elements in each field. The authors would therefore like to conclude by saying that we are confident that the confluence of these categories to form larger streams can contribute to the further development of this company's business.