Transfer of The Development Process and Project Organizational Systems Between Japan and the U.S.

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ABSTRACT

The main subject of this thesis is the development project process and the differences in project organizational systems in different environments. Through the case study of the Toyota Kentucky (KY) Project and three other comparable projects, Nissan Smyrna (Tennessee), Toyota Tahara (Japan), and Fuji Gunma (Japan), the differences in project development systems between Japan and the U.S. are examined. It is found that the American development environment is more flexible and dynamic, especially because of the possibility of a fast-track program, than the Japanese environment.

Specifically, differences and similarities in the project organizational systems, such as, traditional, design-build, and construction management, between the two countries are studied. A framework of the project organizational systems is built and used to analyze the project organizations in the four automotive plant projects as well as to define the differences and similarities between the two countries. The influence on the project organization of a fast-track program to achieve the shortest possible project duration time is examined in the Toyota KY Project. For the base of the analysis of the four project organizational systems, a theoretical model developed by Minden is used and its validity is simultaneously evaluated by the applicability to the projects. Additionally, the organizations of the client (Toyota Motor Corporation) and the design-builder (Ohbayashi Corporation) for the Toyota KY Project are analyzed.

Thesis Supervisor: Dr. Bernard J. Frieden

Title: Professor of City Planning

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List of Tables, Figures and Project Summaries

Tables

Figures

Schematic Project Summaries

TABLE OF CONTENTS

INTRODUCTION

The meeting of two different cultures is a significant character of the Toyota Kentucky (KY) Project, the first $800 million direct investment in the U.S. by Toyota Motor Corporation (TMC/Toyota), the biggest Japanese automobile manufacturer. The main subject of this thesis is the development project process and the differences in organizational systems in different environments. Toyota is trying to build a Toyota style auto-plant, with Japanese management leadership applying the Toyota Total Quality Control (TQC) system to the construction using a Japanese construction manager, Ohbayashi Corporation (OHB), and using American general and sub contractors in the U.S.

This thesis analyzes this project as a core case study examining the following questions:

1) What are the differences in the development process and organizational system for an automotive plant construction in Japan and in the U.S.?

2) What kind of project organizational system (including project members' internal organization) do TMC and OHB build to cope with uncertainties, such as many change orders caused by a fast-track program?

3) What kind of conceptual model and design methodology of project organizational systems should be used or developed for future projects?

In addition to these main questions, TMC and OHB's learning process in the new business environment, and the difficulties of technology transfer in the construction industry are supplementally examined. Finally, the thesis analyzes several alternative strategies employed by TMC and OHB to manage uncertainties in the new environment.

Special characteristics of the core case, the Toyota Kentucky Project, are as follows:

1) This is the first individual direct investment into the U.S. by the Toyota Motor Corporation; 2) The Ohbayashi Corporation, one of the Big Five Japanese engineering contractors, manages the project using the fast-track program as a construction manager by turnkey contract with Toyota; 3) Toyota will get more than or equal to $125 million in aid from Kentucky government for $900 million and 200,000 cars per year plant; 4) Toyota and Ohbayashi made a project agreement (PA) with AFL-CIO, construction labor union, during the construction.

This thesis analyzes the Toyota KY Project as of the end of January 1987, though the project is still under construction. Because the PA was officially signed on the beginning of December 1986, the impact of the PA is not studied in the thesis. Although the complete analysis of labor relations in the project is out of the focus of the thesis, the description of important events about labor relations and their influence on the project will be presented.

New concepts for TMC and OHB associated with the project are those such as the fast-track program, cost-plus-fee contract, construction management, turnkey contract, state incentives for the project site, and labor relations including those with AFL-CIO. The Japanese decision making system, long term relationship between clients and contractors, and TQC program are unusual factors in the American construction industry.

Comparative studies using the Nissan Smyrna Project, the Toyota Tahara Project, and the Fuji Gunma Project will be done to find answers to the main questions. The Toyota Tahara project would be an ideal comparable project in Japan with the Toyota KY Project because they have many common factors, such as building type, client, and prime contractor. Therefore, the difference between the U.S. and Japan's development process and organization will be extracted. The Fuji Gunma Project will be used to check special features of Toyota's methods for its construction by comparing the project with the Toyota Tahara Project. This comparison will be important to define the Japanese style of development process and organization for automotive plant construction.

The Nissan Smyrna Project would be an ideal project for the comparison of the Toyota KY Project in order to examine the differences between the TMC's strategy and Nissan's in regard to risky projects. These two projects also have many similar points: the clients, Toyota and Nissan, are the two largest Japanese international car manufacturers; both projects are the first large direct investment in the U.S. by Toyota and Nissan; the location of each project is in the mid-South, Kentucky and Tennessee; the project manager, Robert B. Jordan, working for Ohbayashi in Toyota KY was the project manager for Daniel Construction in the Nissan Smyrna Project. Therefore, special features or roles of Ohbayashi in the Toyota KY Project will be extracted by the comparison of Toyota KY with the Nissan Smyrna Project.

Table 1-1 summarizes the projects and the differences of the most important factors. The differences in each development process and organization will be explained mainly by the differences between these important factors shown above the double horizontal lines. Factors below the double horizontal lines will be analyzed in Chapter 4 and 5.

Though TMC's policy for the project may well be to use TMC's traditional methods for its plant construction in Japan as much as possible, many factors of the development process and organization seem to contradict the policy, such as the use of a fast-track program and a cost-plus-fee contract with OHB and general contractors. They are undesirable for TMC because the fast-track needs instant decisions and many change orders during the construction stage. Namely, TMC uses a group decision system to analyze various factors of problems, and is not used to quick decision making. Further, the cost-plus-fee contract does not guarantee the final project cost for TMC, and many change orders increase the uncertainty of the final cost. Moreover, the necessity of flexibility of a base design plan in the fast-track program sometimes contradicts intensive use of value engineering as a part of TMC's TQC program, because excessive use of value engineering tends to eliminate spare space or the possibility of future changes.

TMC's short construction schedule, probably due to the uncertainty of the future compact car market in the U.S., creates

TABLE 1-1: PROJECTS AND DIFFERENCES OF MOST IMPORTANT FACTORS

PROJECTS / FACTORS	TOYOTA KENTUCKY	NISSAN SMYRNA	TOYOTA TAHARA	FUJI GUNMA
LOCATION	U.S.	U.S.	JAPAN	JAPAN
MNGT NATIONALTY	JAPANESE	AMERICAN	JAPANESE	JAPANESE
CLIENT, TOYOTA	YES	NO	YES	NO
PRIME CONTRACTOR,	OHBAYASHI	DANIEL	OHBAYASHI	OHBAYASHI
STAFF NOTIONALTY	Ame.& Jap.	Ame.	Jap.	Jap.
A/E	(OHBAYASHI) GIFFLES	KAHN	TOYOTA (OHBAYASHI)	(FUJI) OHBAYASHI
PROJECT SIZE (FLOOR AREA)	370,000 SM	300,000 SM	73,000 SM	30,000 SM
BUSINESS RELATIONSHIPS CLIENT & CONTRACTOR	LONG TERM	SHORT TERM	LONG TERM	LONG TERM
(MONTH) CONTRUCTION PERIOD	(PLAN) (20)	22	(BUILDING) 11	(BUILDING) 6
CONSTRUCTION METHOD	PHASED (FAST TRACK)	PHASED (FAST TRACK)	TRADITIONAL	TRADITIONAL
PROJECT ORGANIZATION	DESIGN-MANAGE (TRUNKEY)	Contractor Const. Mngt.	TRADITIONAL (OWNER'S A/E)	DESIGN-BUILD
CONTRACT TYPE CLIENT & PRM.CONT.	COST PLUS FEE	COST PLUS FEE	LUMP SUM	LUMP SUM
METHOD TO SELECT PRIME CONTRACTOR	NEGOTIATION	NEGOTIATION	SELECTIVE BIDDING	SELECTIVE BIDDING
SELF PERFORM BY PRIME CONTRACTOR	NO	YES (STRUCTURAL FRAME WORKS)	YES (TEMPORARY WORKS)	YES (TEMPORARY WORKS)
LABOR RELATIONS	MERIT SHOP TO CLOSED SHOP	MERIT SHOP (OPEN SHOP)	MULTI-LAYER SUB-CONTRACTING	MULTI-LAYER SUB-CONTRACTING
TOTAL QUALITY CONTROL (TQC) IN CONSTRUCTION	YES	NO	YES	NO
INCENTIVES FOR CLIENTS BY STATES	$125 mil	$19 mil	n.a.	n.a.

those undesirable factors unintentionally because the schedule requires the fast-track program, which needs the cost-plus-fee contract.

The separation of the construction management function from the use of the company's own forces (self performance of construction) is OHB's decision based on the policy and capacity, but the decision basically fits TMC's strategy which employs a turnkey contract with OHB. OHB tries to distribute the project to many American contractors to avoid unnecessary blame for new trade friction in the construction industry, and OHB does not have enough Japanese staff to use self performance in addition to construction management.

KY's incentives for TMC have influenced the strong reaction by the AFL-CIO (construction union) against TMC and OHB because they try to use local workers (75% non-union) regardless of the workers' labor relations rather than only union contractors. This is based on the local business conventions and probably is based on the best effort base agreement between TMC and KY.

The difficulties of the implementation of TMC's Total Quality Control program on the American construction system, and the difficulties of American managers' associating with TMC's Japanese-style group decision process show the difference in business conventions and the potential difficulties for American contractor's entry to the Japanese construction market.

There are many variables that affect a development process and organization in a development project; building type, project size (physically or monetary), construction schedule, location, and contract type are important variables, as are the participants in a project, such as a client, a state or local government, an architect and engineer (A/E), a construction manager, a general contractor, subcontractors, and labor union. Environmental conditions around the project are important ,too, such as political, legal, economical, social conditions, and business conventions.

To be more specific, differences and similarities of construction management or project procurement methods between Japan and the U.S. will be studied. Despite many text books and articles about construction management, they do not have a rational general theory of the selection for an optimal procurement method, and each author sets his/her individual definition or terminology of alternative project management methods, such as construction management and design-build. Similarly, although there are many studies about technology transfer of construction in the broad transfer of the development process in the context of the developing areas, there is almost no study about technology transfer (including management systems) of development process in developed countries. Because of the popularity and explicitness, Barrie and Paulson's Professional Construction Management[1] is used as the text book to define alternative construction management methodologies. Based on B&P's definition, the author develops a framework of project organizational systems in a triangular shape in Figure 4-1-3. For a theoretical framework, Minden's procurement decision making model[38] is employed to define theoretically optimal project organizational systems of the four automotive plant projects because of this is probably the first and firm attempt to develop a theoretical procurement methodology. At the same time, applying the decision making model for the four automotive projects, the validity of the model will be evaluated.

Additionally for a framework for organizational analysis of TMC and OHB for the Toyota KY Project, the concepts built by Mintzberg,[9] Bronfman Professor of Management Policy at McGill University is used. This theory provides a framework for the classification of organizations and for defining independent variables known as contingency factors, to change or formulate organizational structure. Irwig's[27] summary of Mintzberg's framework is used to show the results of the analysis of TMC and OHB's organization for the Toyota KY Project on Irwig's pentagon diagram after Mintzberg.

Finally, the strategy of TMC and OHB for the project to cope with uncertainties is analyzed. Several alternatives of the actual strategy are examined.

The thesis structure is as follows:

Chapter 2: Background information of the project. This chapter includes four sections. The first section presents historical background on the economic and political situation of Japan and the U.S. The second section describes the history of OHB in the U.S. The third section presents an outline and the history of TMC. The last section describes three projects comparable with the Toyota KY Project: Toyota Tahara, Fuji Gunma, and Nissan Smyrna, are explained respectively.

Chapter 3: Toyota Kentucky Project. This chapter includes a project summary, development process and schedule, and project organization. The project summary presents important factors used to describe the project outline. The development process and schedule section presents a detailed description of events on each development stage and the possible reasoning of these events. The project organization section describes the organizational structure and contract types of the project, and explanation of OHB's organization of the project.

Chapter 4: Alternative procurement methods/project organizational systems (including classification of the four automotive plant projects). A new framework of project organizational systems is presented. Alternative procurement methods comparing Barrie and Paulson's definition[1] and Minden's one[38] are explained here. The four automotive plant project organizations will be classified in the framework.

Chapter 5: Evaluation of the development process and the project organizational systems of the Toyota KY Project. The development project process and the organizational systems of the Toyota KY Project are analyzed. Differences between Japan and the U.S. about these points and the strategies employed by TMC and OHB are studied. Several alternative strategies employed by TMC and OHB to manage uncertainties in the new environment are examined to define possibly the optimal procurement methodology for TMC and OHB. Comparative studies using the Nissan Smyrna, Toyota Tahara, and Fuji Gunma projects, are used to find these answers.

Chapter 6: Conclusions and Further Research.

2. Back ground information of Toyota Kentucky Project

This section includes on account of the general economic situation between Japan and the U.S. in projects comparable with the Toyota KY Projects. The first part explains the brief history of trade friction between Japan and the U.S., Japanese direct investment, and Japanese international contractors operations. The next part describe the outline and history of the Ohbayashi Corp. in the U.S. Then, an outline of the history of the Toyota Motor Corp. will be explained. Finally, three projects, Toyota Tahara, Fuji Gunma, and Nissan Smyrna, will be described. These projects will be compared with the Toyota KY Projects in section four.

2-1 Trade friction, Japanese direct investment, and Japanese international contractors.

Special features of the Toyota KY Project and the scarcity of the study about transfer of development process between developed countries will definitely support the importance of the thesis. The Toyota KY Project is a symbolic event in the context of the current relationship between the U.S. and Japanese industry. At the same time, the project is a symbol of the rapid increase of the share by Japanese international engineering construction companies in the U.S.

Trade friction between the U.S. and Japan is classified into three periods: the first period was 1971 to 1972; the second period was 1976 to 1978; the third period is 1981 to date. Special features of the third period is the sophistication of the items that cause the trade friction. In the first period, the textile industry was the major problem. Then in the second period, the steel industry was discussed. Now the items are expanded to automobiles, color televisions, semiconductors and financial services.

Japanese direct investment overseas is related to trade friction. The first period of the direct investment boom was 1972 to 1973. At this time, mostly the manufacturing industry invested in developing areas, such as Asia and South America. Only trading and financial service industries invested in developed countries. In 1973, the investment yielded $3.5 billion due to the favorable environment for the direct investment because of the scarcity of the domestic (Japanese) labor supply and the strong yen created by the "Nixon shock." Backed up this environment, the textile industry and some electric manufacturers invested in South east Asia and other areas. But on the other hand, Japanese manufactures were not strong enough to go to developed countries, such as the U.S. and Europe. The second direct investment boom, begun since 1980, has been accelerated by the strong yen against U.S. dollar. Compared with the first period, the contents of the investment and the target areas are very different. The transport machine, electric, and mechanical industry have increased their share. Especially, in VTRs, semi-conductors, computers, and communication devices, which Japan has a technical advantage, are increasing. In the automobile industry, after Honda and Nissan, Toyota decided to invest in the U.S. Mazda, Mitsubishi, Fuji, and Isuzu are following, too.

Because of the slow economic growth in Japan and the economic slump in developing countries, the Japanese construction industry has recently turned their target to the direct investment by Japanese corporations in developed countries. The U.S. has become the most attractive market for them. The total contract amount overseas in 1985 was 11 billion yen which was 10 % more than in 1984. This total includes direct contract by Japanese contractors and their overseas subsidiaries. Contracts by the overseas subsidiaries have been increasing every year since 1979.[8]

Figure 1-1 shows the market trend of the international construction market and the share of Japanese contractors in it. Figure 1-2 shows where the Top 250 international contractors won foreign contracts. These graphs indicate the declining market of the Middle East and Asia, and the relatively steady market of North America. The increasing share of Japanese contractors is not still significant but it appears stable compared with the big ups and downs of the whole market.

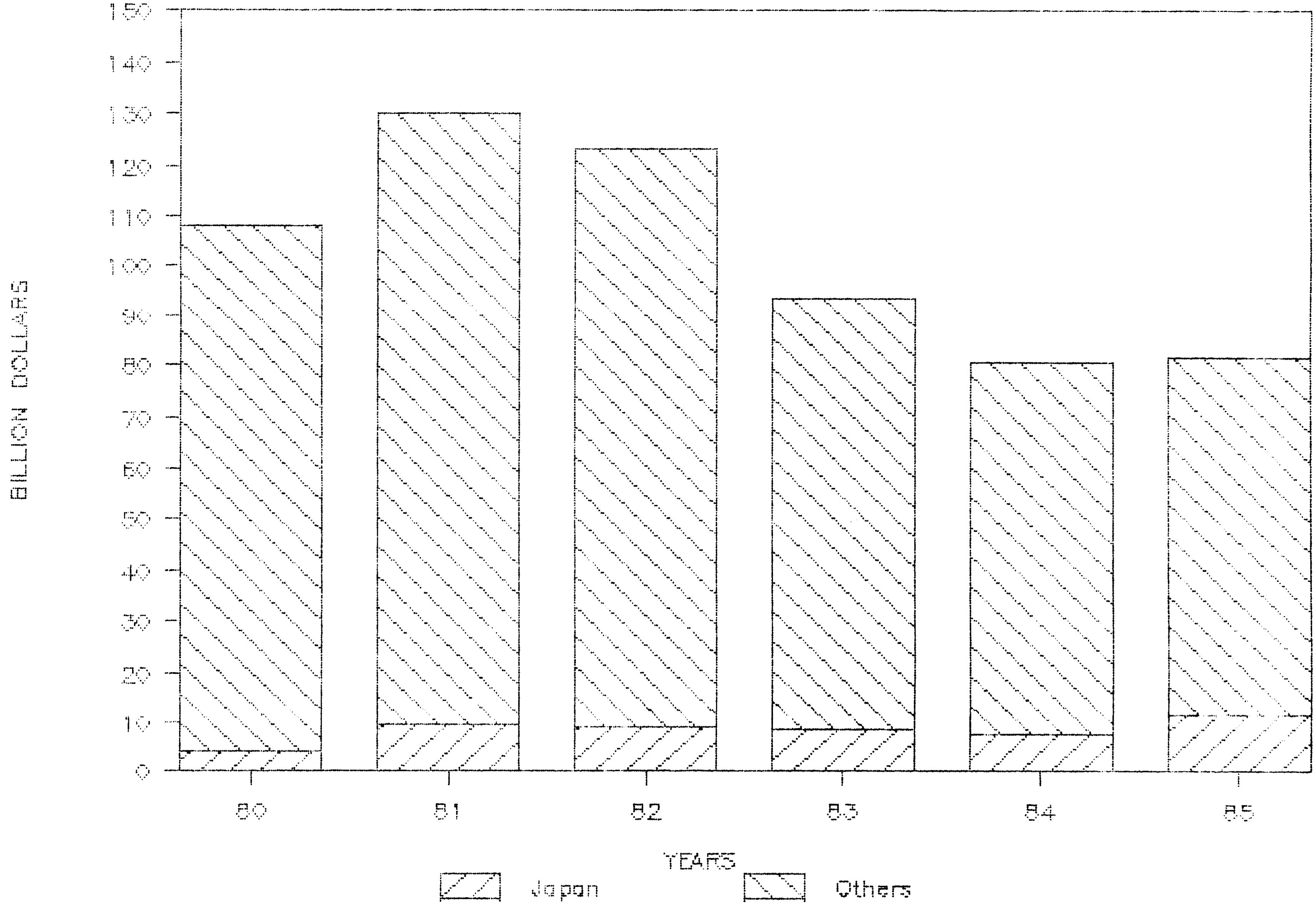
Figure 1-3 shows 13 years trend of Japanese contractors' overseas operations. It shows rapid expansion of international operations by Japanese contractors in this decade.

The regional share of the contract is changing. While the share of Asia has shrunk drastically, North America, Europe, and Pacific region are increasing and occupy 46% of the total overseas contract. The top five countries are as follows:

1) The U.S. except Hawaii, 199 billion yen;

Figure 1-1

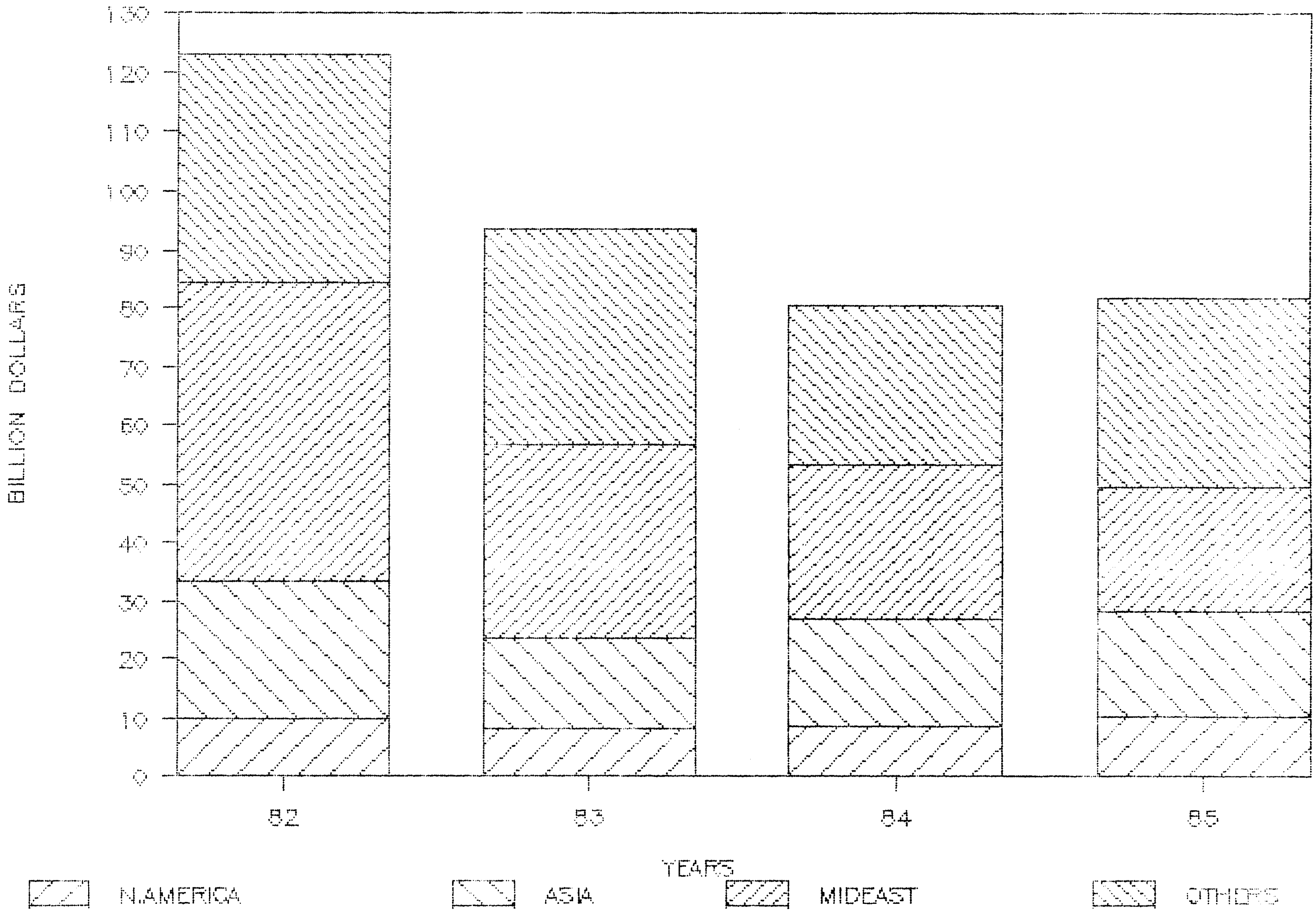
INTERNATIONAL CONSTRUCTION MARKET



SOURCE: ENR
TOP 250 INTERNATIONAL CONTRACTORS

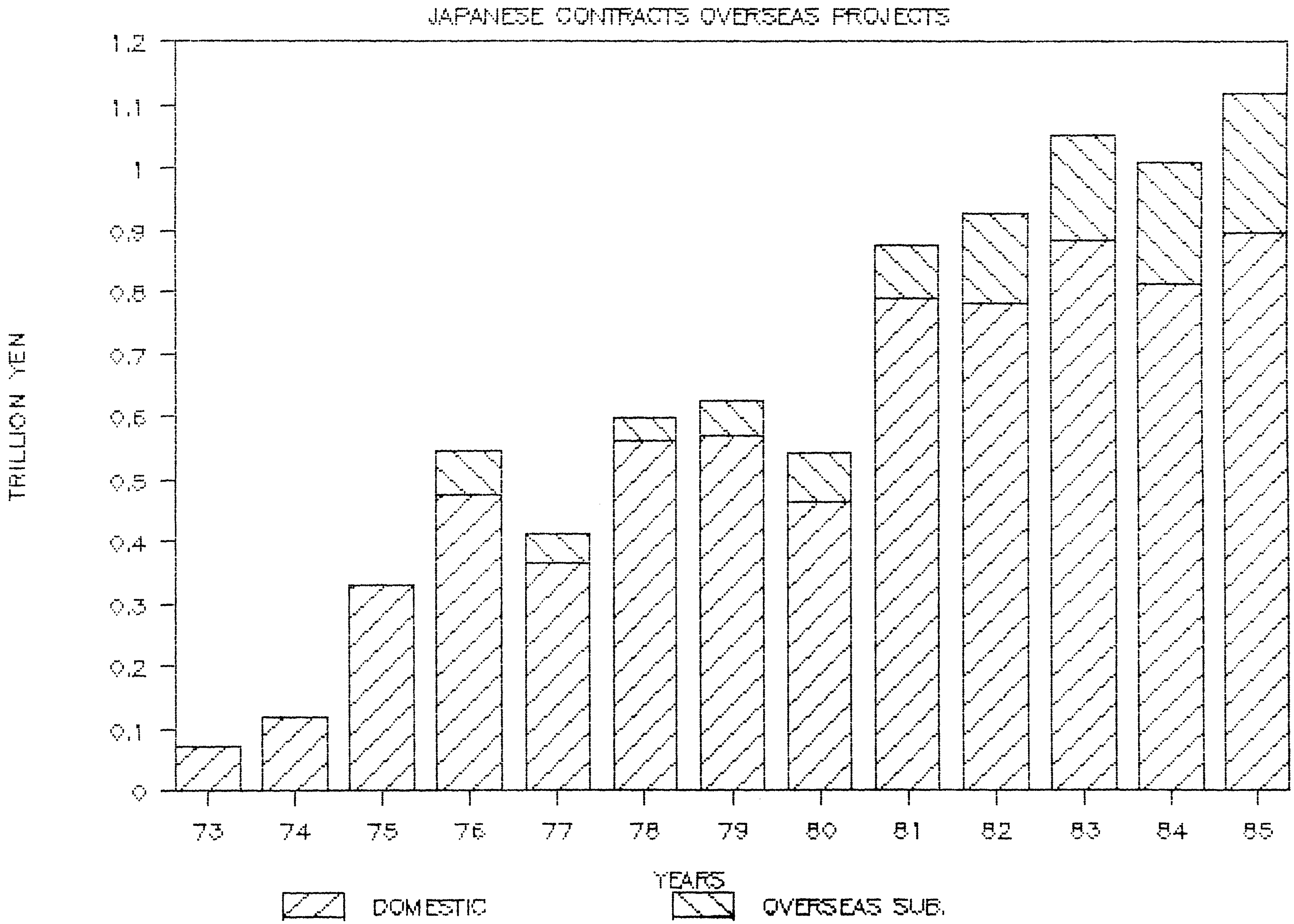
FIGURE 1-2

WHERE TOP 250 WON FOREIGN CONTRACTS



SOURCE: ENR
TOP 250 INTERNATIONAL CONTRACTORS

FIGURE 1-3



SOURCE: THE WHITE PAPER OF CONSTRUCTION
JAPAN'S MINISTRY OF CONSTRUCTION

2) Australia, 176 billion yen;

3) Hongkong, 106 billion yen;

4) Singapore, 86 billion yen;

5) Hawaii, 77 billion yen.

Figure 1-4 shows the recent change of major international market for Japanese contractors.

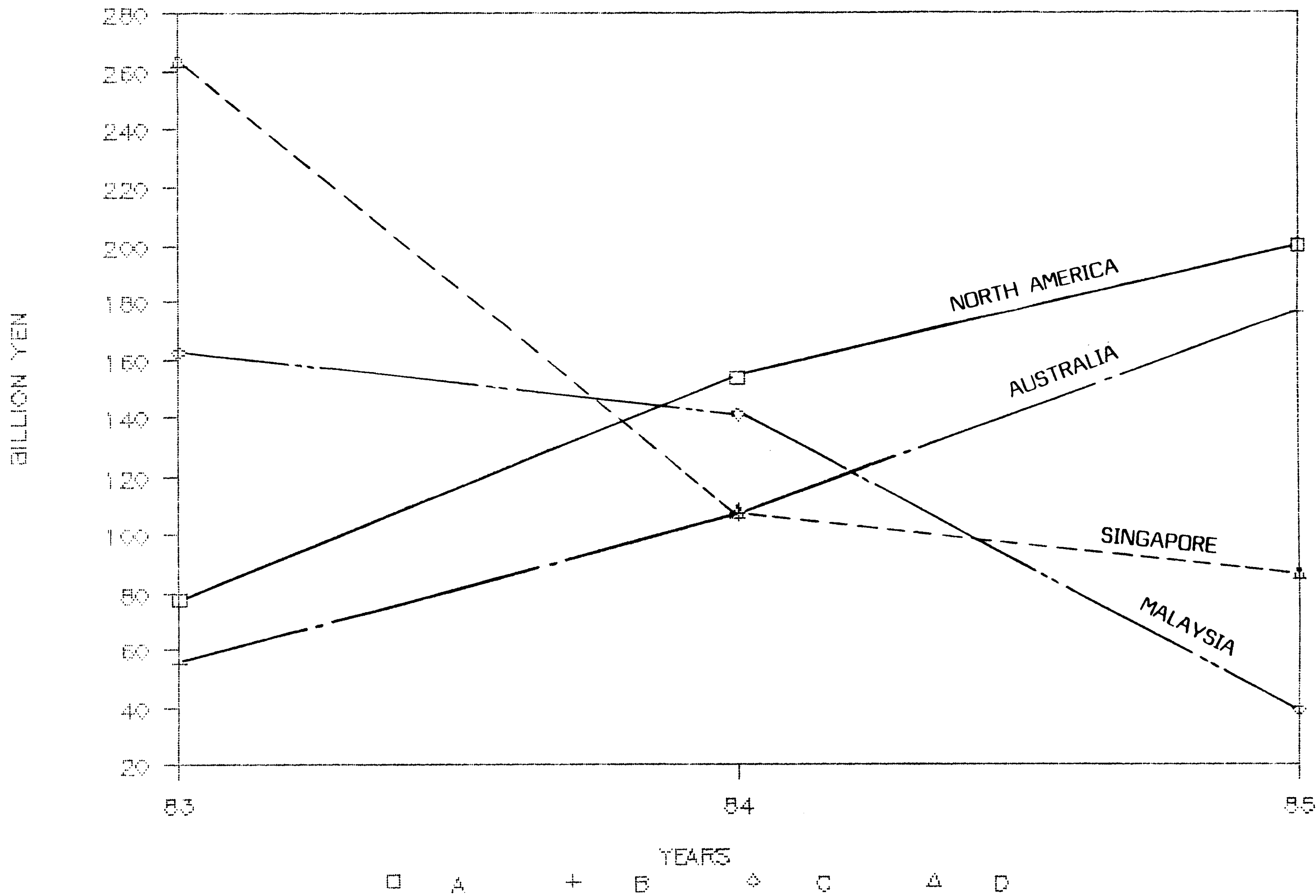
Figure 1-5 shows the recent trend of overseas operations by the Japanese Big Five contractors plus Kumagai-gumi. Kumagai-gumi has extended its business drastically, and the Big Five seem to be starting new steps in the international market.

The Japan's ministry of Construction explains that the reason for the decline of contract share of Asia for Japanese contractors from 59% in '84 to 36% in '85 is due to the inactive economy of ASEAN (Association in South East Asian Nations) and the decrease of new projects. The reason for the increase of contract share in the U.S. and Australia for Japanese contractors is the increase of Japanese plants and offices in the U.S.[26] associated with the direct investment by Japanese corporations. Additionally, the rapid increase of real estate development by Japanese contractors in the U.S. and Australia is another reason for the increased share in these areas for Japanese contractors. The Ministry of Construction forecasts that the U.S. and Australia will continue to be major overseas markets for Japanese contractors.

Reaction by the U.S. against the current increase of Japanese contractors' operations in the U.S. has begun to change gradually. Because of the imbalance in contracts between

FIGURE 1-4

MAJOR MARKET FOR JAP. INT'L CONTRACTORS

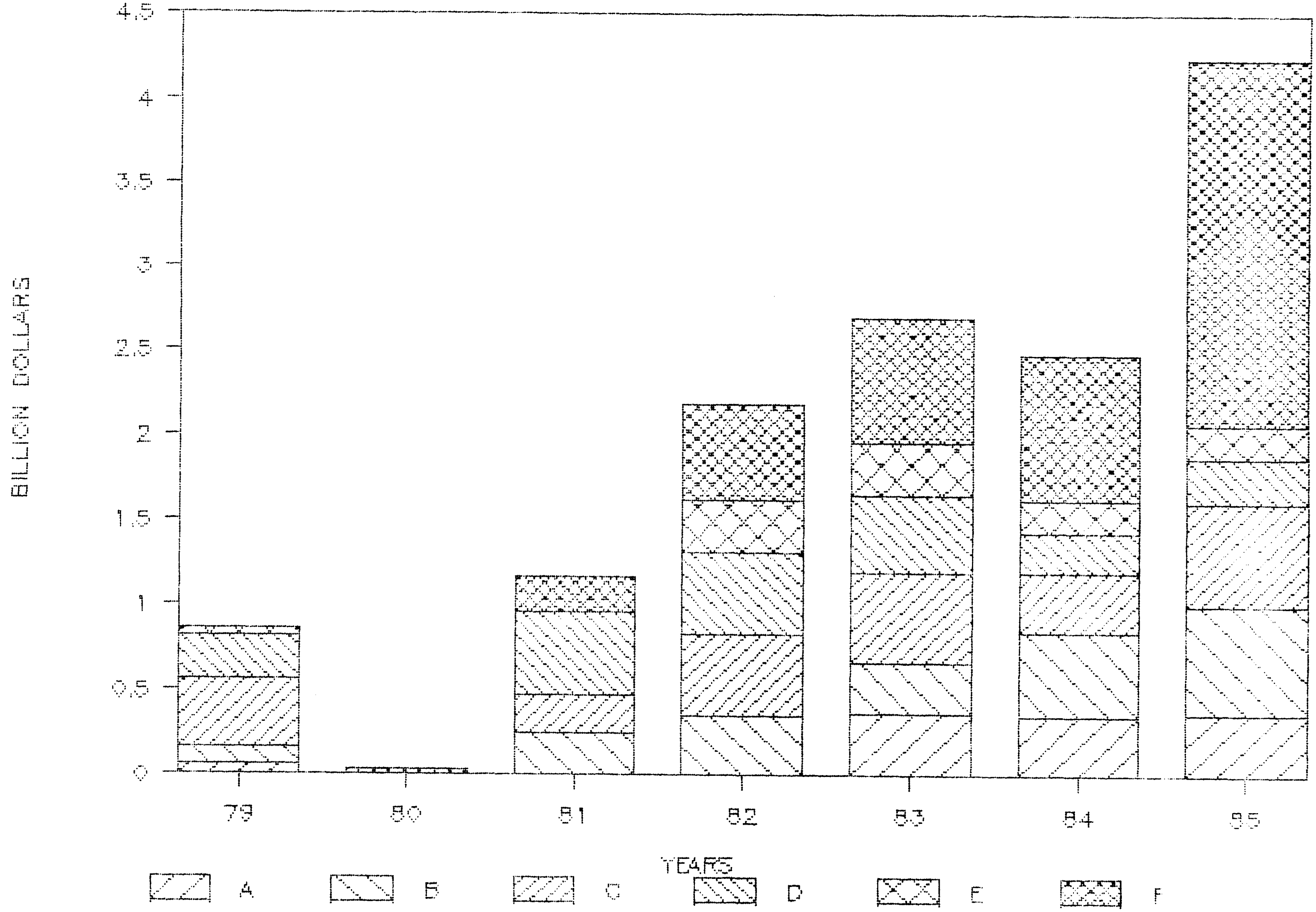


NORTH AMERICA AUSTRALIA MALAYSIA SINGAPORE

SOURCE: THE WHITE PAPER OF CONSTRUCTION

FIGURE 1-5

INTL CONTRACTS OF JAP. BIG 5 + KUMAGAI



OHBAYASHI KAJIMA SHIMIZU TAISEI TAKENAKA KUMAGAI

SOURCE: TOP 250 INTERNATIONAL CONTRACTORS

Japanese contractors in the U.S. and American contractors in Japan, the U.S. government has asked Japan to open up its construction market. Japanese contractors got 280 billion yen in the U.S. market, but on the other hand, American contractors got nothing in '85. The Kansai International Airport Project is the first target by the U.S. government. Though there is little visible movement in the Japanese government, Japan has a new potential problem in the construction industry in 1986.

Topics about Japanese contractors in the U.S. have recently appeared both in professional construction magazines such as Engineering News record and national newspapers in the U.S. Engineering News Record, Sep. 20, '84, reports the recent rush of Japanese contractors into the U.S. market comparing it with the previous Canadian movements.[29] It explains the attractiveness of the U.S. market as much space, political stability, relatively loose restriction. The magazine describes the general situation for Japanese international contractors and states their activities as contractor developers in the U.S. The U.S. market for Japanese contractors has become the first in '84, from the fifth in '83.

In The New York Times, Bennet writes "Now, Japan Inc. Wears a Hard hat: Japanese builders are beginning to win some big contracts in the U.S."[17] The article begins with Ohbayashi Corp.'s tunnel construction for the I-10 highway in Phoenix and concludes using the favorable comments for Ohbayashi by Shank-Artukovich, the American joint venture partner of Ohbayashi for the project. Bennet explains the basic situation of the U.S. construction market as "This year ('86), the (Japanese) companies may capture $4 billion of the more than $100 billion in American contracts - no far bellow the $5 billion in domestic contracts won last year by Bechtel, one of the nations top three builders." In the article, he states American construction companies' reactions that "some American builders are bitter, others are profiting." John P. Boone, senior vice president of the Dallas based Vantage Companies, one of the nation's largest private developers, described briefly that "It is a two way street. While they are learning about doing business here, we can tap technology from Japan." This statement seems to point out the essential relationship between the U.S. and Japan's construction industry to date, though differences of building construction technology between these countries seem to be little.

Though the drainage tunnels construction for the I-10 highway by Ohbayashi is a sensational event in the U.S. construction industry in terms of public construction done by a Japanese builder, it is still an exceptional case to date. Most work for Japanese contractors in the U.S. comes from their Japanese clients or from development projects by themselves. A report prepared by international Business Information Inc., a leading Tokyo-based construction firm says that medium-size Japanese contractors are now setting up subsidiaries in the U.S. and expanding along with leading firms such as Ohbayashi Corp. and Kajima Corp. Hann and Krizan summarize this report and say that the bulk of the U.S. contracts have been for the factories and offices of Japanese companies setting up shops in the U.S.

including Toyota, Nissan, Cannon, and Nippon Denso.[24] Bennet says that the Japanese construction companies have strong ties with other Japanese corporations, because the traditional Japanese way of doing business insures long-lived relationships between builders and their clients.[17] Actually this is the main reason why the Ohbayashi Corp. got the Toyota Kentucky Project from the Toyota Motor Corporation, one of Ohbayashi's most important clients.

Supplementally the following part of this section presents the discussion about Japanese contractors' general strategy of structuring a project organization especially in the U.S. As a general policy of Japanese contractors, they are trying to capture overseas projects by Japanese investors, such as auto-manufacturers and financial institutions. But competition among Japanese contractors and local contractors is unavoidable. Therefore cooperation with the local construction industry is important to avoid new trade friction. President Ohbayashi says that a joint venture with local contractors,or construction management contracts like the Toyota KY Project should be actively used to ease friction with the local construction industry.[44]

Historically, joint ventures have been a traditional and popular method for Japanese engineering construction companies to avoid or reduce business risks in unfamiliar countries. Joint ventures are also very popular in the Japanese construction industry, though the emphasis of their merits are quite different from the usual joint venture concept, the distribution of business risks. Joint venture construction in Japan is very popular because it is a convenient way to distribute public projects to small or mid-size local companies maintaining the high quality guaranteed by the joint venture sponsor, a big engineering construction company. This type of joint venture is an effective way to transfer technology from a big and advanced company to a small or medium sized local construction companies.

Another purpose of joint venture in Japan is coordination for construction companies by a client or sometimes by construction companies themselves. For instance, when a manufacturing company decides to rebuild its main factory, the company will choose some contractors who are usually building or maintaining the company's facilities. Historically, the share among contractors for the manufacturing company does not vary so much. If the rebuilding project is unusually big, the manufacturing company may well arrange a joint venture whose participating ratio will be similar to the historical distribution of contracts among the contractors for the company.

Through much experience of joint venture in Japan, Japanese international contractors are aware of its merits as well as demerits. Diversification of construction risks is an important factor of the joint venture in overseas construction for Japanese contractors despite the unusual application of it in Japan. Knowledge about local business conventions is one of the most important purposes for international contractors to structure a joint venture with a local construction company. Considering the difference between the U.S. and Japan, and their matured construction industry, companies without sufficient knowledge of business conventions in each country must get help to secure their operations in the new environment. The necessity for help from local companies reduces as a company accumulates the know-how of operations in the new market.

Information about local trade or jurisdiction of the construction industry in the U.S. is very important to manage a project effectively and successfully. Structuring project organization including subcontracting in a reasonable way is a key factor to achieve project goals. Either through a traditional construction process or construction management style construction, the input of local construction conventions into design and procurement is critical and not an easy task.

Information about the local construction industry in Japan is important, too, because even in open shop areas in the U.S., local information is very important including labor relations. It may not be appropriate to describe the labor relations in Japan as open shop, however, it has many similarities between Japanese labor relations and the open shop in the U.S. For instance, the Japanese construction industry has no industrial unions, so trade or jurisdictional arrangement is not necessary in Japan.

Ohbayashi Corp. has used the joint venture as a learning tool for American construction business as well as avoiding some business risks since its first operation in the U.S. There are some examples in Ohbayashi's history in the U.S. such as the Kyoto Inn Hotel construction in 1974 and the Evertrust office building in 1985. Ohbayashi did this construction by structuring a joint venture with American contractors to learn business and to avoid some risks.

In the context of both the Japanese and American construction industry, a Japanese construction company could gain a greater reputation by doing construction management than by contracting as a sponsor of a joint venture. This is because the construction management for Japanese contractors is a new contracting style and challenging subject for them. It is too risky for unexperienced Japanese construction contractors who have come recently to the U.S. seeking for Japanese clients because of the difficulty of getting information and hiring good American managers.

2-2 Outline and the history of Ohbayashi Corporation in the U.S.

Ohbayashi Corp. has been in the U.S. since 1966, having worked on relatively small projects in Hawaii and on the West Coast until 1982. It has gradually undertaken bigger projects, primarily the building of factories and warehouses for Japanese companies setting up operations in the U.S.[23] Ohbayashi began to attach importance to the U.S. market around 1982 because it began to get heavy construction in the U.S.[80]

Though Ohbayashi Corp. is almost unknown except very recently in the U.S., it has been famous as one of the Big Five engineering construction companies in Japan. The outline of it is as follows:

1) name; Ohbayashi corporation,
2) head office; 3, 2-chome, Kanda Tsukasa-cho, Chiyoda-ku, Tokyo, Japan,
3) establishment; Jan. 25, 1892,
4) capital assets; 32.6 billion yen (Mar. 31, 1986)
5) employees; 9,915 (ave. 39.4 years old) (Mar. 31, 1986)
6) subsidiaries in the U.S. (1985)
 a. Ohbayashi America Corporation, California
 b. United Development Corporation, Washington
 c. J. E. Roberts-Ohbayashi Corporation, California
 d. Ohbayashi Hawaii Corporation, Hawaii
 e. Ohbayashi Associates Hawaii Inc., Hawaii
 f. Citadel Corporation, Georgia
7) Overseas office in the U,S. (1985)
 a. New York
 b. Los Angels
 c. San Francisco
 d. Chicago
 e. Atlanta
 f. Honolulu

Important events of Ohbayashi corp. in the U.S. are as follows:

1966-1971; the first operation of Ohbayashi Corp. in the U.S. was the Surfrider hotel in Honolulu, Hawaii. After Ohbayashi got a negotiated contract from a Japanese overseas subsidiary, Kyouya, Ohbayashi registered as a foreign corporation, and then received a contractor's licence in 1967. The completion of the construction was in 1969. In addition, Ohbayashi got an enlarging and remodeling construction contract for the Princess-Kailua Hotel, and completed it in 1969.

Ohbayashi started real estate development as well as construction in Hawaii. Ohbayashi acquired a 1600 square meters (SM) parcel in downtown Waikiki in 1971. This acquisition was the first permit by the Ministry of Finance (Japan) regarding the acquisition of overseas real estate for Japanese corporations. Ohbayashi opened its local office in Honolulu in 1971. Then, it set up its overseas subsidiary, Ohbayashi Hawaii Corp., in 1972.

1972; Ohbayashi started its operations in North America by setting up the overseas subsidiary, Ohbayashi America Corp. in Los Angels (L.A.). It received a licence of a general contractor in the U.S. in 1973.

1973; Ohbayashi set up the Department of Overseas Business in the Tokyo Head Office. Besides Ohbayashi America Corp., it opened a local office, which mainly dealt with heavy construction in Los Angeles.

1974-1975; After two years of market research, Ohbayashi America started active operations on the West Coast. It got the construction of Hotel Kyoto Inn from America Kintetsu Kougyou. The completion of the construction was in 1975. Ohbayashi chose J.E.Roberts Co. as the joint venture partner for the construction. Actually, Ohbayashi did not make a profit because it gave too many incentives to the partner. Since then, Ohbayashi America has gotten many projects mainly from Japanese companies or their subsidiaries. Ohbayashi did this construction by itself with little profit, but it learned the construction business through these experiences.

1976-1977; Ohbayashi America expanded its network from Los Angels to San Francisco (S.F.) and Seattle. Then, Ohbayashi America took on a big project, the Milcreak Project. This project is located in a suburb of Seattle, and developed about 3,200 private residents and various recreational facilities on 1,085 acres wilderness. Ohbayashi Corp., Tokyuu Group., and American investors set up the United Development Corporation to manage the project. The corporation plans to complete the project in 1988.

Ohbayashi got the Koncho Building project from an American company. This event was a milestone in Ohbayashi America's history because Ohbayashi America got it for the first time from an American company through competitive bidding with construction bonds, which does not exist in the Japanese construction business. In Nov. 1976, Ohbayashi America hooked up with Adlian Wilson Co., a big American design firm, and arranged Ohbayashi America's organization to manage a turnkey program. Consequently, it constructed the L.A. office of American Komatsu Forklift, by turnkey contract.

1978; Ohbayashi chose J.E.Roberts Co. as a strategic partner in order to expand Ohbayashi's operations into public facility construction because J.E.Roberts had much experience in the field. J.E.Roberts-Ohbayashi succeeded in getting a public housing project in north San Francisco from the Federal Housing Department. Ohbayashi began to manage the Wilshire Building in L.A., one of the Ohbayashi's properties, this year.

1979-1980; Ohbayashi got a sewage project of the City of San Francisco, proposing "Slurry Shield Tunnel Construction Method," a sophisticated tunnel construction method. This project was sensational both in the U.S. and Japan because of its advanced civil engineering technology, which once the U.S. had exported to Japan, came back to the U.S. from Japan. Engineering News Record, Sep.20,1979, used the president, Ohbayashi's portrait on the cover, and wrote a special topic about Ohbayashi Corp. because this tunnel project was the first public heavy construction project done by a Japanese contractor in the U.S.

1982; Ohbayashi opened the New York office. The original purpose of opening the New York office was to get business information especially for American companies that planned to go to Japan. Soon after some efforts to get such kind of information, managers in the office realized that someone who does not give anything cannot get anything in business. Then, managers in the office began to get projects on the East Coast.

The first success was the NEC Information's Boston factory. Ohbayashi contracted this project with Turner Construction using the lump sum contract. Doing the construction, Ohbayashi began to get business information through its business relations.

Noma, the head of the New York office, gave an example of this relationship. When a typhoon destroyed Ohbayashi's hotel in Hawaii, Ohbayashi had difficulties getting insurance money. An insurance broker at Hartford, which Ohbayashi asked to introduce an underwriter of the NEC project, introduced a construction insurance specialized lawyer for Ohbayashi. It received more money from the insurance company than it had expected. If Ohbayashi had not done business in N.Y., it would not have found such an appropriate person, Noma added.[80]

1983; Ohbayashi corp. got a public housing project from the L.A. Urban Renewal Department. This was the first case for a Japanese contractor to get a public building construction project. It also got the Westside Pump Facility from the City of San Francisco, and a condominium, Tokyo Villa in L.A., through competitive bidding.

1984; Ohbayashi Corp. agreed to business cooperation with The Rothchild Realty Group, Ill. Ohbayashi got the drainage tunnel construction for I-10 in Phoenix.[17] It also got a big (324,000 SF) high rise (17F) office building from Evertrust, a subsidiary of Ever Line, in Jersey City, New Jersey, on just the other side of the river from Manhattan. This was the first case for a Japanese contractor to get a project from a non-Japanese company in the greater New York area.

Ohbayashi chose Sordoni, a medium size construction company in New Jersey (about one tenth of Turner Construction), as a joint venture partner. Turner Construction rejected the offer from Ohbayashi Corp. to be the joint venture partner though Turner had contracted the NEC Boston project with Ohbayashi. According to Noma, the head of the N.Y. office, because Ohbayashi tried to get involved in the construction and to learn the business on the East Coast, it chose joint venture rather than lump sum contract with an American contractor. Ohbayashi was cautious enough to avoid doing construction individually in N.Y. At the same time, it was afraid of unforseen problems during and after the construction because it had not enough experience on the East Coast. Why Ohbayashi could not do construction in New Jersey, despite it doing construction individually in L.A., is that the concessions related construction business especially in greater New York is extremely complicated. A very strong construction union is one of the special features of the construction business in Manhattan. Noma explains that even Sordoni, the joint venture partner, cannot do business in Manhattan island. To do construction business in Manhattan, construction companies have to hire powerful project managers who have much experience there and know who does what exactly.[80]

Though several Japanese contractors do tenant construction for Japanese clients in Manhattan, usually by lump sum contract with American contractors, Japanese contractors did not suffer from obstructions by the union or others until 1985. This is probably because the Japanese construction business is too small for the union or others to pay it special attention.

One of the reason that Ohbayashi does not do construction independently on the East Coast is that Ohbayashi cannot fail in its construction for its Japanese clients. Even in the U.S., failure of construction for Japanese clients causes a terrible influence on Ohbayashi's business in Japan. Japanese clients regard their contracts with Ohbayashi for overseas projects as a simple extension of their long term relationships with Ohbayashi.

If Ohbayashi fails in a Japanese client project overseas, Japanese competitors will take some portion of Ohbayashi's share for the client. At worst, Ohbayashi may loose its reputation and historical advantage for the client; it may loose chances even for selective bidding of the client's projects, which used to be automatically contracted with Ohbayashi by negotiation.

1985; Ohbayashi Corp. changed its operation system in the U.S. after 20 years after its first operation in the U.S. It has three main overseas offices in the U.S., N.Y., L.A., and S.F. Ohbayashi added two other offices in Chicago and Atlanta. It completed the first full-turnkey project as a Japanese contractor for the Sumitomo Kinzoku Kouzan's semi-conductor factory in Fremont.

Ohbayashi set up Citadel Corp. in Atlanta, a key city in the Sun Belt. The reason for setting up a new subsidiary in the Sun Belt is the increasing Japanese investment there and the necessity to set up an open shop construction company. Ohbayashi is a closed (union) shop company in the Sun Belt, so it cannot contract with open (non-union) shop companies which dominate the area; the contract between union and Ohbayashi prohibits Ohbayashi to use non-union contractors in contracted areas. The Sun Belt is very popular for Japanese corporations partly because it is largely non-union. Japanese management tries to avoid unfamiliar headaches which would be caused by labor unions. Labor unions exist in Japan, too, but most of them are individual unions within their corporations rather than interindustry or craft unions. Therefore, the concept of the labor union in Japan is totally different from that in the U.S.

Ohbayashi Corp. uses a so called "Double Breast Strategy," that means the strategy for an owner of construction companies to possess two different operational companies, closed and open shop companies. Most big American construction companies use this strategy in the U.S.

A special feature of Citadel Corp. is that all management is American. Noma explains that because excellent American managers tend to avoid working under Japanese managers, Ohbayashi decided to hire an American president for its new subsidiary. Ohbayashi simply gives policy but does not try to control the operations of Citadel. Though Citadel has gotten only small projects as of 1986, the top management of Ohbayashi is looking for Citadel to get into the American construction market while Ohbayashi provides business for it. Management recognizes that the goal of its operations in the U.S. is to be able to get sufficient work from American clients in all areas in the U.S.

At the end of 1985, Ohbayashi got the Toyota KY Project. Citadel did a good job for Ohbayashi to gather information regarding site selection or other project related matters, during the planning stage of the project for Toyota Motor Corp. Main reason for Ohbayashi's success in getting the project was the long-term relationships between Toyota and Ohbayashi in Japan, but the contribution by Citadel was significant for Ohbayashi.

2-3 History of Toyota Motor Corporation (TMC)

This section has two parts: the first part is a summary of the history of TMC; the second part is a summary of the historical relationship between TMC and Ohbayashi.

Since the independence from Toyoda Automatic Loom Company (established in 1918 by Sakici Toyoda) in 1937, TMC has grown to a world famous auto-manufacturer through ups and downs during 50 years. TMC produced 3.4 million cars next to the top, GM's 5.7 million cars in 1984. TMC became the top Japanese manufacturing company in 1978 because its sales, and profit, both after financing and taxes, were the most. TMC has maintained the prestigious position in Japanese industry since then. TMC employs 62,000 people and has 11 factories in Aichi prefecture in Japan. The products are automobiles, industrialized housing, industrial transporters, and parts.

The outline of TMC is as follows (1986):

1) Name; Toyota Motor Corporation

2) Establishment; Aug. 28,1937

3) Location; 1 Toyota-Machi, Toyota City, Aichi Prefecture, Japan

4) Capital Assets; 133.2 billion yen

5) Employees; 61,676 (m.:56,117, f.:5,579)

Table 2-3-1 shows its factories. The Tahara factory, one of the comparable plants with the Toyota KY plant, is a relatively new factory, the tenth factory of TMC. The Honsha factory is the oldest, the dedication was about one year after the establishment of Toyota Motor Industry Co. Figure 2-3-1 shows the location of the TMC's plants in Japan. All factories are located in Aichi

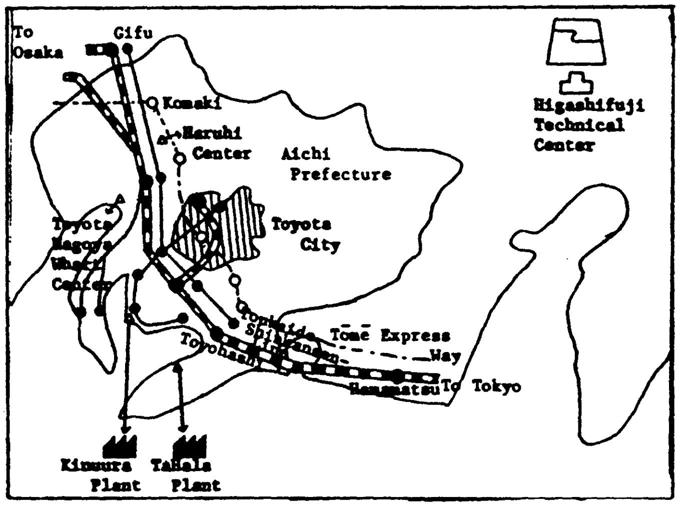
Table 2-3-1
Factories of Toyota Motor Corp.

NAMES	DEDICATION	LAND AREA ('000s SM)	FLOOR AREA ('000s SM)	EMPLOYEES	PRODUCTS
TAHARA	1979	3930	610	4800	PASS. CAR, SMALL TRUCK
HONSHA	1938	790	400	2400	TRUCK, BUS, HOUSING
MOTOMACHI	1959	1610	730	5200	PASS. CAR
KAMIGOU	1965	880	540	3400	ENGINE, TRANSMISSION
TAKAOKA	1966	1360	540	5100	PASS. CAR
MIYOSHI	1968	330	140	1900	SUSPENSION, SMALL PARTS
TSUTSUMI	1970	970	530	5800	PASS. CAR
AKECHI	1973	330	140	900	DIECAST PARTS
SHIMOYAMA	1975	410	210	1600	ENGINE, ANTI-POLUTION DEVICE
KOROMOURA	1978	820	230	2300	TRANSMISSON, POWER TRAIN
TEIHOU	1986	320	90	1400	MACHINE, DIE

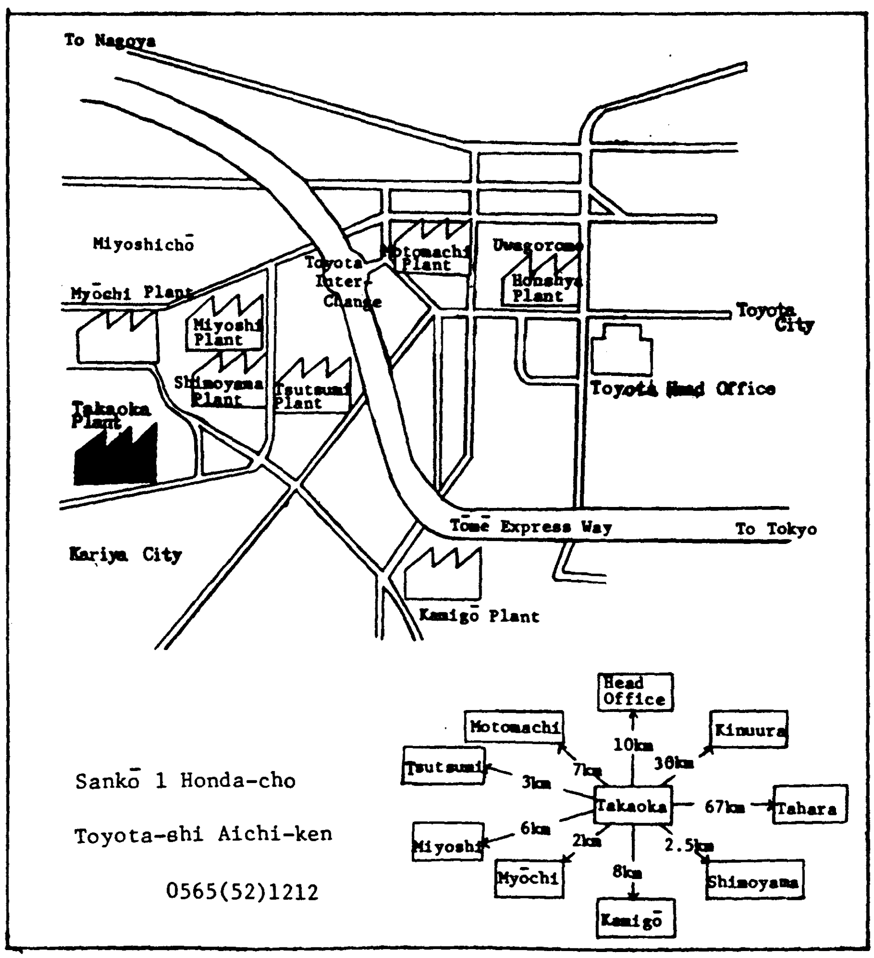
AS OF DEC. 1985
SOURCE: TOYOTA 1986 BY TMC

LOCATION OF TMC'S PLANTS

1. Location of Toyota City



2. Location of Takaoka Plant



Sankō 1 Honda-cho

Toyota-shi Aichi-ken

0565(52)1212

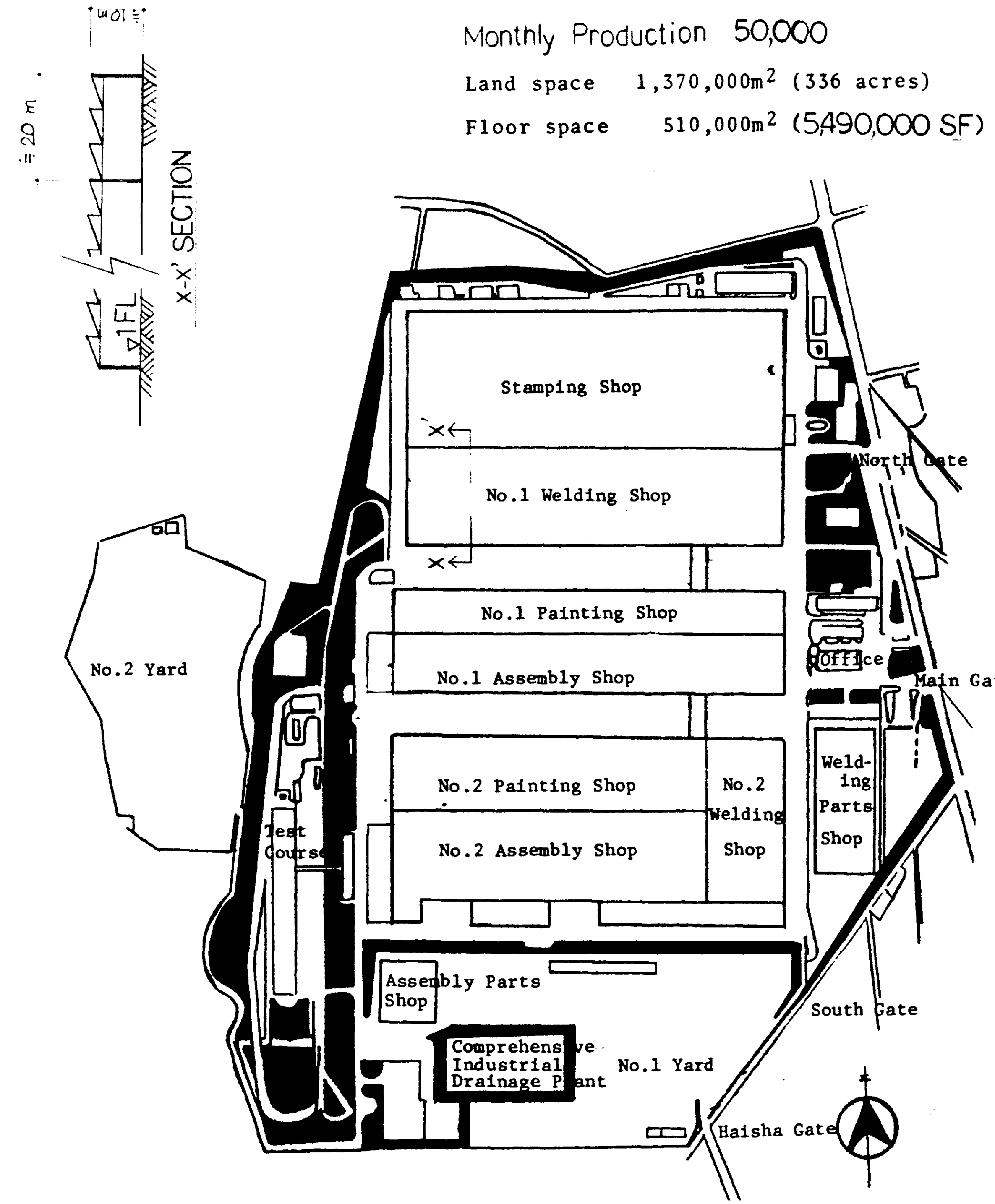
FIGURE 2-3-1 SOURCE: OUTLINE OF TAKAOKA PLANT BY TMC, 1983

Layout of Takaoka Plant

Monthly Production 50,000

Land space 1,370,000m² (336 acres)

Floor space 510,000m² (5,490,000 SF)



SOURCE: OUTLINE OF TAKAOKA PLANT BY TMC, 1983

FIGURE 2-3-2

Prefecture and most of them are in Toyota City. Figure 2-3-2 shows a typical TMC's plant layout (Takaoka Plant). Most TMC's plants use structural steel and are one-story buildings.

Table 2-3-2 gives a brief history of TMC. Sakichi Toyada (1867-1930), a famous inventor of the Toyoda Automatic Loom in Japan, is the founder of the parent company of TMC. He became interested in motor vehicles around 1910. Then, he had his eldest son, Kiichirou (1894-1952), study automobiles. After graduation from the Mechanical Engineering Department of Tokyo University, Kiichirou entered his father's company. Though Kiichirou got an excellent education, he was not willing to enter the automobile industry because the level of Japanese industry was far behind the Western countries at that time. The main reason for Kiichirou to enter a new business field was his father's personal wish, so it was emotional rather than logical.[2]

After the independent establishment of Toyota Motor industry Co.(Toyota), there were many ups and downs. Gradually, Toyota built its factories and set up sales companies both in Japan and overseas. It won the Deming Prize, an award for excellent companies for quality control in 1965. Toyota has developed its Total Quality Control system further after that event. Since the '70s, Toyota has actively done social and cultural activities including establishing the Toyota Foundation and the Toyota Industrial Institute. The merger of Toyota and Toyota Motor Sales was a big event in the '80s. Another big issue is the

Table 2-3-2

Outline of the History of Toyota Motor Corporation

Year	Events
1933	Set up Department of Automobile in Toyoda Automobile Loom Manufacturing Co.
1935	Prototype of A1 car
1937	Establishment of Toyota Motor Industry Co.
1938	Start of Honsha Plant's operation
1950	Establishment of Toyota Jidousha Hanbai (Toyota Motor Sales) Company
1956	Establishment of Toyopet Shops (sales chain)
1957	Establishment of Toyota Motor Sales U.S.A., Inc.
1961	Establishment of Toyota Publica shops (now, Toyota Corolla Shops) (sales chain)
1962	One million car production (accumulated total)
1965	Wining the Deming Prize
1966	Business cooperation with Hino Motor Industry Co.
1967	Establishment of Toyota Auto Shops (sales chain); Business cooperation with Daihatsu Industry Co.
1972	Ten million car production (accumulated total)
1974	Establishment of Toyota Foundation
1975	Publication of Toyota Office (industrialized office building)
1976	20 million car production (accumulated total)
1977	Publication of Toyota Home (industrialized housing)
1980	30 million car production (accumulated total); Establishment of Toyota Vista Shops (sales chain)
1981	Opening of Toyota Industrial Institute
1982	Merger of Toyota Motor Industry Co. and Toyota Motor Sales Co.; the new company name is Toyota Motor Corporation
1983	40 million car production (accumulated total)
1984	Start of NUMMI's operation, joint venture of TMC and GM
1986	50 million car production (accumulated total); Toyota KY Project

SOURCE: TOYOTA 1986 BY TMC

trade friction between the U.S. and Japan, especially about automobiles. TMC set up New United Mortar Manufacturing, Inc. (NUMMI) with GM in order to ease the trade friction and a preparation for the individual direct investment, the Toyota KY Project.

TMC has 30 overseas manufacturing or assembling plants in 20 countries. It is also building manufacturing plants in the U.S. and Canada. In the U.S., TMC has two manufacturing companies: NUMMI and Toyota Auto Body Inc. of California. TMC invests 50 % of NUMMI which was set up in 1984 and has 2,500 employees. Toyota Motor Sales, U.S.A.,Inc. invests 100 % of Toyota Auto Body Inc. of California which was set up in 1964 and has 350 employees.

TMC has 24 overseas subsidiaries around the world. There are six subsidiaries in the U.S. as of Jan. 1986: an outline of the subsidiaries in the U.S. is shown in Table 2-3-3.

Toyota Motor Sales, U.S.A.,Inc. is the first overseas subsidiary of TMC whose business is the import of TMC's cars and the distribution of them to four distributors in the U.S. Toyota Motor Distributors, Inc. is one of four Toyota distributors in the U.S. whose business is wholesale sales. The Toyota Technical Center, U.S.A.,Inc. is a Research Laboratory for automobiles in the U.S. though TMC has its main research institute, Higashi Fuji Kenkyujo, in Japan, which has 2000 employees. Calty Design Research, Inc. is a research and development company for car design in the U.S.

TMC is the core of the Toyota Group which has 13 companies

Table 2-3-3
Subsidiaries of TMC in the U.S.

NAMES	RATIO OF INVESTMENT	CAPITAL ASSETS (mil.$)	ESTABLISH-MENT	OPERATIONS	EMPLOYEES
TOYOTA MOTOR SALES,USA,Inc. (TMS.USA)	TMC 100%	55.00	1957	IMPORT & DISTRIBUTE	1550
TOYOTA MOTOR DISTRIBUTORS,Inc.	TMS,USA 100%	5.00	1958	WHOLESALES	630
TOYOTA TECHNICAL CENTER,USA,Inc.	TMC 80% TMS,USA 10% AISHINSEIKI 5%, NIHON-DENSOU 5%	1.80	1977	RESEARCH, LAB. ABOUT AUTO.	70
CALTY DESIGN RESEARCH Inc.	TMC 60% TMS,USA 20% YACHIDA INDSTRY.20%	0.15	1973	R&D OF CAR DESIGN	30
TOYOTA AUTO BODY Inc..OF CALIFOR	TMS,USA 100%	5.00	1974	PRODUCTION OF REARDECK OF HI-LUX	350
NEW UNITED MOTO MANUFACTURING,Inc.	TMC 50% GM 50%	200.00	1984	PRODUCTION OF PASS.CAR	2500
SHIMOYAMA	1975			1600	

AS OF FEB. 1986
SOURCE: TOYOTA 1986

and two business cooperation companies. Table 2-3-4 summarizes the group member companies. Toyoda Automatic Loom Manufacturing Company is the parent company of TMC, the second oldest in the Toyota Group. Most other group members' business is strongly related with TMC. Nihon-Denso is the second biggest company in the group. It is also a world famous electric manufacturing company.

Relationships between TMC and Ohbayashi have continued since the first plant construction in 1937. Ohbayashi has participated in most plant constructions, as well as the dormitories and offices. For instance, Ohbayashi was the sponsor of the joint venture of Toyota Tokyo Building Project, B5F, 19F, 49,000 SM building since 1980 to 1982. Doing maintenance and repair of most of TMC's plants and buildings, Ohbayashi completed the Third Body Shop of Tahara plant in 1986. It got the Toyota KY Project in 1986, too. Because Ohbayashi has done maintenance and repair as well as new construction, the contracts between TMC and Ohbayashi count more than 800 since the beginning.

Several of Ohbayashi's competitors have done construction for TMC. Takenaka Koumuten got its first contract around 1955 from Toyota. Shimizu Construction got its first project around 1965. Around 1967, Kajima Construction began to participate in the construction business for TMC. All of them are members of the Big Five Construction Companies in Japan as well as Ohbayashi. Ohbayashi has the longest relationship with TMC.

TMC usually use selective bidding to choose the prime contractor for a new project. Because TMC has strict criteria of

Table 2-3-4
Outline of Toyota Group Companies

NAMES	ESTABLISHMENT	BUSINESS	CAPITAL ASSETS (BIL.YEN)	EMPLOYEES
TOYODA AUTOMATIC LOOM MANUFACTURING CO.	1926	MANUFACTURING & SALES OF LOOM, CAR, INDUSTRIAL TRANSPORTER	12.4	6500
AICHI SEOKOU (STEEL MANUFC.)	1940	MANUFACTURING & SALES OF SPECIAL STEEL & STEEL PARTS	6.9	3400
TOYODA KOUKI (INDUSTRIAL MACHINES)	1941	MANUFACTURING & SALES OF INDUSTRIAL MACHINES & AUTO PARTS	4.1	3900
TOYOTA BODY	1945	MANUFACTURING OF BODY & PARTS OF PASS. CAR, TRUCK & SPECIAL CARS	3.8	6600
TOYODA TSUUSHOU (TRADING)	1948	TRADE OF RAW MATERIALS	9.6	1600
AISHIN SEIKI (PRECISION MACHINES)	1949	MANUFACTURING & SALES OF AUTO INDUSTRIAL TOOLS, & MACHINES	9.7	8200
NIHON DENSOU (ELECTRIC MANUFACTURING)	1949	MANUFACTURING & SALES OF ELECTRIC PARTS, HVAC SYSTEM, & ELECTRIC/GENERAL TOOLS, & MACHINES	34.9	31000
TYODA BOUSHOKU (TEXISTILES)	1950	MANUFACTURING & SALES OF TEXISTILES, AUTO PARTS, & HOME GOODS	3.6	1100
TOUWA REAL ESTATE	1953	REAL ESTATE MANAGEMANT, DEALING, & RENTING	5.0	120
TOYODA CENTRAL LABORATORY	1960	RESEARCH & DEVELOPMENT OF FUNDAMENTAL TECHNOLOGY	3.0	740
KANTOU AUTOMATIVE INDUSTRY	1946	MANUFACTURING OF AUTO BODY, PARTS, EQUIPMENTS OF HOUSING, &	3.2	5700
TOYODA GOUSEI	1949	MANUFACTURING & SALES OF PLASTICS, RUBBER, & CORK GOODS	3.3	4900

AS OF DEC. 1985
SOURCE: TOYOTA 1986 BY TMC

quality, cost, safety, and timeliness for bidders, TMC eliminates contractors with bad performance. Because TMC's projects require more management on every phase of construction, and are more cost effective than usual projects, selected bidders for TMC are literally selected and limited both in general contractors and subcontractors.

2-4 Other Automotive Plant Constructions

The Toyota Tahara Project, the Fuji Gunma Project, and the Nissan Smyrna Project are described in this section. The outline of the projects, and some details of the development process and organization of the projects, which are comparable with the Toyota KY Project are examined here.

The Toyota Tahara Project has many common factors with the Toyota KY Project, such as building type, client, prime contractor, and TQC program in construction. Therefore, differences between the U.S. and Japan's development process and project organizational system will be extracted without confounding it with comparison of these projects.

The Fuji Gunma Project will be used to define the Japanese style of the development process and organization for automotive construction through the comparison with the Toyota Tahara Project. The comparison is also useful to check special features of Toyota's method towards its construction.

The Nissan Smyrna Project may well be the most similar case to the Toyota KY Project because these two projects have many common points: the clients, TMC and Nissan, are the Big Two Japanese international car manufacturers; both projects are the first big direct investment in the U.S. by TMC and Nissan; the location of each project is in the mid-South, Kentucky and Tennessee; the project manager, Robert B. Jordan,[73] working for OHB in the Toyota Ky Project, was the project manager of Daniel Construction in the Nissan Smyrna Project. By the comparison of these projects, the differences of both companies' strategies for developments in uncertain environments, and the differences of OHB from Daniel will be studied.

2-4-1 Toyota Tahara Project (in Japan).

This section includes a project summary, and development process and organization of the Toyota Tahara Project. Though the long term relationship between TMC and OHB is explained in section 2-3, an outline of the TMC's organization for its facility construction and maintenance is additionally explained as well as the OHB's project organization, here. Most information of this section is provided by Tanabe,[86] Sato,[83] and Ohsaki[82] who were OHB's project manager, quality control officer, and A/E manager for the project, respectively.

2-4-1-1 Schematic Project Summary.

Project summary is as follows:

1) Project name; Toyota Motor Corporation The Third Body Shop Project.

2)Project location; Tahara town, Atsumi gun (county), Aichi Prefecture, Japan.

3) Project organization;

Owner, Toyota Motor Corporation.

General contractor, Ohbayashi Corporation.

Architect/engineer, Toyota Motor Corporation Registered Architects and engineers.

4) Time schedule; Start of building works, Jan.6, 1986.
Completion , Oct.31,1986.

5) Site area; 983.5 acres (3,980,000 SM)

6) Floor area; 774,413 SF (71,943 SM)
(Total floor area in the Tahara Plant is about 320,000 SF)

7) Type of shops; press and welding.

8) Building outline;

a. Foundation -- steel pile and spread footing.

b. Structure -- structural steel.

c. Roof -- Autoclaved Lightweight Concrete panel & sheet water proofing.

d. Exterior finish -- Asrock, colored steel panel.

9) Production capacity; 340,000 cars/year.
(as of feb. 1984)

10) Products; passenger cars: Soarer, Supra, Corona, Celica, Corolla, Sprinter, and HiLux (small truck).

11) Schematic plan of main shops and this project.

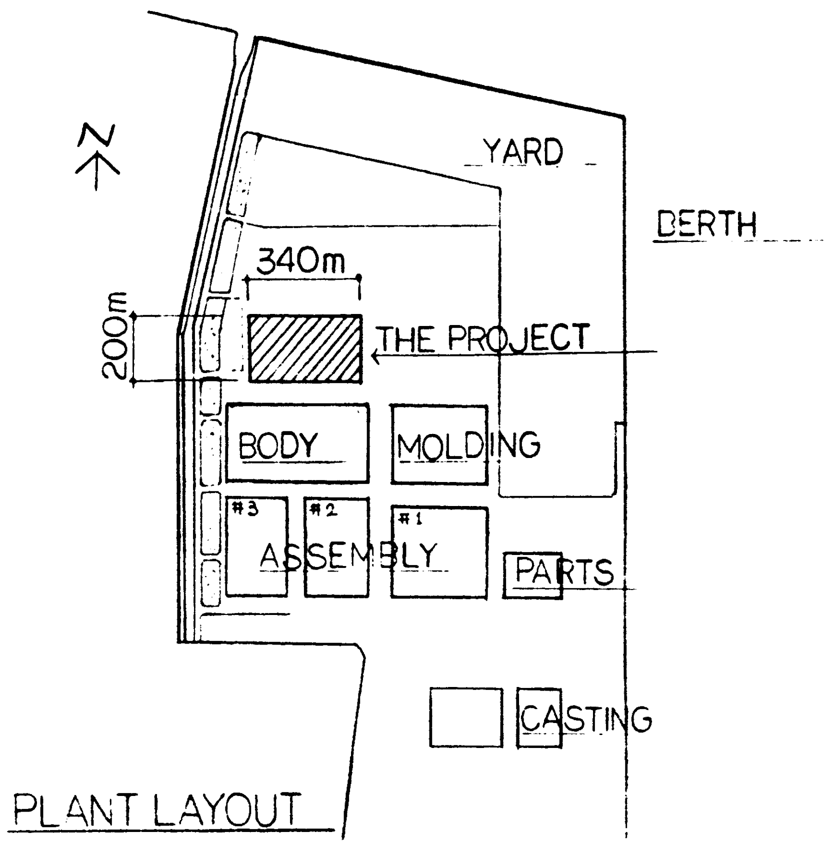


FIGURE 2-4-1-1-a

12) section of press shop.

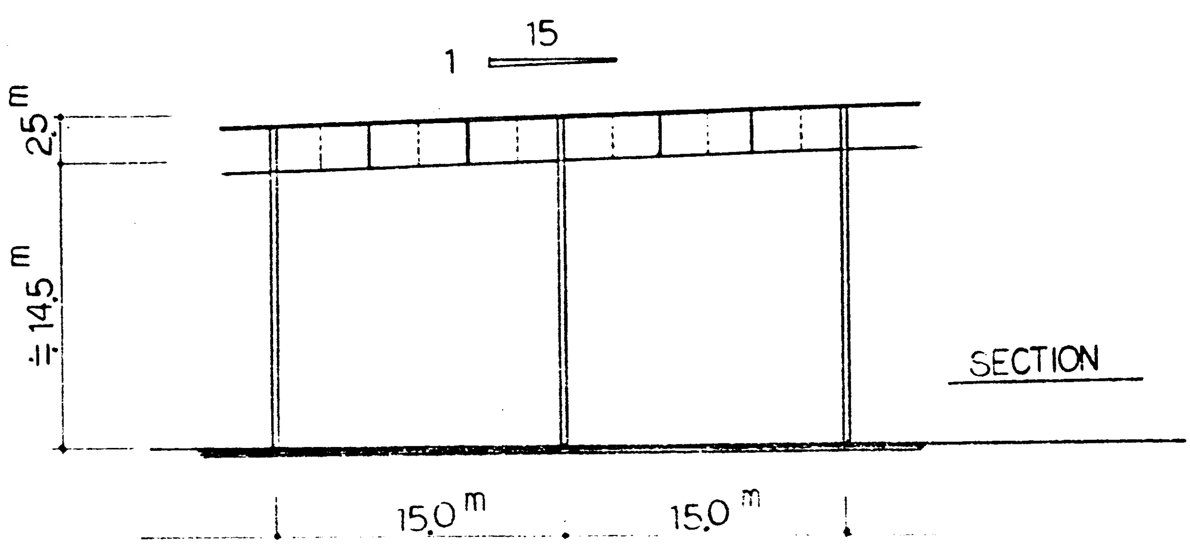


FIGURE 2-4-1-1-b

Development Process and Organization.

The development process, schedule, and organization of the Toyota Tahara Project is described in this section. TMC usually does not hire an A/E because TMC has its own A/E department. TMC does all the A/E's jobs by itself. Except for TMC's roles of owner A/E, this project's development process and organization is a usual Japanese construction project.

The construction method is a traditional sequential method because the Japanese building Code requires completed drawings and specs for building permits. The contract type between TMC and OHB is a lump sum; other contract types between clients and general contractors for new buildings practically do not exist in Japan. TMC used selective bidding to choose a general contractor for the project. Though negotiated contracts are popular as well as competitive bidding in Japan, TMC usually employ competitive bidding to select contractors or suppliers.

OHB uses its own forces for work or does self-performance mainly for temporary works as a usual practice in the Japanese construction. There are no strong national unions in Japanese construction industry, its labor relations are so-called "multi-layer-subcontracting," which has a hierarchy of labor. For example, there are several coordinators or brokers between a general contractor and workers. The number of layers varies by location and trades, but usually from two to four.

As a special feature of TMC's plant or building construction, TMC applies its Total Quality Control (TQC) program for its construction. TMC has its own design-construction management manual that includes TMC's checking items and general contractor's checking items on each development stage. Construction management items are classified in four, such as, scheduling, document control, inspections, and shop drawings. In addition to this manual, TMC also has many special formats, such as a standard construction manual, many kinds of inspection and report sheets, and a value engineering proposal sheet.

Figure 2-4-1-1 shows the development process of the project. The vertical axis indicates the project participants and the horizontal axis means the progressive order from the left to the right. Important events from "Need for Facility" to "Construction" are allocated in boxes in the chart. Because the Tahara Project is an expansion of the plant, after the confirmation of the need for a new facility, TMC must have checked and adjusted the standard manual of its construction management a little for the new construction. TMC has known in advance almost all the important factors for the new project; TMC's work to set up the strategy are minimal.

The Toyota Tahara Project is a quite usual TMC's plant construction, so TMC uses the standard methods of management for the construction of the Tahara Project. TMC does all functions of the A/E and uses a traditional sequential construction program, that is, the construction starts after the completion of all construction documents including work drawings and specifications. Accordingly, Japanese clients including TMC use only the lump sum contract with a prime contractor for new buildings.

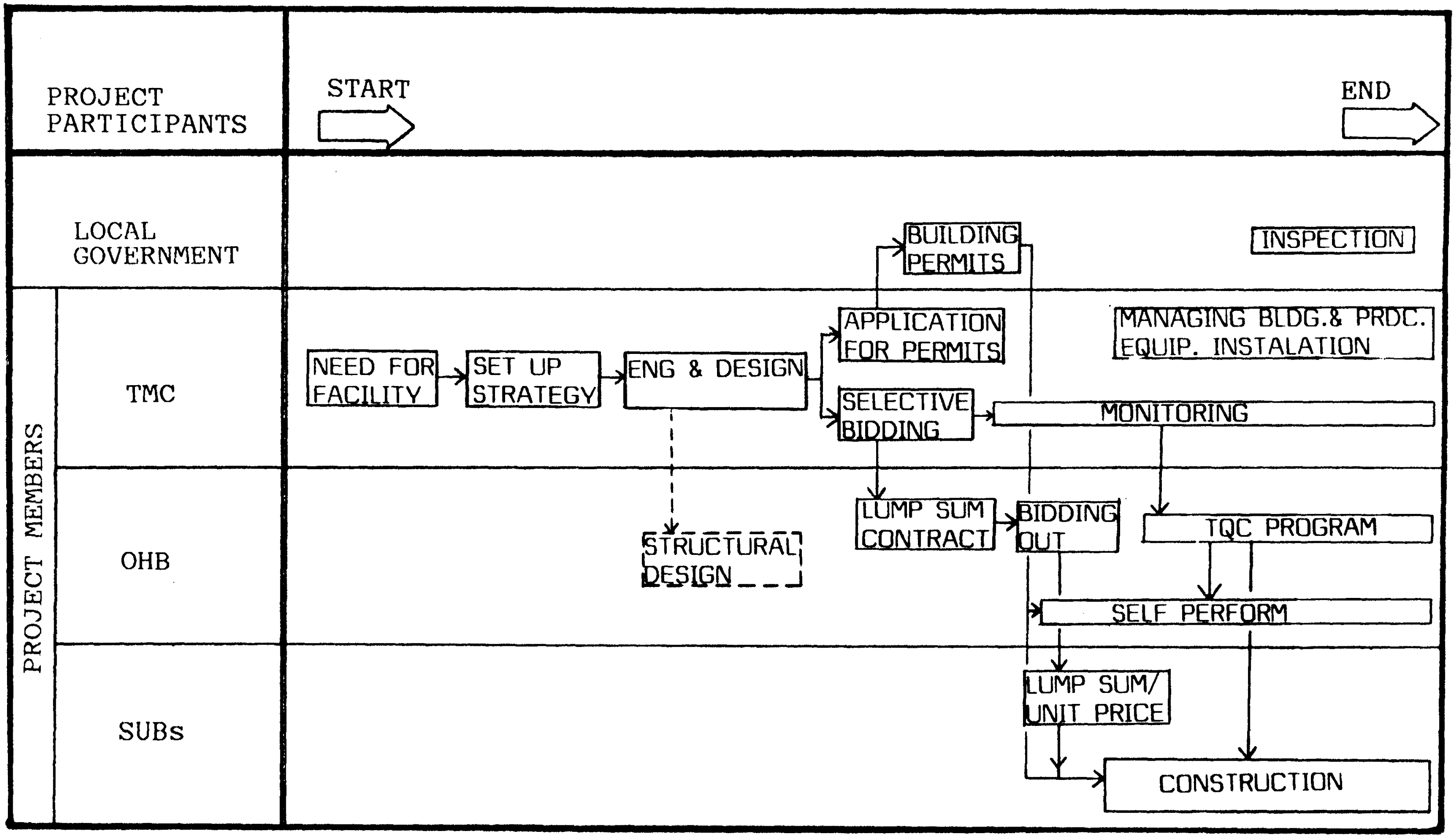


FIGURE 2-4-1-1
DEVELOPMENT PROCESS CHART OF TOYOTA TAHARA

At the design stage, TMC asked OHB to do the structural design for the Tahara Project by a unit price contract. Though OHB cannot cover even the direct cost of the design because of a very low unit price set by TMC, this cooperation does not affect the competitive bidding of the project, at least formally. TMC sometimes asks for some parts of design works from selected general contractors or building equipment companies. The type of the design cooperation varies, such as, only architectural drawings, structural drawings, M/E drawings, architectural and structural drawings, and all work drawings.

At the procurement stage, TMC uses selective bidding to choose a prime contractor for its projects. TMC selects six general contractors as bidders, such as OHB, Shimizu, Taisei, Takenaka, Kajima, and Mitsui. TMC requires bidders to submit the following items: itemized estimates, work plan schedule, construction planning, site organization list, quality assurance items, and value engineering proposals. TMC asked tenderers to make more than 50 value engineering proposals for the original drawings and specs in the Tahara Project. This heavy requirement for value engineering proposals is a special feature of TMC's TQC program for its construction.

Along with competitive bidding, TMC applies for a building permit to the local government. Building permits are the most important permits among many regulations for owners to start the construction. Along with many local government inspections during and after the construction, inspections for occupancy permit and fire safety permit are the most important for general contractors and owners.

After a lump sum contract with TMC, OHB starts the construction using subcontractors and its own forces perform the work. OHB uses a lump sum and a unit price contract with subcontractors. A cost-plus-fee contract is not used in Japanese building construction. One of the reasons for no cost-plus-fee is that Japanese business tradition does not allow contractors to request explicit profit or fees from their clients. For example, during a negotiation between an owner and a bidder, usually the owner asks the bidder to cut or reduce its overhead and profit items, or even to cut them all.

TMC asks OHB to make more than 30 value engineering proposals during the construction phase in addition to 50 proposals at the bidding stage in the Project. TMC applies its own quality control (QC) program to the project. TMC requires OHB to submit many inspection reports during construction. For example, OHB's engineers check R-bar works and form works before the concrete placement. OHB also inspects the form works after the concrete works. Many items of the inspections are required to be quantitative.

OHB also has its own quality control program during construction which has three grades. The grades are determined by the importance of facilities, requirements by clients, size or complexity of the projects, and others. TMC's program is not so different from the OHB's QC program. Regarding inspectors, OHB tries to make subcontractors inspect their work and make reports, but in reality, OHB does most inspections itself. In the Tahara

Project, OHB does many inspections of subcontractors jobs during construction.

Figure 2-4-1-2 shows the Toyota Tahara Project schedule. The engineering and design was completed in Nov. 1985. TMC announced the tender on Nov. 20,1985 to six contractors. The bid date was Dec. 9 and TMC awarded OHB the contract as the general contractor for the project in late Dec. The construction started Jan.6, 1986. The structural steel work began in mid April and finished at the end of June. The building construction was completed at the end of Oct. 1986. It took ten months for the building construction. OHB does not contract most of M/E works or any production equipment works. TMC usually contracts production equipment and installment with individual suppliers directly. TMC often contracts building service equipment works,, such as HVAC, plumbing, and M/E, with special contractors of these works.

Because TMC does A/E works, distributing building construction, building service equipment, and production equipment works to many different contractors, TMC actually functions as "construction management" for its construction in Japan.

Figure 2-4-1-3 shows the outline of organization and contract types of the Toyota Tahara Project. This organization is typical in Japanese manufacturing plant construction except for TMC's in-house A/E. TMC contracts with OHB by a lump sum contract as well as a building service equipment contractor, and many production equipment suppliers. OHB contracts with many

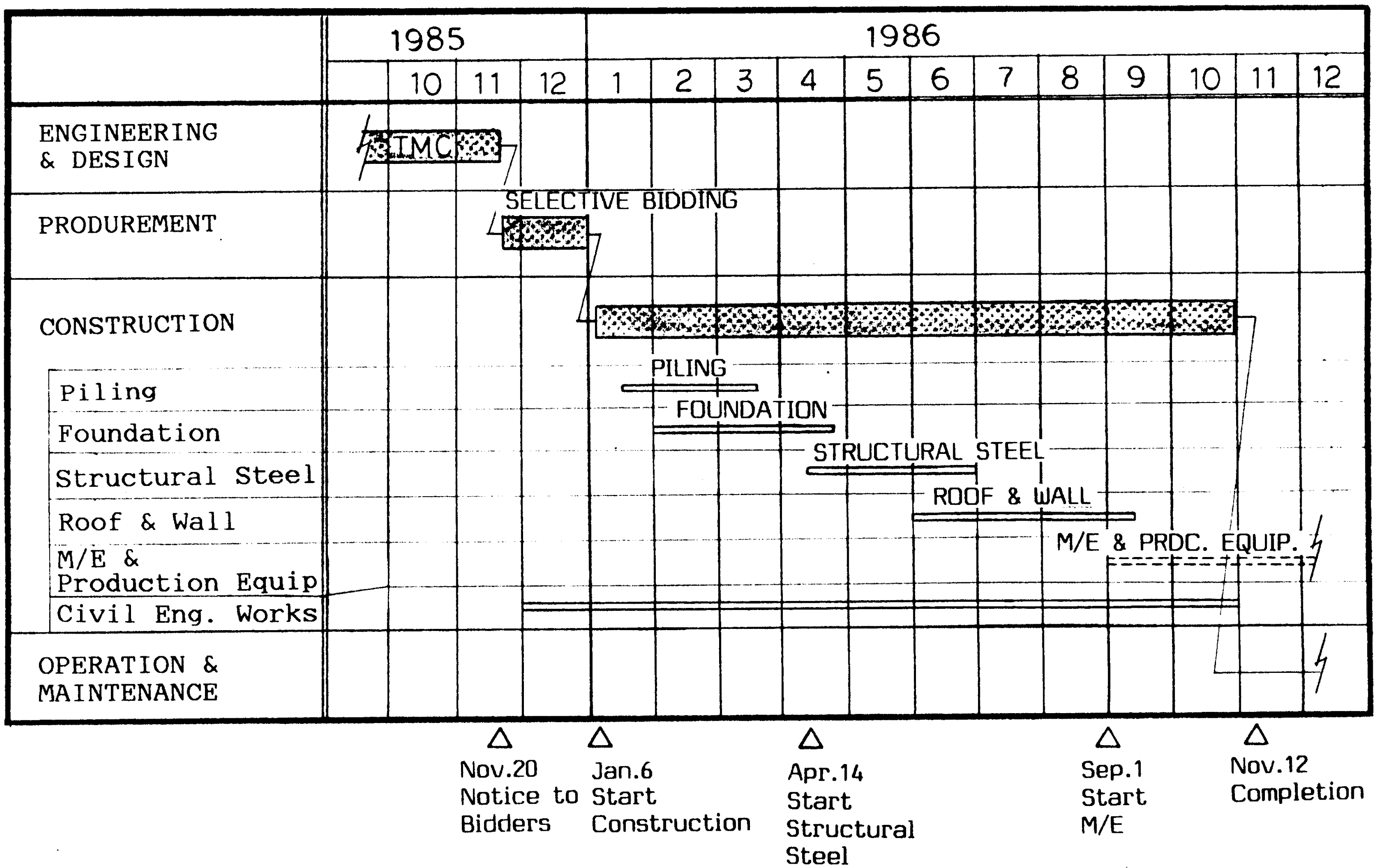


FIGURE 2-4-1-2
TOYOTA TAHARA PROJECT SCHEDULE

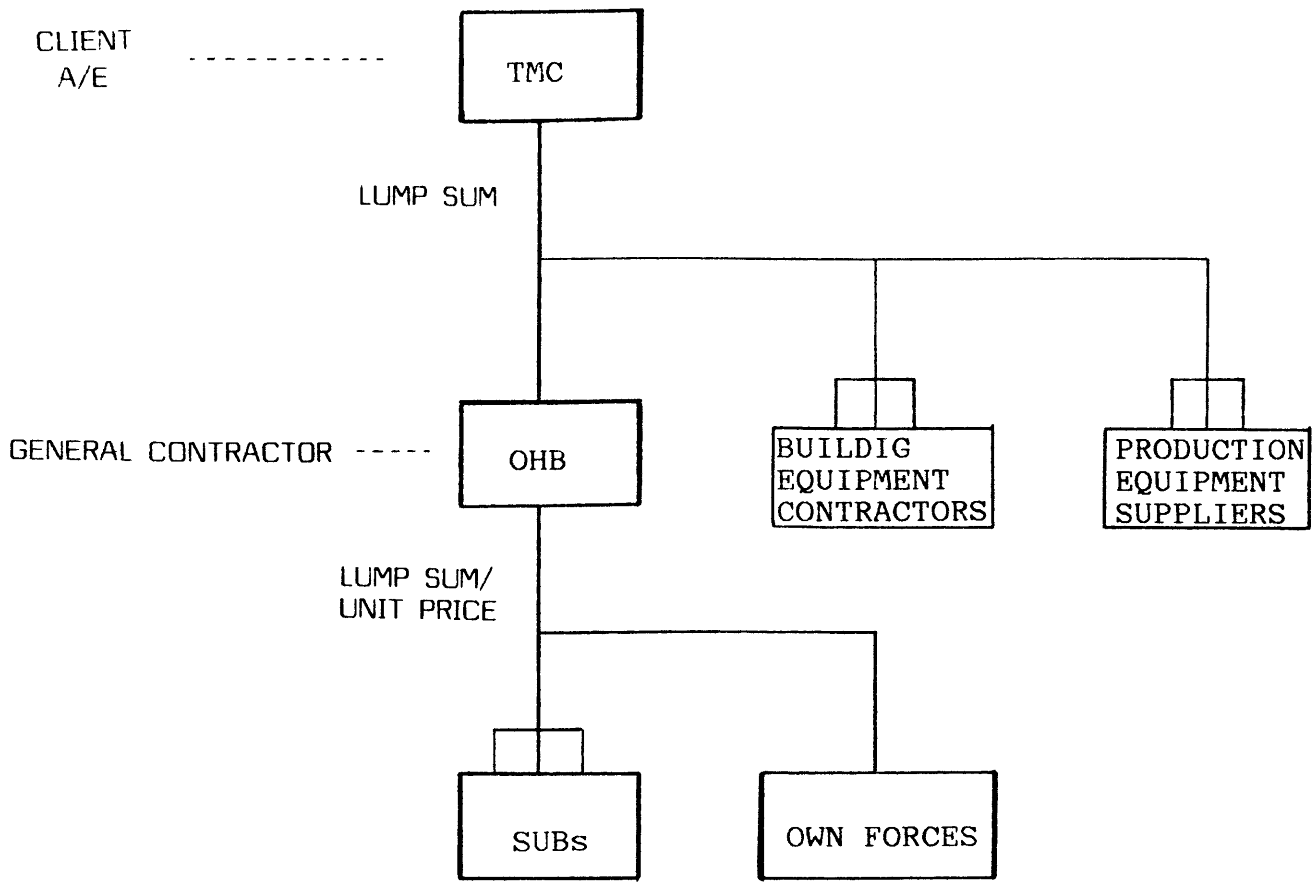


FIGURE 2-4-1-3
OUTLINE OF PROJECT ORGANIZATION AND CONTRACT TYPE OF TOYOTA TAHARA

subcontractors by lump sum or unit price contracts. OHB does self performance mainly for general condition works.

Figure 2-4-1-4 shows the TMC's organization for the Tahara Project. The Department of Facility Environment's roles are those of a construction manager and A/E. The department of Procurement is responsible for all purchases including construction contracts. This department deals with progressive payment for contractors during construction. The flow of OHB's application of progress payment is from the Tahara Project team in the A/E section, through the manager of the Department of Facility Environment, to the Department of Procurement that does not only clerical work but also checks the evaluations closely. This system is applied to the Toyota KY Project, too.

The Department of Production Engineering inputs many requirements regarding production engineering during the design phase into the drawings and specs. The Department of Facility Environment coordinates various requirements from different sections of production engineering.

Figure 2-4-1-5 shows the OHB's site organization for the Toyota Tahara Project. It includes many civil engineers who did the work on pits for the press machines, the slab on grade, and the machine foundations. Because the project is big compared with usual Japanese projects, the site has two managers and eight architects and engineers for shop drawings. Generally, Japanese A/E's drawings includes less details than American A/E's, so shop drawings by general contractors are important and share the substantial portion of the general contractor's jobs. There are

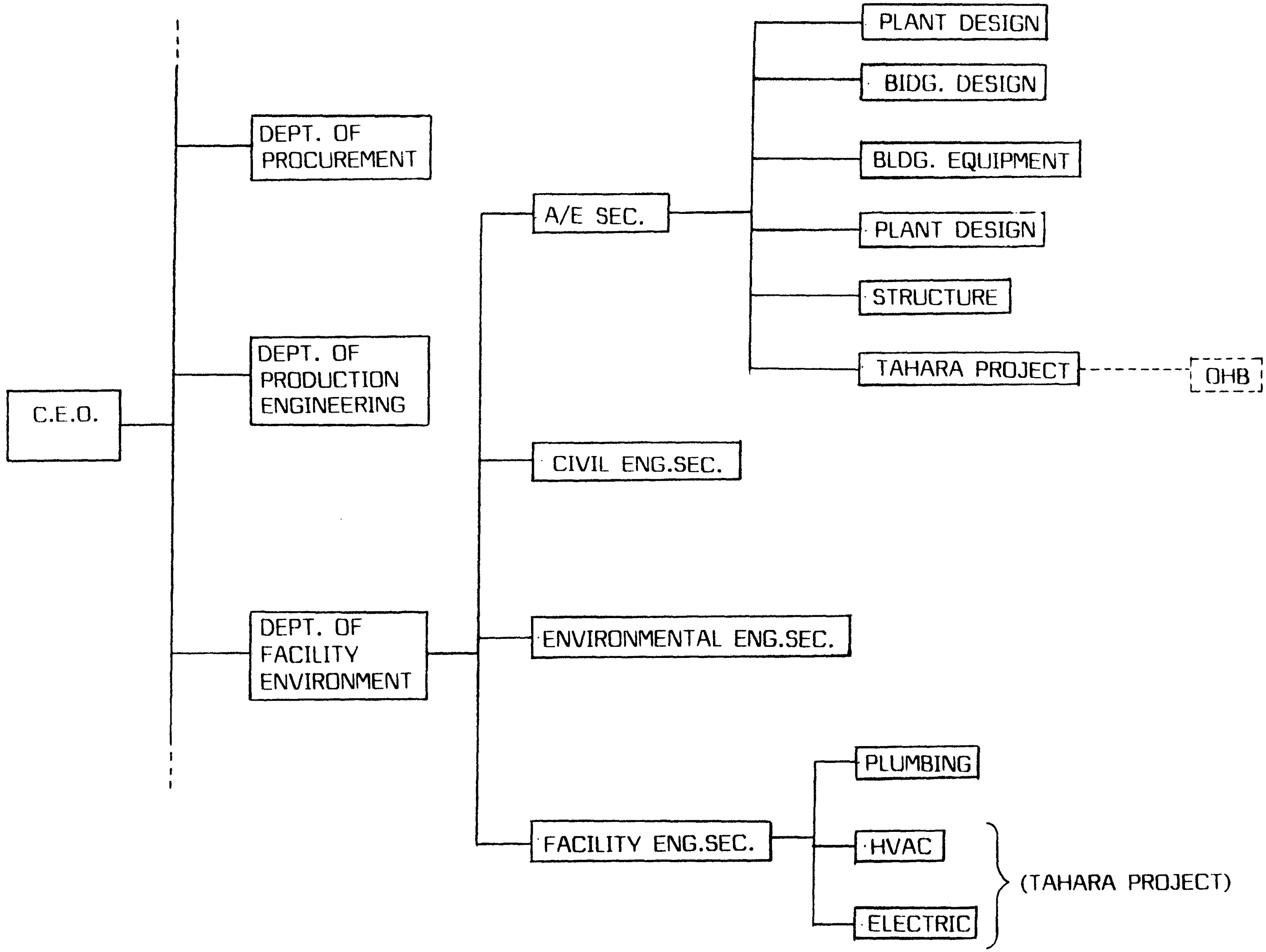


FIGURE 2-4-1-4: TMC'S ORGANIZATION FOR TAHARA PROJECT

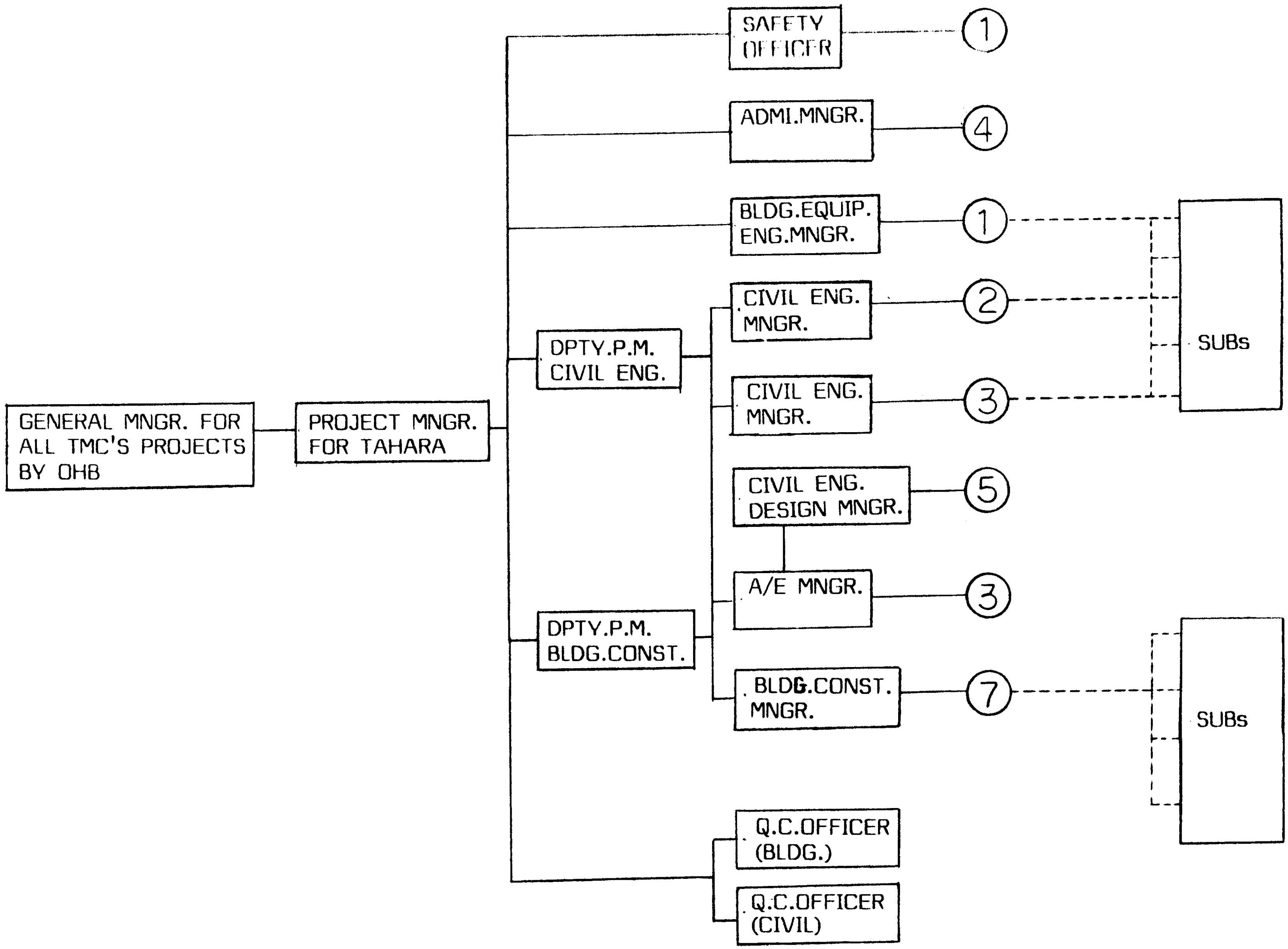


FIGURE 2-4-1-5
OHB'S SITE ORGANIZATION FOR TOYOTA TAHARA PROJECT

two quality control officers and one safety officer apart from the construction line. OHB sometimes assigns a QC officer to a big project like this, but two QC officers were used for the Tahara Project, implying how very strict TMC's QC program is.

Although there are some peculiarities in the project organization and in the OHB's site organization, this organization can be described as typical in Japanese construction for this scale of project.

2-4-2 Fuji Gunma Project (in Japan)

This section includes the project summary, the development process, and the organization of Fuji Gunma Project. Most of the information in this section is provided by the cooperation of Kuroki[75], Kujirai[74], and Imagawa[72], who were OHB's A/E manager, deputy project manager, and the head of Takasaki office for the project respectively. Project summary is presented in 2-4-2-1 Schematic Project Summary.

2-4-2-1 Schematic Project Summary.

Project summary is as follows:

1) Project Name; Fuji Heavy Industry Co., Gunma Manufacturing Division, Yajima Plant, the Second Assemble and Paint Shops Project (Fuji Gunma Project).

2) Project Location; Ohta City, Gunma Prefecture, Japan.

3) Project Organization;
Owner, Fuji Heavy Industry Co.
General Contractor, Ohbayashi Corp.
Architect/Engineer, Ohbayashi Corp.

4) Time Schedule; Start of building works, Feb. 25, 1980.
Completion , Aug. 27, 1980.

5) Site Area; 134.6 acres (545,000 SM)

6) Floor area; 318,973 SF (29,633 SM)

7) Type of shops; Assemble and Paint shops.

8) Building Outline;
a. Foundation -- AC pile and spread footing.
b. Structure -- structural steel.
c. Roof -- corrugated asbestos-cement roof, and corrugated metal roofing.
d. Exterior finish -- insulated metal siding.

9) Products; passengers cars.

10) Schematic plan of main shops and this project.

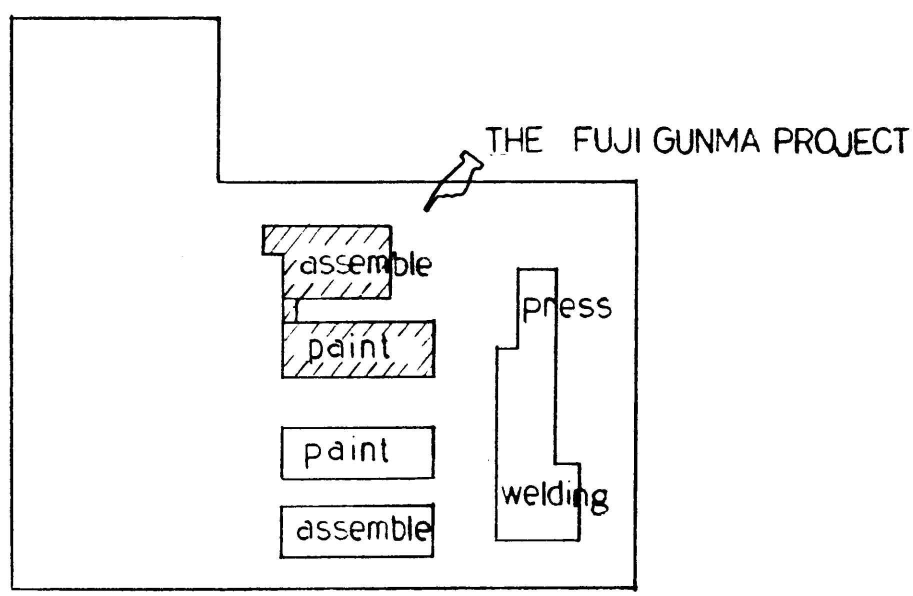


FIGURE 2-4-2-1-a

11) Section of Assembling Shop.

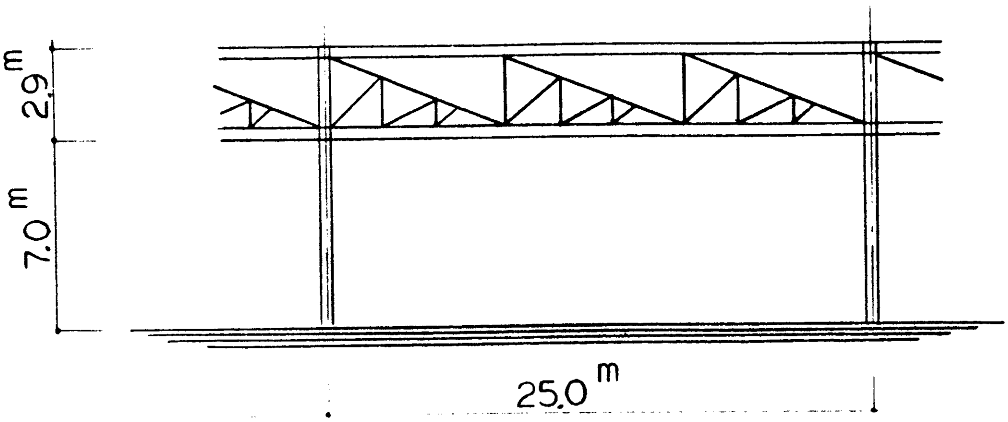


FIGURE 2-4-2-1-b

Development Process and Organization.

The development process, schedule, and organization of the Fuji Gunma Project is described in this section. Fuji selected OHB as a design-builder of the Fuji Gunma Project through selective bidding after the Fuji's schematic design. The project is a quite typical design-build in Japan, though a negotiated contract with a design-builder without selective bidding is also popular in Japanese construction.

The construction method is a traditional sequential method like the Toyota Tahara Project. The contract type between Fuji and OHB is a lump sum after the completion of the work drawings, though the first contract between Fuji and OHB was a design contract. Though Fuji usually uses a negotiated contract with OHB, Fuji uses selective bidding to choose a design-builder for the project so that Fuji tries to confirm the cost effectiveness of OHB this time.

Figure 2-4-2-1 shows the development process of the project. The vertical axis indicates the project participants and the horizontal axis the progressive order from the left to the right. Important events from the "Need for facility" to "Construction" are allocated in boxes in the chart. Because the Fuji Gunma Project is an expansion of the original plant like the Toyota Tahara Project, after the confirmation of need for a new facility, adjustment of the standard procedure of its construction must have been minimal and the project process was as usual.

At the planning/pre-design stage, Fuji planned to use OHB as

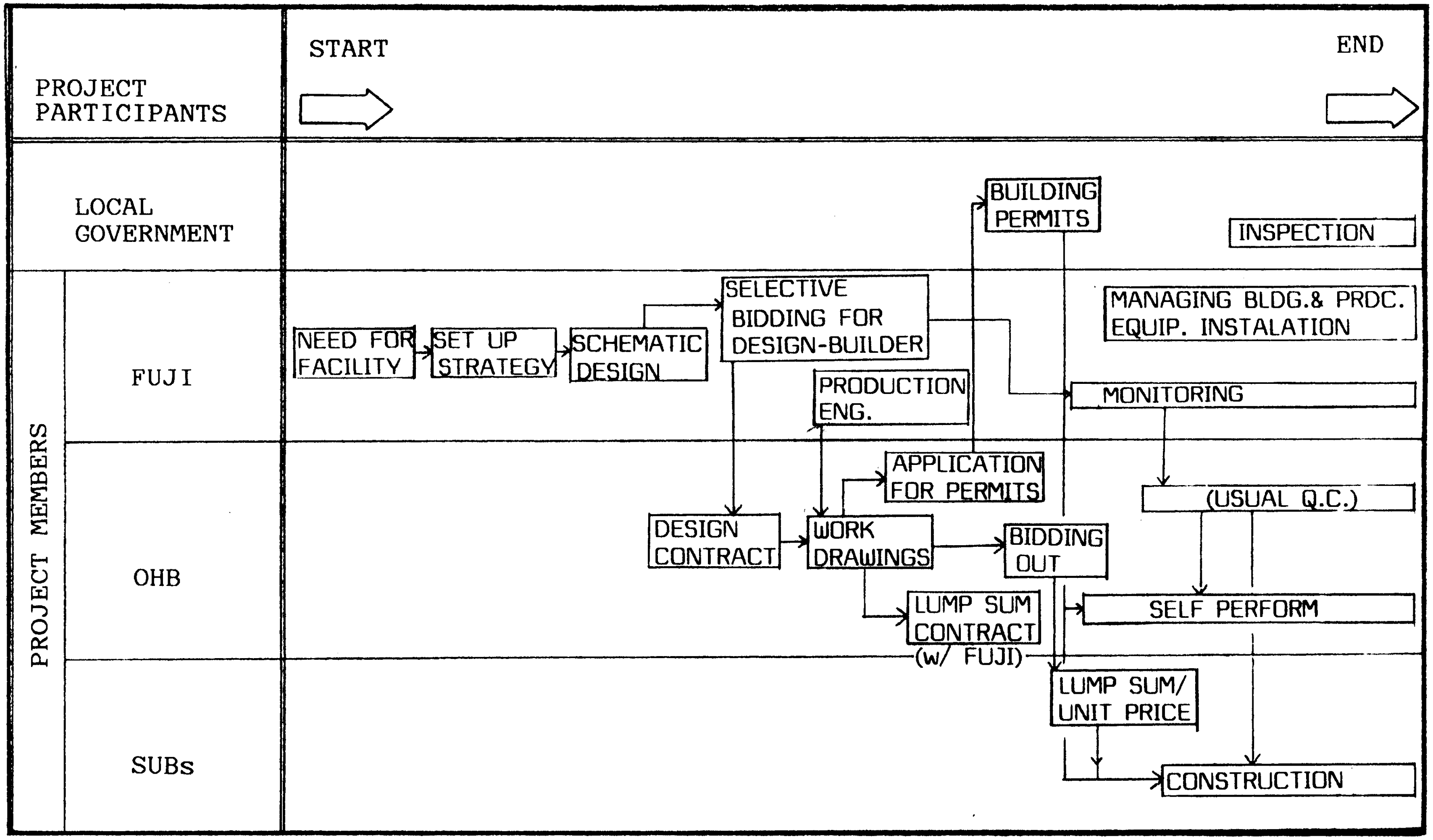


FIGURE 2-4-2-1
DEVELOPMENT PROCESS CHART OF FUJI GUNMA PROJECT

a design-builder for the project through negotiation, because OHB had built almost all buildings by a design-build contract at the Yajima Plant. But during Fuji's schematic design phase, someone in Fuji proposed selective bidding for choosing a design builder to get the maximum cost efficiency for the project. Finally, Fuji decided to use selective bidding and sent notices to the bidders on Dec. 30, 1979.

Figure 2-4-2-2 shows the project schedule. Because all Japanese construction companies set its official holidays at least between Dec.31 and Jan.3, the date of the notice (Dec. 30) to the bidders is very unusual and hard for bidders to bid on Jan.7. Even in the usual business time, only one week for an estimation is too short for bidders to submit definite tenders. Therefore, the effects of Fuji's attempt to do selective bidding is questionable. Fuji selected seven bidders including OHB, but the other contractors of OHB may not have done do their estimate seriously because of the unusual schedule of bidding and OHB's domination of the Yajima Plant construction.

The design and construction schedule of the project is extremely short. OHB completed the construction of a 300,000 SF factory in only seven months after the design build contract with Fuji. If the A/E and the general contractor had been different, the schedule of construction would have been prolonged at least one month because a roll order to a steel manufacturer during work drawing phase is almost impossible without a general contractor.

Compared with other industrial buildings, the construction

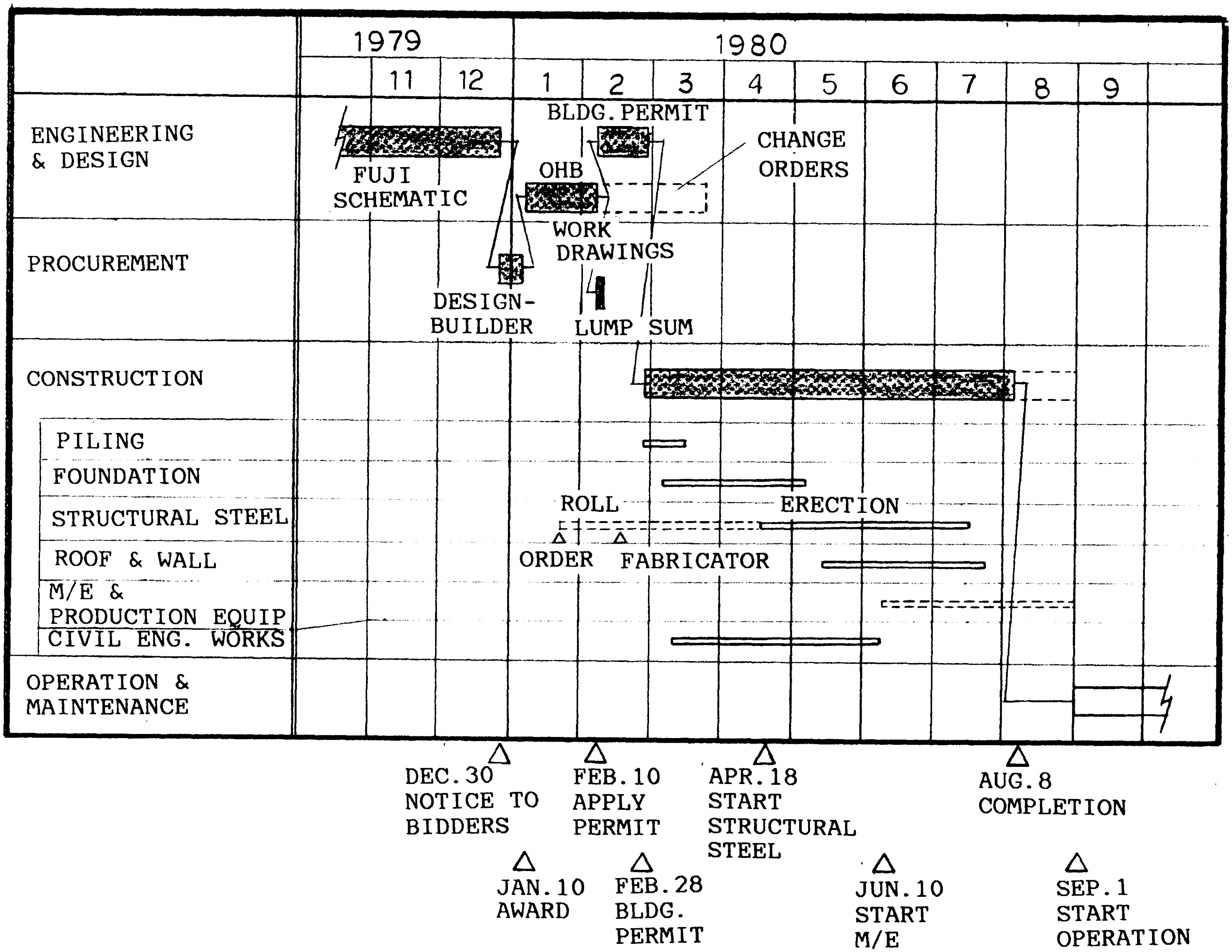


FIGURE 2-4-2-2: FUJI GUNMA PROJECT SCHEDULE period of about five months, and two months for the design and engineering for a 300,000 SF factory is unusual. It took ten months for the Toyota Tahara Plant construction. An example project, a 150,000 SF, structural steel, warehouse, in Barrie and Paulson's Professional Construction Management, takes eight months for the construction, though this duration might include some slack.[1] According to Barrie and Paulson's example, it takes 12 months by a sequential program and takes nine months by a phased program from the beginning of detail design to the completion of the construction. Though the overlap of design and construction is impossible in Japan, OHB had done the detail design and construction of the Project within seven months. In the Project, piling works (the beginning of the construction) actually started on the building permission day; pile driving machines had waited the permission on the construction site. There was no overlap of design and construction, however, design and procurement were overlapped, and this overlap was one of the significant advantages of a design-build in Japan.

Figure 2-4-2-3 shows the outline of organization and contract type of Fuji Gunma. The structure of this project is the same as that of the Toyota Tahara Project except the placement of A/E function. Fuji did the schematic design and provided all production engineering for the project. Fuji also directly contracted with a building equipment contractor and with many production equipment suppliers who supplied and installed equipment. Therefore, Fuji acted as a construction manager especially in the later part of the construction, as did Toyota.

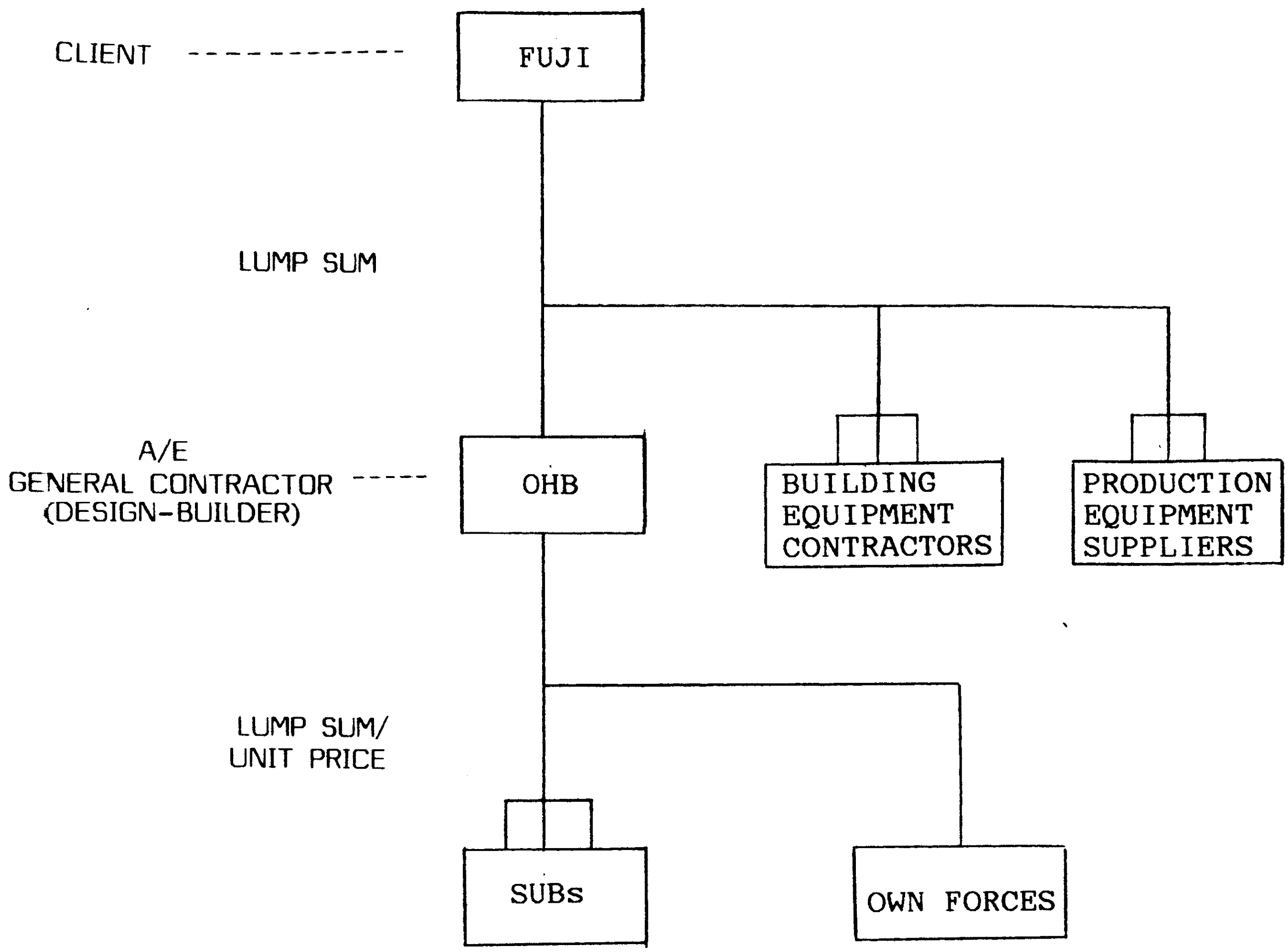


FIGURE 2-4-2-3
OUTLINE OF PROJECT ORGANIZATION AND CONTRACT TYPE OF FUJI GUNMA

Figure 2-4-2-4 shows the organization of Fuji for the project. The development process in the organization is as follows:

1) The Engineering Department forms a plan of a new shop. Along with the production equipment planning, it defines the building outline, such as plan, clearance height, and transportation.

2) The administrative manager and staff in the Facility Section checks the outline of the building defined by the Engineering Department, the costs with the budget, the schedule, and contract types (negotiated or bid). Then, the Material Purchase Department orders the design and the construction from the A/E, contractors, or suppliers.

3) The Engineering Department is responsible for engineering decisions regarding the construction (production equipments), and the Facility Section is responsible for the building (shell, building equipments, and finish).

Figure 2-4-2-5 shows OHB's organization for the Fuji Gunma Project. Though OHB is the design builder for the project, OHB does not have a general project manager who is responsible both for design and construction. One of the reasons for the lack of a general project manager of design-build in OHB as well as other Japanese engineering contractors is due to almost independent design and construction work during the design phase in a traditional sequential method.

The four departments are parallel in the organization structure because their supervisor is the head of the Tokyo Branch who practically does not manage the specific projects.

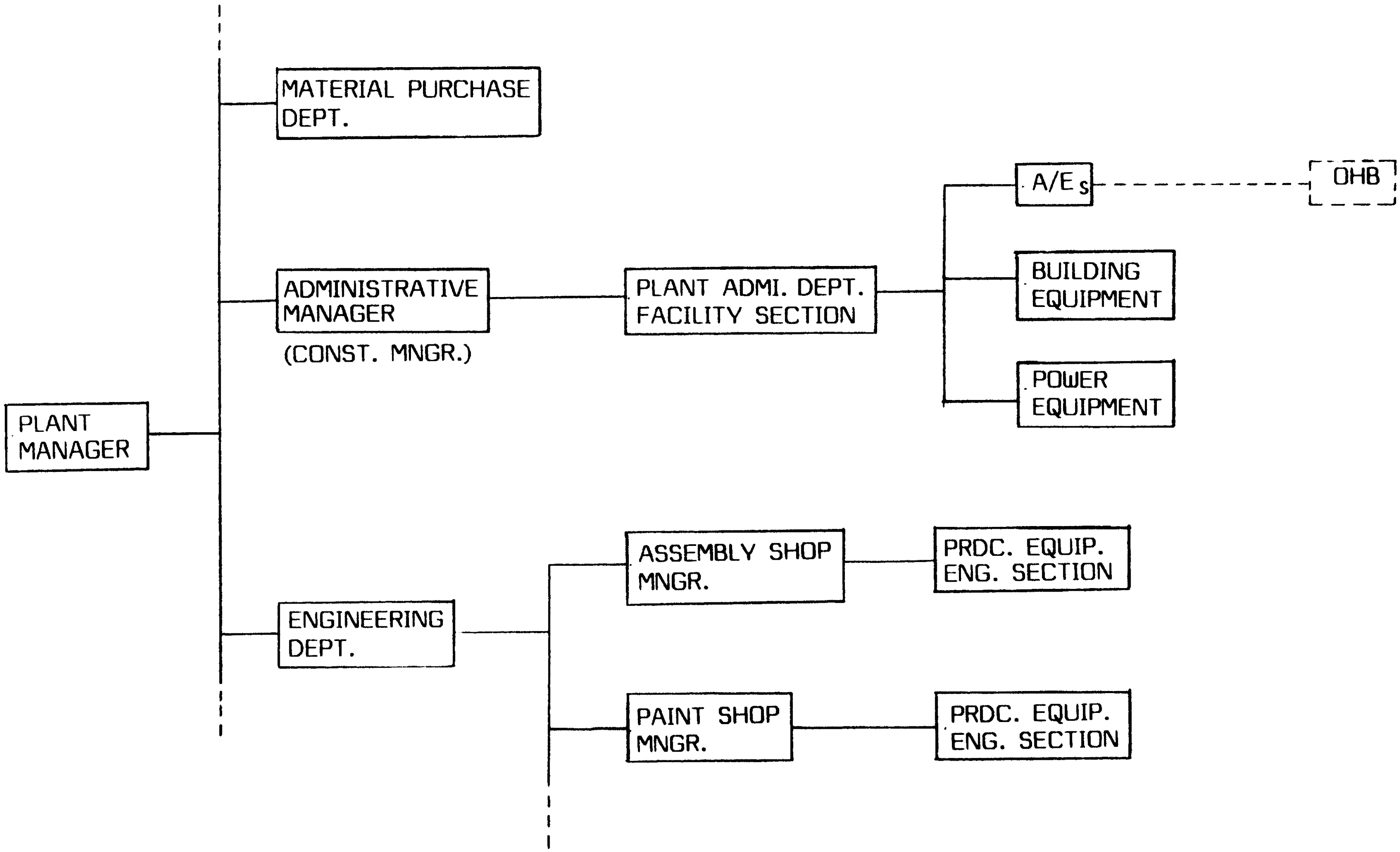


FIGURE 2-4-2-4: FUJI'S ORGANIZATION FOR FUJI GUNMA PROJECT

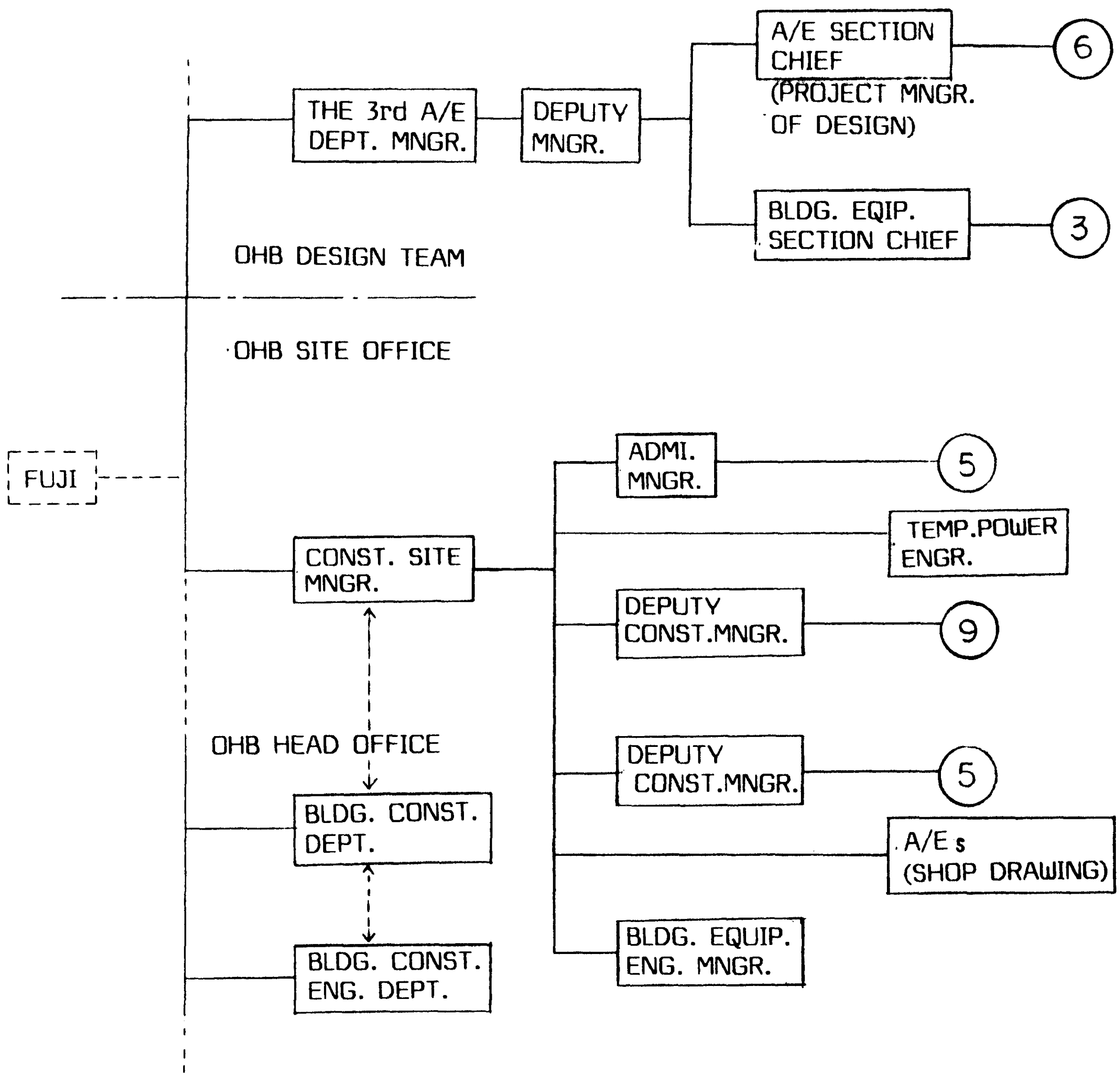


FIGURE 2-4-2-5: OHB'S ORGANIZATION FOR FUJI GUNMA PROJECT

The A/E Departments are responsible for completion of construction documents, obtaining the building permissions, and supervision of the construction. The Building Construction Department is responsible for estimation, negotiation with clients about contract terms and prices, and the final inspections of projects based on OHB's standard. Construction site managers are responsible for all activities of the project after the contracts with clients. They are responsible for subcontracting, application for progressive payment, payroll, cost control, scheduling, quality control, safety control, and others. The Building Construction Engineering Department is responsible for structuring site organization, assistance in construction planning, providing construction engineering service for sites, and others.

Because of the extremely short design schedule for the Fuji Gunma Project, the number of the design staff is large for this kind of project. A section chief of an A/E section is the project manager of design who corresponds with the client, manages the design team, is the representative registered architect for the application for the building, and cooperates with the construction site manager during design stage.

The structure of the construction site organization is usual except for the large number of building construction engineers because of the extremely short construction schedule for this size of project. The Construction Site Manager was assigned at the beginning of the design phase in order to mange the pre-purchase of structural steel and to obtain several subcontractors before the start of the construction.

This overlap of the design phase and the procurement phase by a design builder is an important advantage of a design build contract especially for fast construction. Another important advantage of a design-build contract is good coordination of the design, building construction, and installation of production equipment that was managed directly by Fuji in the project.

Except for the extremely short design and construction schedule, this project is a good example of a design build for industrial plant construction. This project highlights the advantages of a design-build contract for a client in a short schedule construction in Japan. The development process is quite usual as a design build construction, though Fuji used selective bidding for its schematic drawings to choose a design builder. The project organization and the OHB's organization for the project are usual and very similar to those in the Toyota Tahara Project. Finally, the organization structure of Fuji and TMC for their construction is found to be similar though TMC has more staff than Fuji.

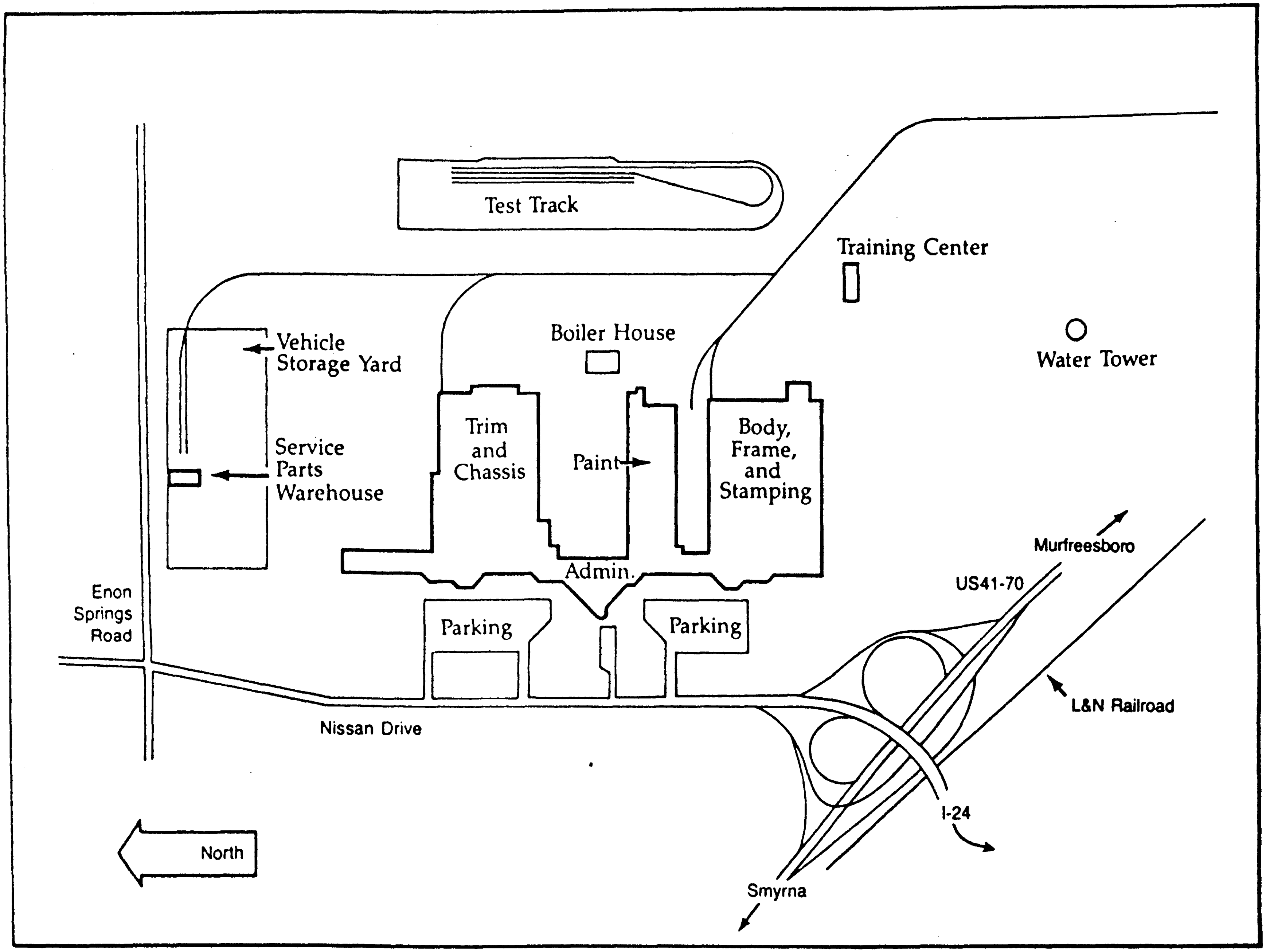
2-4-3 Nissan Smyrna Project (in the U.S.)

This section includes the project summary, the development process, and the organization of the Nissan Smyrna Project. This section also includes outline of Nissan Motor Manufacturing Corporation U.S.A. (NMMC). Most of the information in this section is provided by Robert[73] Jordan, who is the project manager in OHB for the Toyota KY Project and was the project manager for Daniel on the Nissan Smyrna Project, and is referred from Nissan in Tennessee by NMMC.[41]

2-4-3-1 Schematic Project Summary

Project summary is as follows:

1) Project name; the Nissan Motor Manufacturing Corporation U.S.A. plant project (NIssan Smyrna Project).
2) Project location; Smyrna, Tennessee.
3) Project organization;
   Owner, Nissan Motor Manufacturing Corporation U.S.A. (NMMC).
   General contractor, Daniel Construction Company.
   Architect/Engineer, Albert Kahn Associates, Inc.
4) Time schedule; Start of grading work, February, 1981.
   Start of building work, April, 1981.
   Completion , April, 1983.
5) Site area; 782 acres (3,166,000 SM)
6) Floor area; 3,400,000 SF (315,864 SM)
7) Types of shops in the project;
   Body, Frame, Stamping Shop.
   Paint Shop.
   Trim and Chassis Shop.
8) Building Outline;
   a. Foundation -- spread footing.
   b. Structure -- structural steel.
   c. Roof -- metal deck, built-up roofing.
   d. Exterior finish -- block & metal siding.
   e. floor -- slab on grade.
9) Production capacity; 100,000 cars & 140,000 light trucks/year
10) Products; passenger cars and light trucks.
11) Schematic plan of main shops (next page).



SOURCE: NISSAN TENNESSEE

Nissan's Smyrna operations encompass more than 78 acres under roof, and there is ample space for expansion.

FIGURE 2-4-3-1-a: SCHEMATIC PLAN OF MAIN SHOPS IN NISSAN SMYRNA

Outline of Nissan Motor Manufacturing corporation U.S.A. (NMMC).

This section includes a summary of NMMC and Nissan's strategy for the development as well as for the business in the U.S.

Nissan has been the rival of TMC since their beginning in truck manufacturing before World War Two. Contrary to the Toyoda family's strong leadership and group-isms of TMC, Nissan's formation is the history of merger and separation of corporations. In addition to the dynamic company history, Nissan and Hitachi have been linked through the Japan Industrial Bank, which has close ties with the Ministry of International Trade and Industry (MITI), and the Ministry of Finance.

The formation of NMMC and Nissan's strategy for the development as well as for the business in the U.S. are unique for Japanese corporations and very different from TMC. Nissan's first step for the new manufacturing company in the U.S. was the formation of the subsidiary's organization that was intended to be localized. This local company has been expected to be responsible for all operations except production engineering. Therefore, this American company of Japanese parentage was responsible for the construction of the new plant.

Nissan succeeded in inviting Marvin T. Runyon, the former Vice President in charge of body and assembly operations of Ford Motor Company, to become the president and a chief executive officer of NMMC in Aug. 1980. He was given the widest possible latitude to develop not a Japanese company in the U.S. but an American company of Japanese parentage. Zaitsu, a chief executive officer of NMMC, explained that " Most Japanese companies with American subsidiaries have relied on Japanese managers to run these enterprises. We decided to try a different way; we would hire the most experienced American manager we could hire, and give him a free hand to build an American company with American leadership and American workers." The board, made up of four directors, including three Nissan executives and Runyon, outlined four objectives for NMMC, and gave Runyon the responsibility and the authority to achieve them. After the appointment, Runyon hired four vice presidents for engineering, manufacturing, finance, and human resources. Alvin Folger, Vice President for Engineering came from the Ford Motor Company in 1980. Jerry Benefiled, Vice President for Manufacturing joined NMMC from the Ford Motor Company in 1980, too. James Stewart came to NMMC in 1981 from Gulf+Western Manufacturing Company. Wayne Write, Vice President for Human Resources, joined NMMC in 1982 from Texas Instruments Incorporated. The other two vice presidents came from Nissan: Shuichi Yoshida for quality assurance and Masuo Kiyota for production design. All six vice presidents are responsible to Runyon.

Accordingly, Nissan's control on the development was minimal. It formed a so-called C-30 task force whose leader has been Zaitsu since the preliminary planning phase. During construction, a small team of Japanese coordinators (C-30) of five individuals remained constant and acted as consultants for NMMC. In addition to Nissan's commitment to NMMC, NMMC also committed to Daniel Construction regarding decision authority of change orders. Daniel was given the latitude to decide $50,000 or less items by itself. Resident representatives of NMMC decided more than $50,000 items. In the Toyota KY Project, TMC did not give OHB decision making power on change orders. Moreover, TMC's head office in Japan decided change orders of more than $10,000, spending much time because of its group decision making system.

Development Process and Organization.

The development process, the schedule, and the organization of the Nissan Smyrna project is described in this section. Because Nissan committed Runyon to manage most of NMMC's operations including the construction of the new manufacturing plant, the client's strategy might well be very similar to that of Ford Motor's. NMMC is an American company, so it uses only American A/E and a general contractor in a relatively traditional project organization, though a fast-track program is used for the project.

Timing of the formation of the project organization, including the selection of A/E and a general contractor, is one of the most significant factors in the development process. A fast-track program is another important factor that requires a cost-plus-fee contract between a client and general contractors and also requires operational complications during the design and construction stage.

Some focal points of each development stage is as follows:
1) At the conceptual planning stage, the strategy of Nissan and NMMC, that is, Runyon's strategy is important.

2) At the planning/pre-design stage; the site selection and structuring of the project organization are major events. Runyon's previous association with Albert Kahn Associates, A/E in Detroit, is a key factor in the project formation.

3) At the engineering and design stage; interaction between C-30 (Nissan's task force), NMMC, Kahn, and Daniel is an interesting aspect.

4) At the procurement stage; contract types between project participants as well as labor relations are important topics.

5) At the construction stage; the construction is the quite usual American style. Daniel's self performance, and the use of night and weekend shifts are important factors in the success of the early delivery of the facility.

Figure 2-4-3-1 shows the development process of the Nissan Smyrna Project. The vertical axis indicates the project participants and the horizontal axis the progressive order from the left to the right. Important events from "Need for Facility"to "Construction" are allocated in boxes in the chart. Arrows between boxes shows the relations of events. Among the project participants, TN means Tennessee government or the local government. AFL-CIO means the national construction union. Nissan, NMMC, Kahn, Daniel and subs are the members of the project organization.

The first events in the development process is Nissan's confirmation of the need for a new facility. Nissan did the preliminary survey for a plant site in the U.S. in the early 1970s. Like TMC, Nissan did political, market, industrial, and

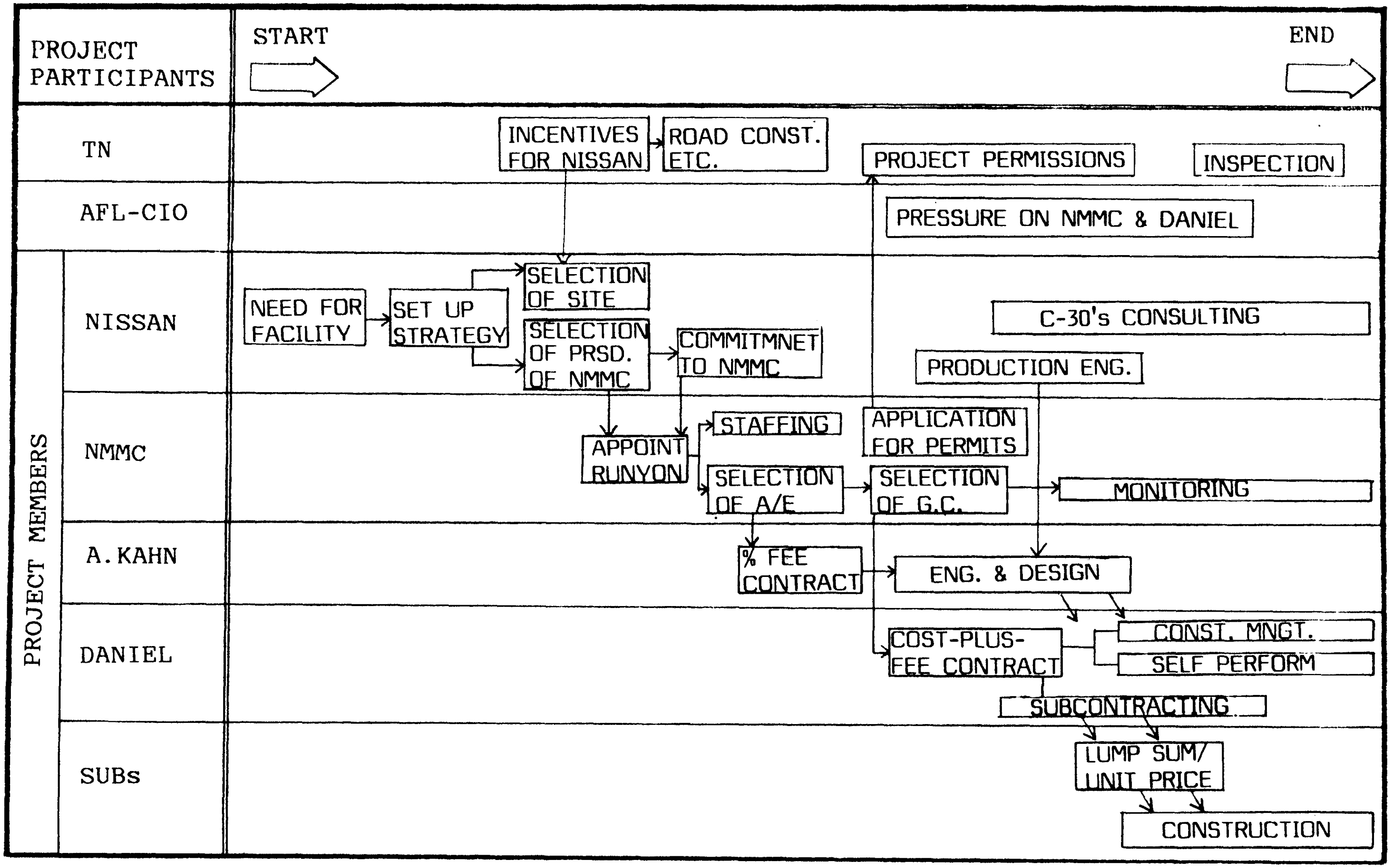


FIGURE 2-4-3-1: DEVELOPMENT PROCESS CHART OF NISSAN SMYRNA feasibility analyses for the new plant in the U.S. in the 1970s. In 1979, Nissan formed the company's C-30 planning team whose head was Zaitsu. Probably, Nissan decided the necessity of a new plant in the U.S. around this time. Although the initial production for the new manufacturing plant was small trucks, even at this stage, Nissan presumably had a plan to change or expand the plant to produce compact cars in the future.

As described in the previous section, Nissan set up a unique strategy for its new subsidiary, NMMC. Nissan decided that NMMC should be an American company and should hire an american president and give him/her the widest possible authority to structure and manage the new subsidiary. After Nissan's set up of the strategy, Nissan succeeded in inviting Runyon to NMMC as the president. Soon after his joining NMMC, he assumed full responsibility of the development project, becoming actively involved in the negotiation with the Tennessee government regarding the site selection, and hiring Kahn as A/E for the new construction.

Though Nissan's site survey in the U.S. began in the early 1970s, the intensive activities began after the formation of C-30 in 1979. Since Nissan's first visit to the site, Nissan sent the investigation team five times or more before Runyon joined NMMC. In early 1980, Nissan refined its requirements: About 400 acres of flat land were required within fifty miles of the Nashville airport, readily accessible to a railroad and an interstate highway; the site must have an adequate water supply and other necessary utilities, and its subsurface foundation must be firm and stable.

Nissan officially announced the new pickup truck manufacturing plant project in the U.S. in April, 1980. During Nissan's negotiation with several states including TN, NMMC was incorporated in July. The president, Runyon started working on Aug. 1. Though his major work in the early months of NMMC was design, construction, and staffing, his contribution to the site selection was important. Nissan got about 19 million dollars in incentives from TN. Finally, on Oct. 30, 1980, Ishihara, the president of Nissan, announced the decision on the Smyrna site.

Runyon's first major decision was his selection of Albert Kahn and Associates as A/E, a prestigious Detroit A/E having plenty of experience in auto plants. Runyon and Folger had known several members of the firm personally through some previous projects. Additionally, Shahan, Kahn's president, and his associates helped the plant-site selection process to get the project from NMMC.

After the selection of Kahn, Runyon made another key decision on the development, the selection of Daniel Construction for the general contractor in early 1981. Though Daniel had not had experience in automobile plant construction, it had enough skills and the manpower to manage the project. Daniel's head office was located in South Carolina and its operations were world wide.

Daniel Construction managed the fast-track program so well that NMMC could begin production two months ahead of the [52] schedule. Because Daniel is an open shop contractor, it build a merit shop for the project. Daniel used it own forces' work (self performance) widely for the shell construction to facilitate the fast-track program. Because of the self performance, 280 of Daniel's staff worked in the site office at the construction peak. The figure is very large compared with OHB's about 60 staff in the Toyota KY Project site. According to Jordan, Daniel's project manager of the Nissan Smyrna Project, if Daniel had operated in a pure construction management mode, the staffing would probably have been in the range of 40 to 45 individuals.

Daniel, one of the leading open-shop companies, built a merit shop for the project. As NMMC expected, the AFL-CIO attacked the project demanding that NMMC use only union construction workers in the project, though about 95% of the construction in middle Tennessee is done by nonunion labor (ENR, Dec. 12, 1985). For example, on the ground-breaking day, several hundred protestors came to interfere with the ceremony. Runyon kept a firm stance against the unions saying that the union's objectives did not match those of TN and NMMC. Governor Alexander, supported Runyon's attitude expressing embarrassment and disappointment that the hecklers had given such a rude reception. Despite continued pressure by the AFL-CIO, Daniel and NMMC carried out the project keeping the merit shop.

A fast-track program is an important factor in describing the design and construction stage. The overlap of design and construction had Daniel start construction without Kahn's detailed blueprints that would be provided as construction proceeded. Because of the big size of the project and the short schedule, both Kahn and Daniel's staff were large. More than one hundred of Kahn's architects, engineers, and draftsmen worked on the design. More than 250 of Daniel's staff managed more than 200 subcontractors which used nearly 4,000 construction workers at a peak on the site. Daniel kept construction going day and night with two ten-hour shifts working Monday through Thursday and a thirteen-hour shift working Friday through Sunday.

Though Daniel and Kahn worked very hard with excellent proficiency, the most important factor for the success in the fast track-program is probably the good coordination between NMMC, Kahn, and Daniel. Following Nissan's basic information for the plant through the C-30 task force, NMMC working closely with Nissan's consulting engineers, combined the local experience with Japanese data. Kahn was the next party to make drawings according to the NMMC's information. Finally Daniel built the plant following Kahn's construction documents. Because of the nature of a fast-track program, there were far more decisions, instructions, specific steps, facts and figures for the project team to deal with during construction than in traditional projects. NMMC reacted promptly not to terminate the flow of construction. Nissan's delegation of authority to NMMC must be seen a key factor in facilitating the cooperation between the project participants.

Figure 2-4-3-2 shows the outline of the Nissan Smyrna Project schedule. From the start of building construction in April 1981 to the start of the test production in Feb. 1983, it

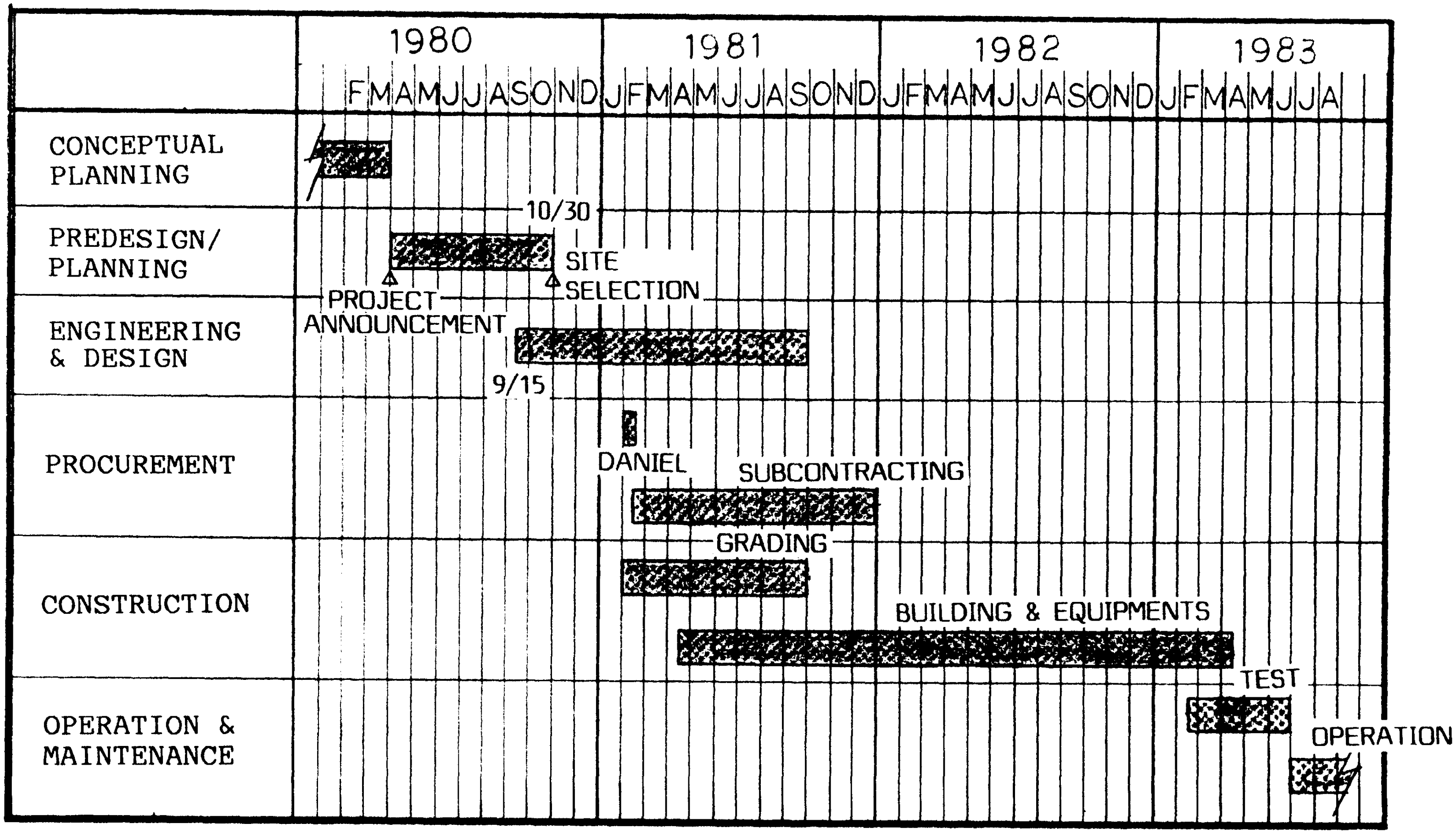


FIGURE 2-4-3-2: NISSAN SMYRNA PROJECT SCHEDULE took about 22 months. Seven months after the start of design and engineering on Sep. 15, 1980, the building construction started in Apr. 1981. This timing of design and construction is almost the same as the Toyota KY Project. Nissan spent seven months to make final decision on the plant site after the announcement of the project in Apr. 1980. The general proportion of the Nissan Smyrna Project schedule is similar to that of the Toyota KY Project though grading work is less than in the Toyota KY.

Figure 2-4-3-3 shows the design and construction schedule of the project. NMMC contracted with Daniel just before the ground-breaking ceremony in Mar. 1981. Much work overlapped during the construction. The weekend shift started in Dec. 1981 and the night shift started in Mar. 1982. These shifts continued until Feb. 1983. Compared with the traditional sequential program, the fast-track program saved about seven months, which is the overlap of design and building construction. The early start of production equipment installment made for the complicated coordination by Daniel between building construction work and production engineering work.

Figure 2-4-3-4 shows the outline of the organization and contract types of the Nissan Smyrna Project. The project organization is classified as a contractor mode CM (explained in Chapter 4). A separate designer, the single general contractor appointed before the completion of work drawings, and numerous subcontractors are factors of a contractor mode CM project organization. The process of the organization formation is also typical; NMMC selected Kahn first because of its good reputation

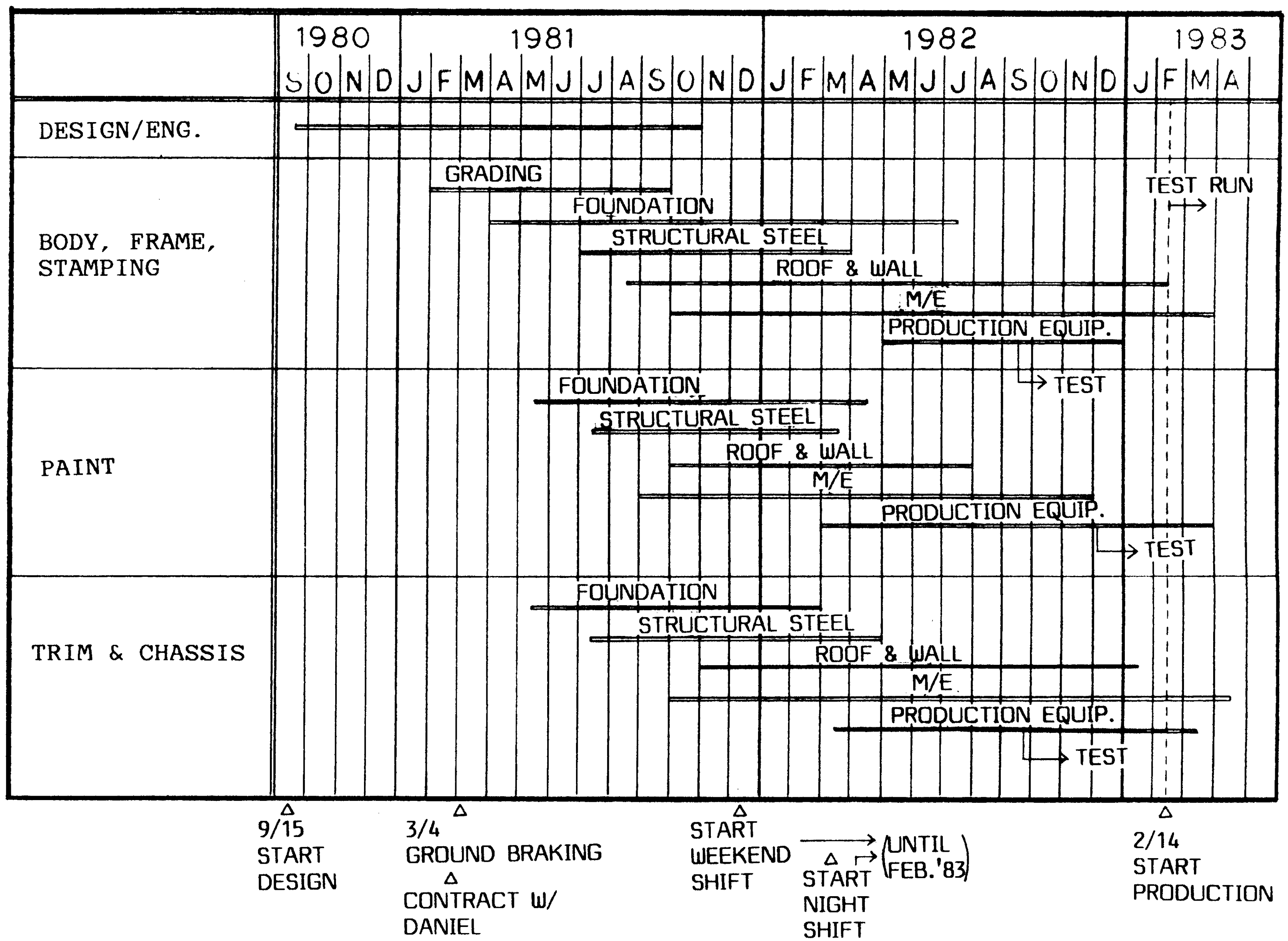


FIGURE 2-4-3-3
NISSAN SMYRNA PROJECT SCHEDULE (2)
(DESIGN & CONSTRUCTION)

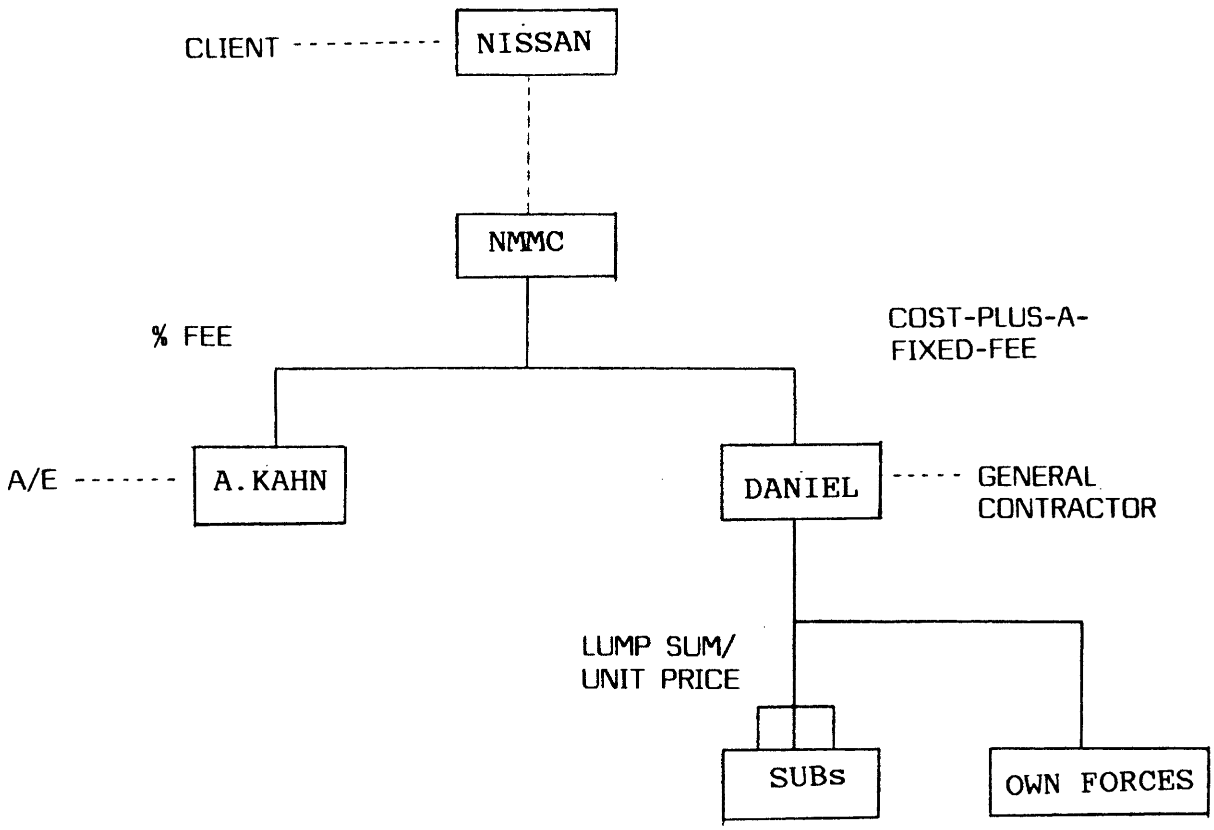


FIGURE 2-4-3-4
OUTLINE OF PROJECT ORGANIZATION AND CONTRACT TYPE OF NISSAN SMYRNA PROJECT

and previous work experience with NMMC's executives; then NMMC selected Daniel as the general contractor.

Nothing is unusual in contract types between project members as a development project in the U.S. NMMC contracts with Kahn by a percentage fee contract, the most popular contract type between clients and A/E. Because of the fast-track program, NMMC contracted with Daniel by a cost-plus-fee contract, which is also used often in American construction industry. Subcontracting is a lump sum or unit price contracts, which use basically the same rules as OHB in the Toyota KY Project.

According to Jordan, Daniel's project manager, Daniel had the authority to spend up to $5,000 without Nissan approval and the Nissan site construction manger had authority to spend up to $50,000. Purchase up to $100,000 could be approved by the manager of engineering. All expenditures over this level went to Runyon's office for approval, and presumably Runyon had the ultimate authority. This delegation of authority is totally different from that of the Toyota KY Project.

Figure 2-4-3-5 shows the organization of NMMC for the project. Former Ford Motor executives, Runyon and Folger, had the final authority over the construction. Nissan's C-30 task force acted as a consultant with NMMC regarding process and tool engineering. NMMC seemed to have enough staff and effective organization to monitor the project and to correspond with Kahn and Daniel.

Figure 2-4-3-6 shows the organization of Daniel's site office for the Nissan Smyrna Project. The heavy use of Daniel's

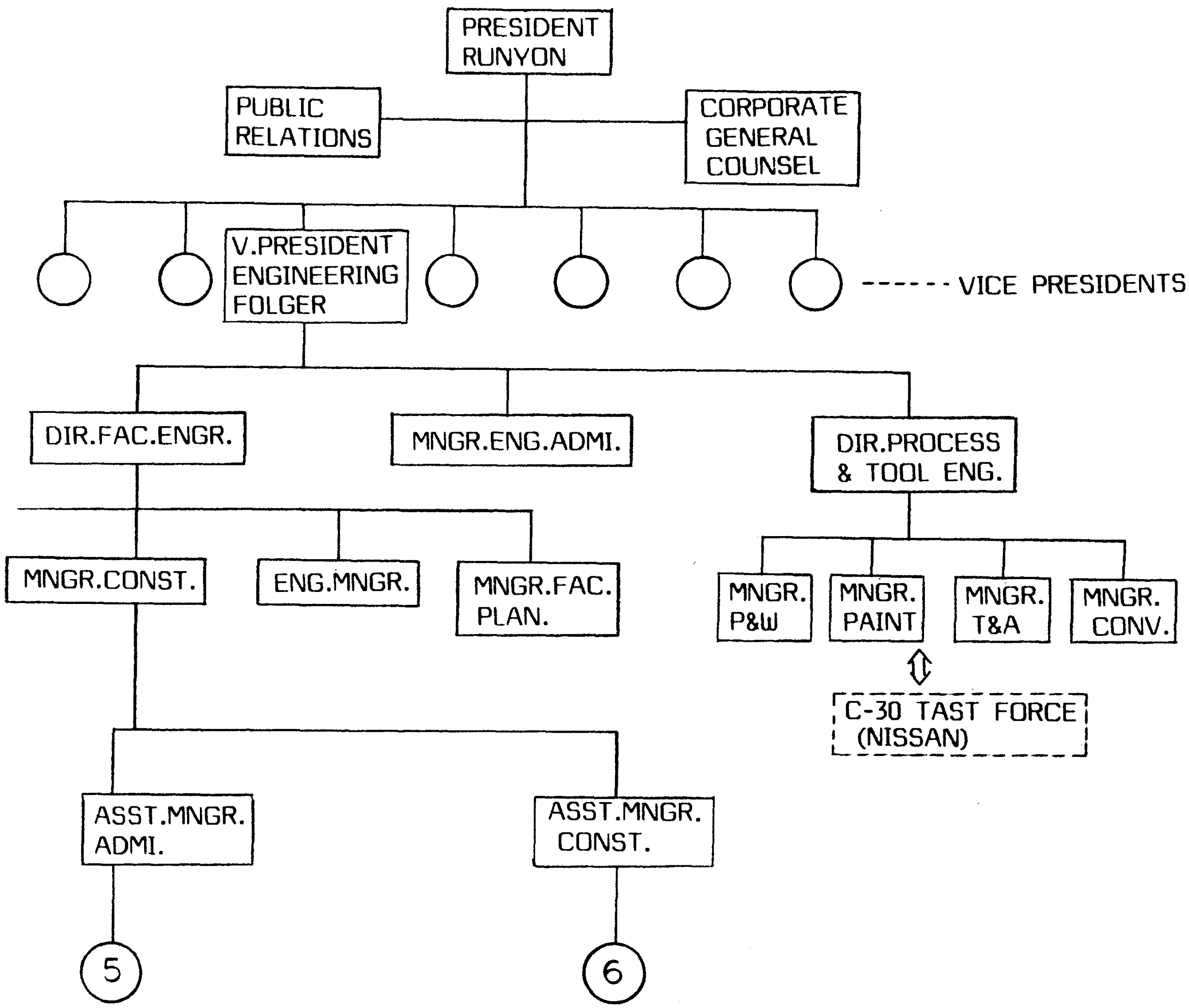


FIGURE 2-4-3-5: NMMC'S ORGANIZATION FOR THE PROJECT

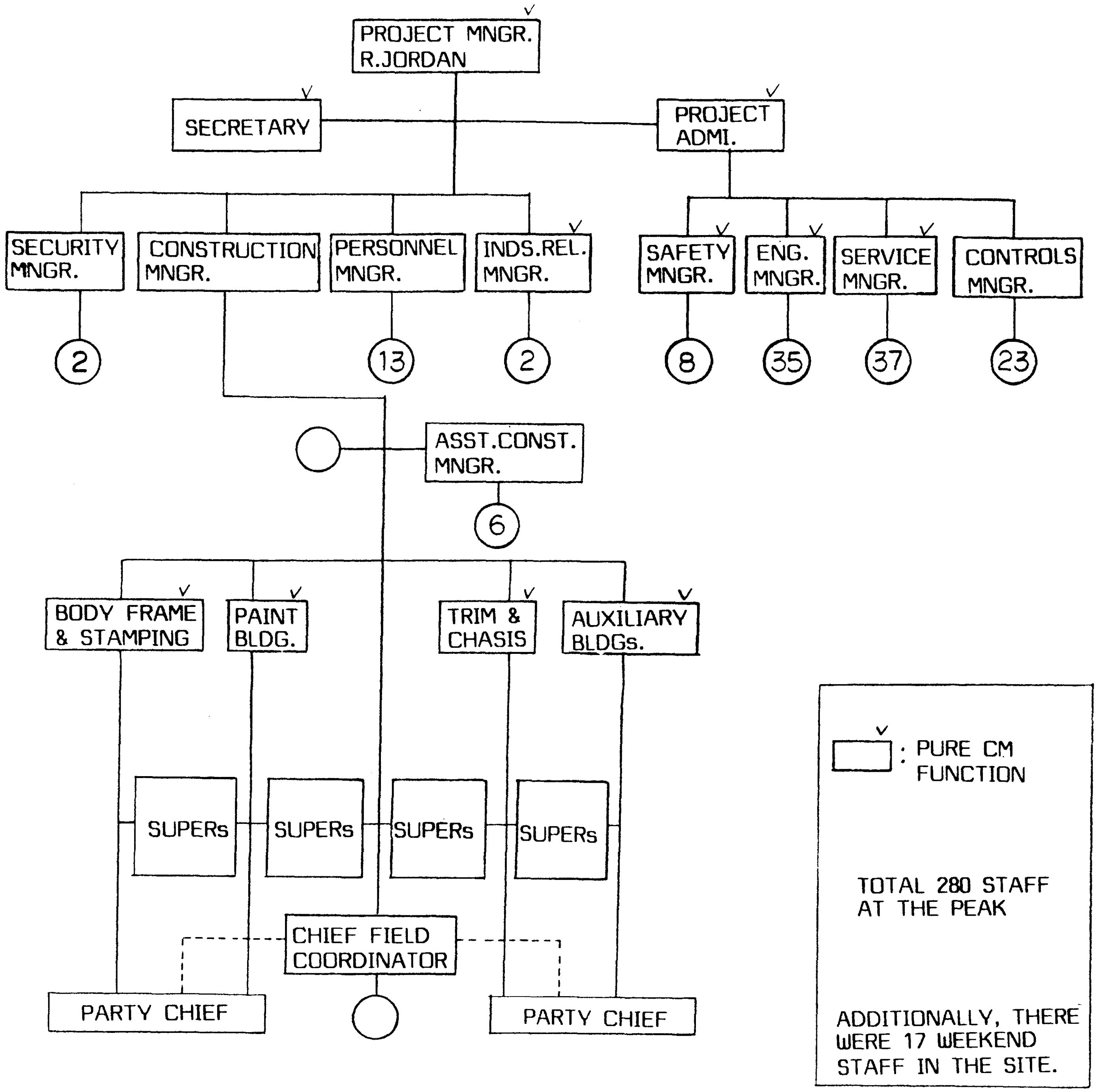


FIGURE 2-4-3-6
ORGANIZATION CHART OF DANIEL'S SITE OFFICE FOR THE NISSAN SMYRNA PROJECT

own work forces for the building shell work is an interesting feature at the construction stage. Because of the flexibility of Daniel's using its own forces' work to deal with the fast-track program, the Daniel's staff counted 280 at the peak both for the pure function of "construction management" and direct supervision of the own forces work. According to Jordan, the staff taking responsibility for the pure construction management for OHB in the Toyota KY Project was in the range of 40 to 45; the function of 235 to 240 of Daniel's staff in the Nissan Project is allocated to general contractors and subcontractors in the Toyota KY Project.[73] Daniel's site organization was almost self contained as with medium or even large American contractors organization.

3. Toyota Kentucky Project

About one year after the announcement of TMC's $800 million automotive plant construction in Scott County, Kentucky, most structural steel frames have been assembled on the 1.300 acres site, in January,1987. (see figure 3-0-1) The project has been sensational both in the U.S. and Japan since the planning stage. The thesis covers the project until the end of Jan. 1987, when about 50% of the construction was completed.[46]

The first part of this section (3-1) summarizes the important items of the project including some drawings and pictures. The second part (3-2) describes the development process and schedule in detail. The last part (3-3) explains the project organization including contract types.

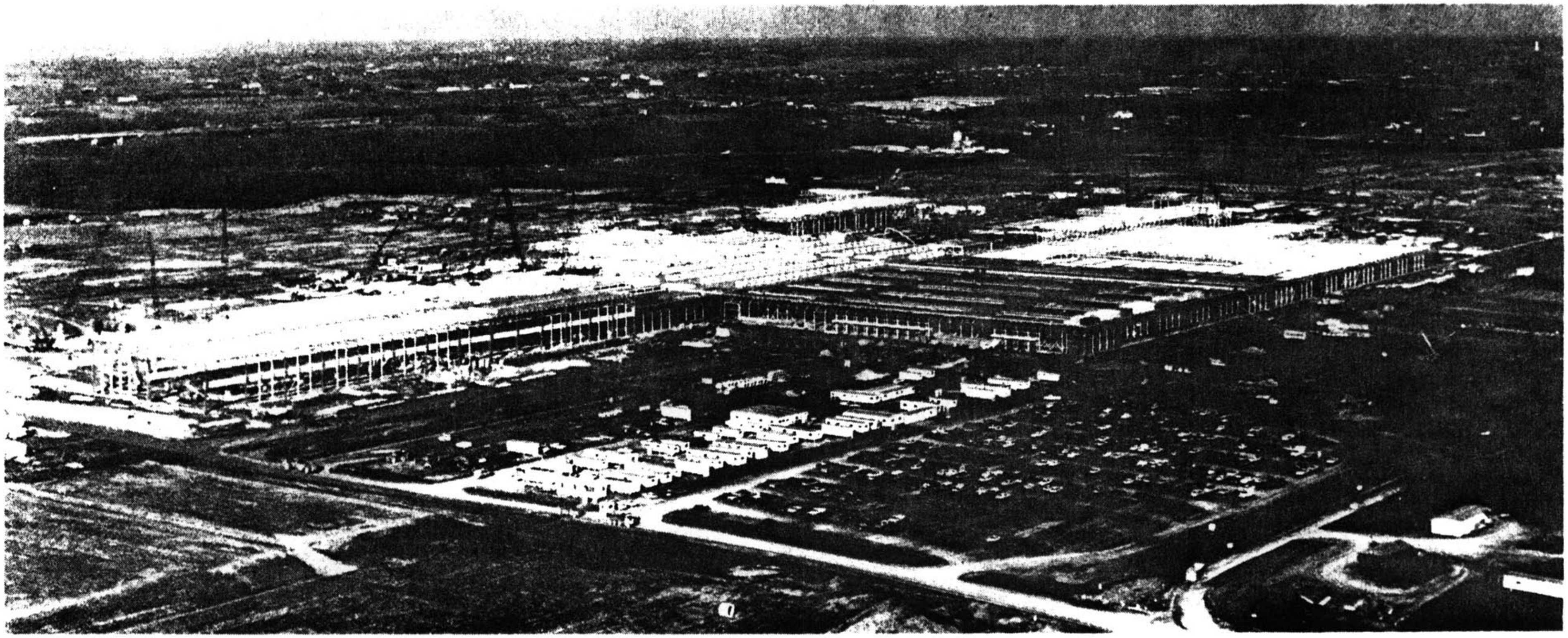
Special features of the project are as follows:

1) This is the first individual direct investment into the U.S. by TMC,

2) Ohbayashi manages the project using the fast-track program as a construction manager by turnkey contract with TMC,

3) TMC will get more than or equal to $125 million in aid from the Kentucky government,

4) TMC and Ohbayashi made a project agreement (PA) with the AFL-CIO, construction labor union, during the construction.



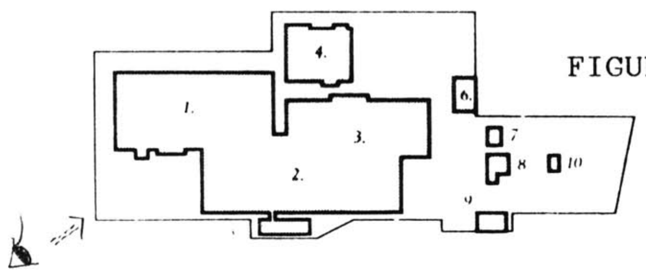


FIGURE 3-0-1: TOYOTA KY PROJECT IN JAN. 1987

The site diagram identifies building name and location. Square footage for each is shown below. The completed facility will cover approximately 1,400 acres.

1. *Press & Welding (1,170,016)*
2. *Trim & Assembly (1,054,878)*
3. *Paint (869,336)*
4. *Plastics (343,175)*
5. *Administration (91,964)*
6. *Test Laboratory (57,028)*
7. *Electrical Powerhouse (13,300)*
8. *Utility Building (66,377)*
9. *Training Center (46,400)*
10. *Wastewater Pretreatment (17,252)*

SOURCE: OUTLINE, JAN. 1987

3-1 Schematic Project Summary

Project summary is as follows:

1) Project name; Toyota Automotive Manufacturing facility Project
2) Project location; Scott County, Kentucky
3) Project organization;
   Owner, Toyota Motor Manufacturing, USA,Inc.
   Construction manager, Ohbayashi Corp.
   Architect/Engineer, Giffles Associates Inc.
4) Time schedule; Start of grading work, Mar.3,1986
   Start of building work, Aug.4,1986
   Completion (plan) 1988
5) Site area; 1293.03 acres (5,232,763 SM)
6) Floor area; 3,980,189.00 SF (369,760 SM)
7) Area names and general contractors

Area Name	Bldg.Area (SF)	General Contractor
#100 Press & Welding	1,344,389	Daniel International Corp.
#200 Paint	753,718	NIC Constructors
#300 Trim & Assembly	1,230,831	Blount Brothers Corp.
#400 Plastics	384,901	James N Gray Const. Co.,Inc.
#500 Utility	109,700	Beacon const. Co., Inc.
#600 Admi. & Testlab	153,400	
#700 Site Works	3,250	Metric Const.,Inc.
Total	3,980,189	

8) Building Outline;
   a. Foundation -- caisson & spread footing
   b. Structure -- structural steel
   c. Roof -- metal deck & insulation & built-up roofing
   d. Exterior Finish -- brick & block & insulated metal siding
   e. Floor -- slab on grade, hardener
9) Production capacity; 200,000 cars per year
10) Products; passenger cars of 2000cc class

11) Schematic plan of main shops

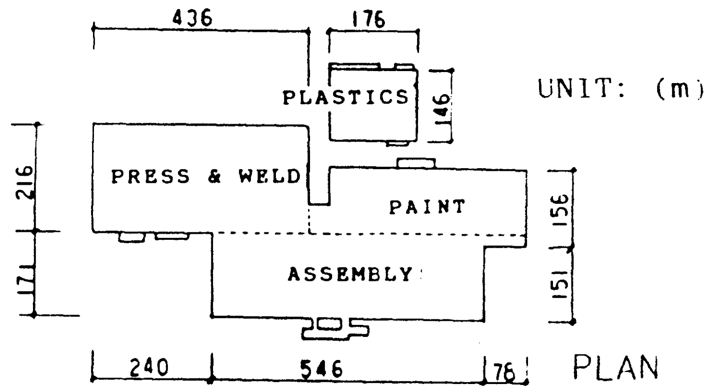


FIGURE 3-1-a

12) Section of main building

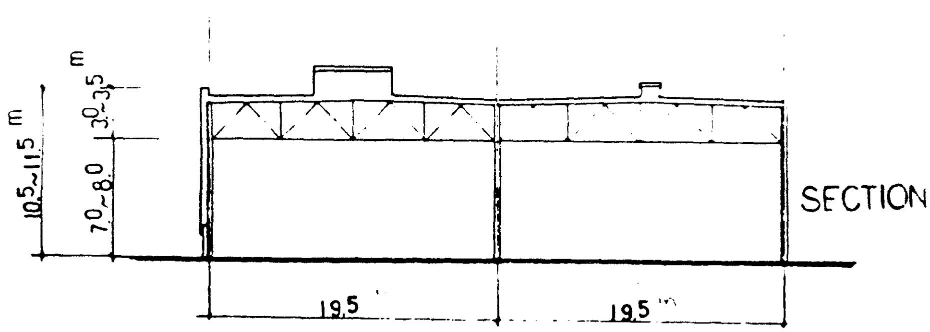


FIGURE 3-1-b

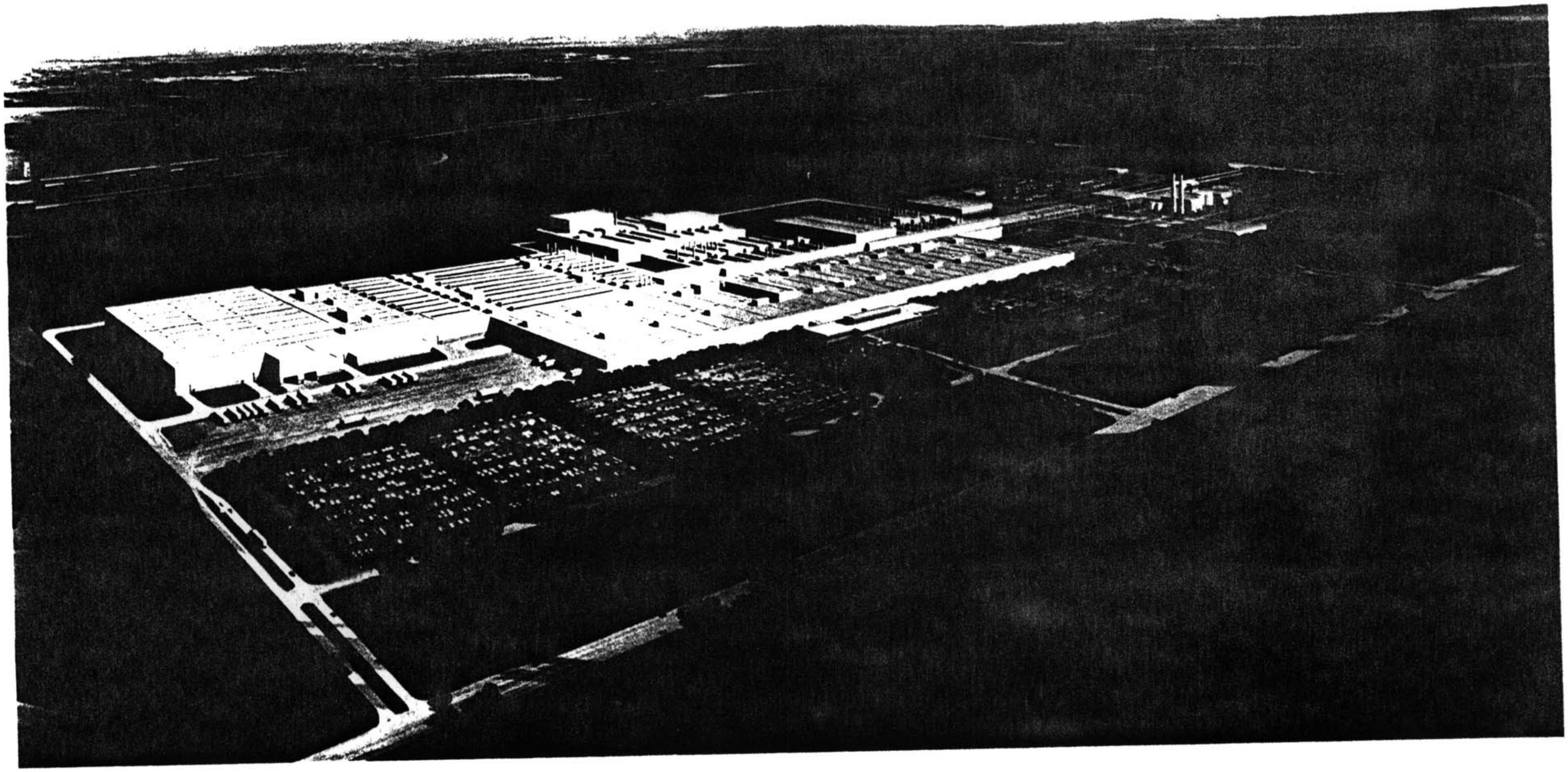


FIGURE 3-1-c: PERSPECTIVE DRAWING OF TOYOTA AUTOMOTIVE MANUFACTURING FACILITY BY GIFFLES ASSOCIATES INC.

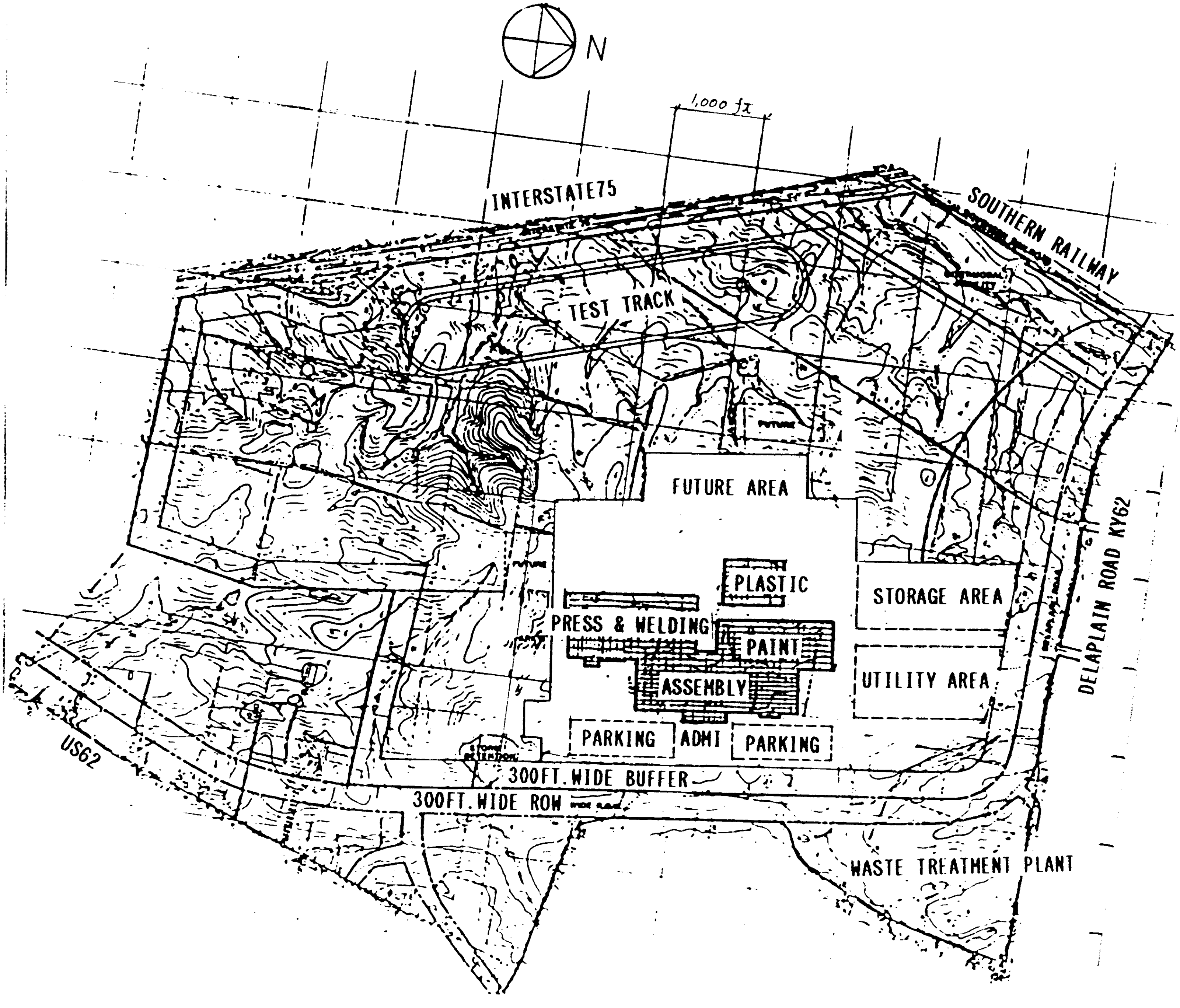


FIGURE 3-1-d SITE PLAN

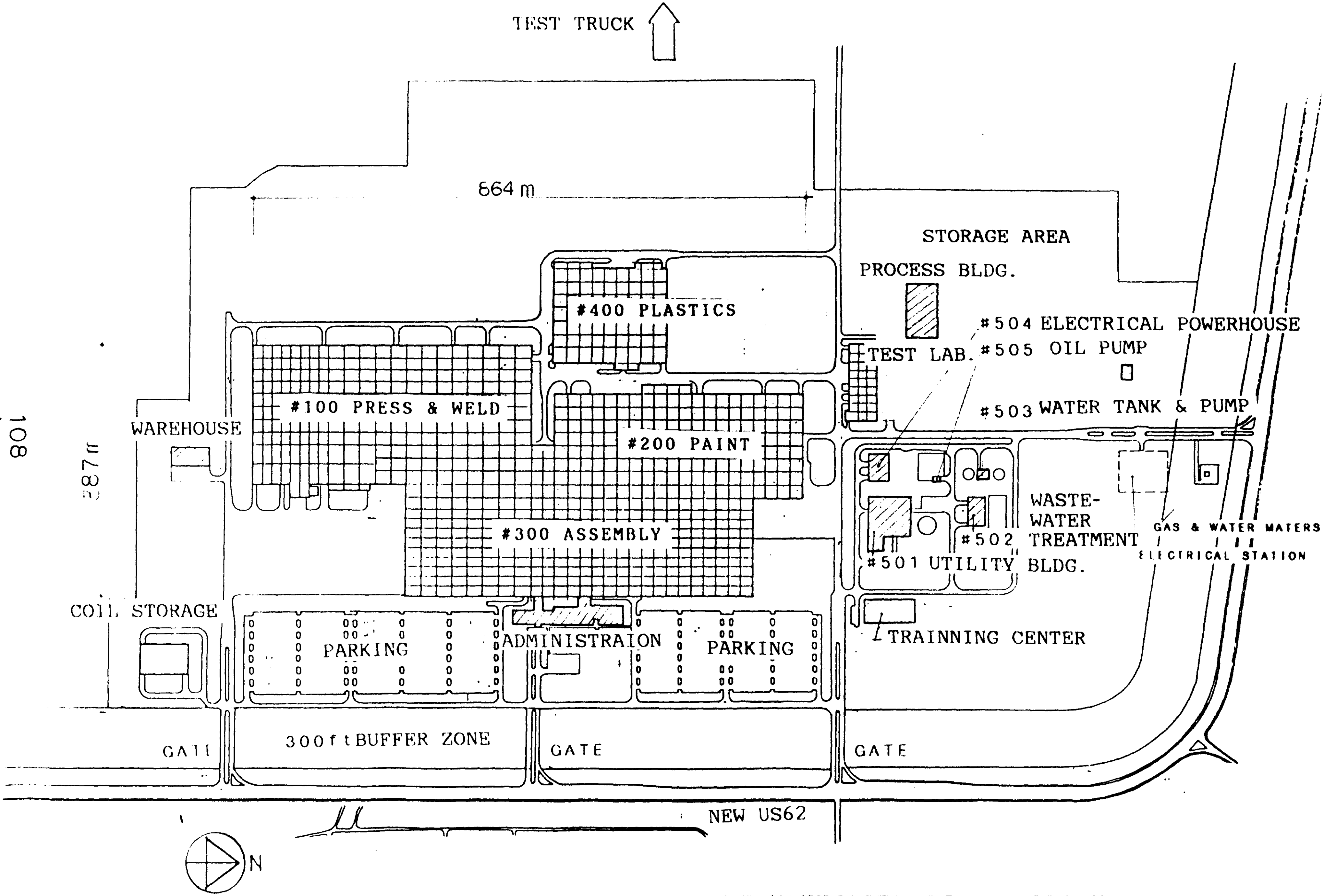


FIGURE 3-1-e TOYOTA AUTOMOTIVE MANUFACTURING FACILITY SITE PLAN 2

3-2 Development Process and Schedule

The development process and schedule of the Toyota KY Project is described in this section. After the outline of the development process and schedule, details will be explained following the order of development process from the conceptual planning stage through the construction stage.

The timing of the formation of the project organization, which includes the selection of the construction manager and the architect and engineer (A/E) is one of the most important factors in the development process. The fast-track program is another important factor which has a critical influence on the project organization and operational complications throughout the design and construction stages.

There are several focal points at each development stage. On the conceptual planning stage, TMC's strategy for the new project is an important issue as well as its long term relationship with OHB. Structuring the project organization and selecting the site are major events during the planning/pre-design stage. Interaction between TMC, OHB, and Giffles Associates (GIF) is an interesting aspect at the engineering and design stage. Labor relations including TMC, OHB, KY, and the AFL-CIO is unavoidable and one of the most important factors during the procurement and construction stages. Contract types and operational procedures on procurement will be described here. Implementation of the Total Quality Control (TQC) program and interaction among TMC, OHB, GIF, and general contractors are the main topics at the construction stage.

Figure 3-2-1 shows the development process of the project. The vertical axis indicates the project participants and the horizontal axis means the progressive order from the left to the right. Important events from "Need for Facility" to "Construction" are allocated in boxes in the chart. Arrows between boxes show the relations of events. Among the project participants, KY means the Kentucky government and the Scott County government. The AFL-CIO means the national construction union. KY and the AFL-CIO are the most influential parties outside of the project organization. TMC, OHB, GIF, general contractors, and sub-contractors are the members of the project organization. Slanting arrows among GIF, GCs (general contractors), and Subs (subcontractors) mean the overlap of the design and construction.

The first event of the development process is TMC's need for the new facility. This includes political, marketing, industrial, and feasibility analyses for the TMC's first individual direct investment for the manufacturing plant. After the confirmation of the need for the facility, TMC has to set up the strategy for the new automotive plant including management, operation of the facility, and construction.

Though there is no clear statement of TMC's policy for the construction of the project, it could be described that TMC has tried to build a TMC-style plant in the U.S. using TMC's traditional construction management as much as possible, even though using American contractors. Because TMC wants to be involved in the construction but does not have any experience of

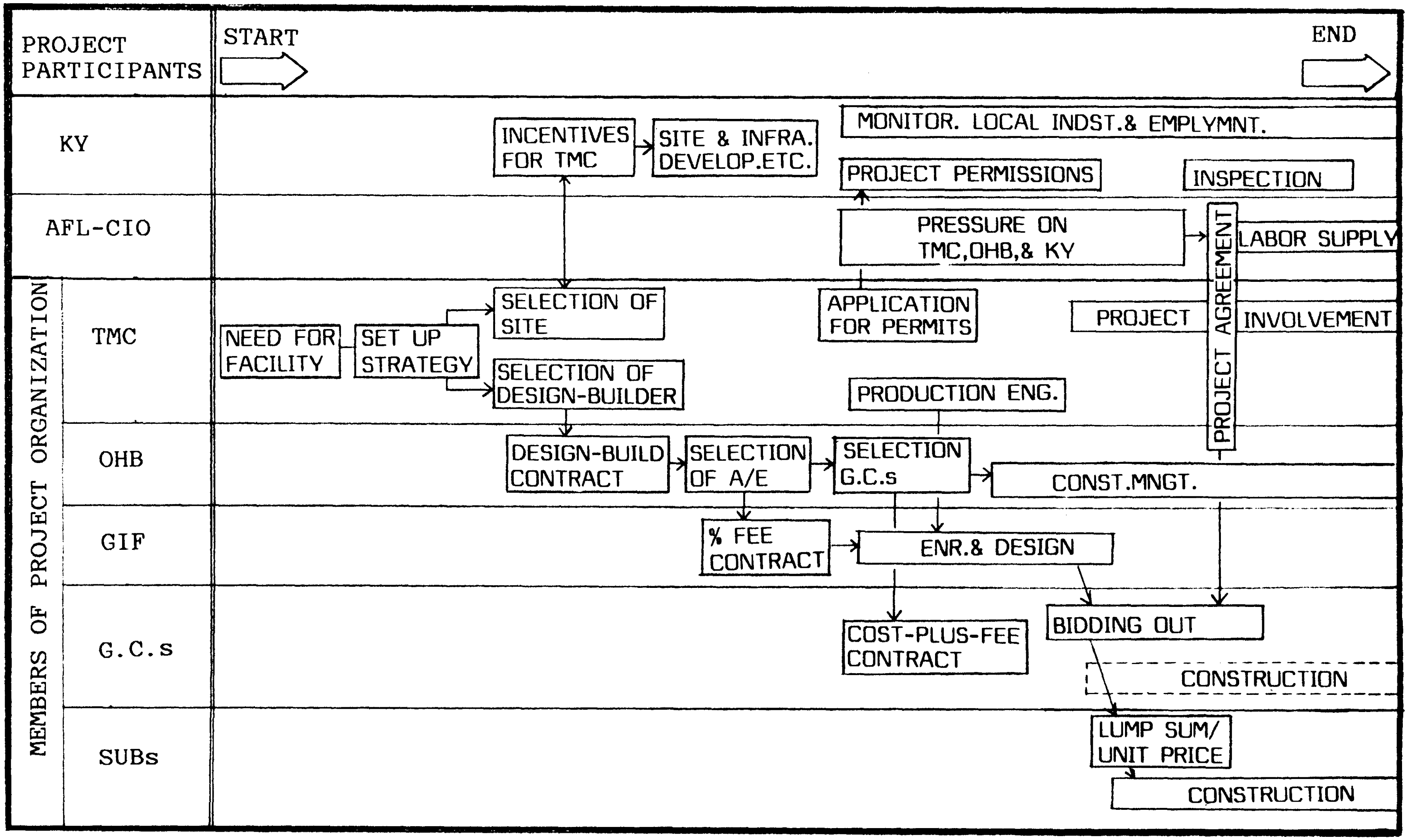


FIGURE 3-2-1: DEVELOPMENT PROCESS CHART

construction in the U.S., TMC decided to select a Japanese design-builder from the most reliable contractors who have had long term relationships with TMC. According to this strategy, TMC contracted with OHB by turnkey contract.

At the same time, TMC tried to select the construction site after the public announcement of the project. Finally, TMC selected KY because of the favorable incentives, labor quality, parts supply, market closeness, and others. After TMC's site selection, KY does the grading of the site, and some infrastructure development around the site as a part of the incentives. Along with this work, KY checks and approves several building permissions, and monitors labor relations for the local construction industry and workers.

After the design-build contract with TMC, OHB selected A/E, Giffles Associates (GIF), and got the approval from TMC. OHB defines itself as a design-manager in the project, that is, OHB deals with design and construction management without dealing with the construction directly. OHB assigns the operational function of the construction to six general contractors with cost-plus-fee contract, who are selected by negotiation. Consulting with TMC, OHB selects the type of labor relations as a merit shop, that is, OHB uses both union and non-union contractors. Talking with KY, OHB and TMC selects the most favorable shop for the local contractors and workers. All of the selected general contractors, except for Gray Construction (open shop contractor in KY), can contract both with union and non-union sub-contractors.

After the selection of the general contractors, OHB's main job is the construction management, that is, assistance for TMC's involvement into design and construction, coordination between A/E and contractors, monitoring the construction, labor relations, public relations, etc.

Though union contractors have a chance to get contracts from OHB because of the merit shop, open shop contractors dominate the contracts because of their higher productivity in this area, which enables them to offer lower bids than union-contractors. The building trades tried to impose on the project an agreement to make the project union shop. The AFL-CIO put strong pressure from the beginning of the project on OHB, KY, and TMC.

Finally, the AFL-CIO got the project agreement from TMC and OHB after about 50% of the construction was completed in Dec. 1986. Though the actual impact of the project agreement on the project is out of the scope of the thesis, the change in the sub-contractors' labor relations, higher wage rate, and change of working conditions, will have about a three-month delay of the schedule.

Figure 3-2-2 shows the outline of the project schedule. The scope of the thesis is until the end of Jan. 1987. The project officially appeared in public on July 23,1985 by TMC's announcement of the decision of direct investment in the auto manufacturing plant in the U.S. Soon after the announcement 31 states offered proposals to invite the plant. On Dec. 11, 1985, TMC decided on the site in Scott County, Kentucky. The schematic design began at the beginning of 1986. Grading work began in

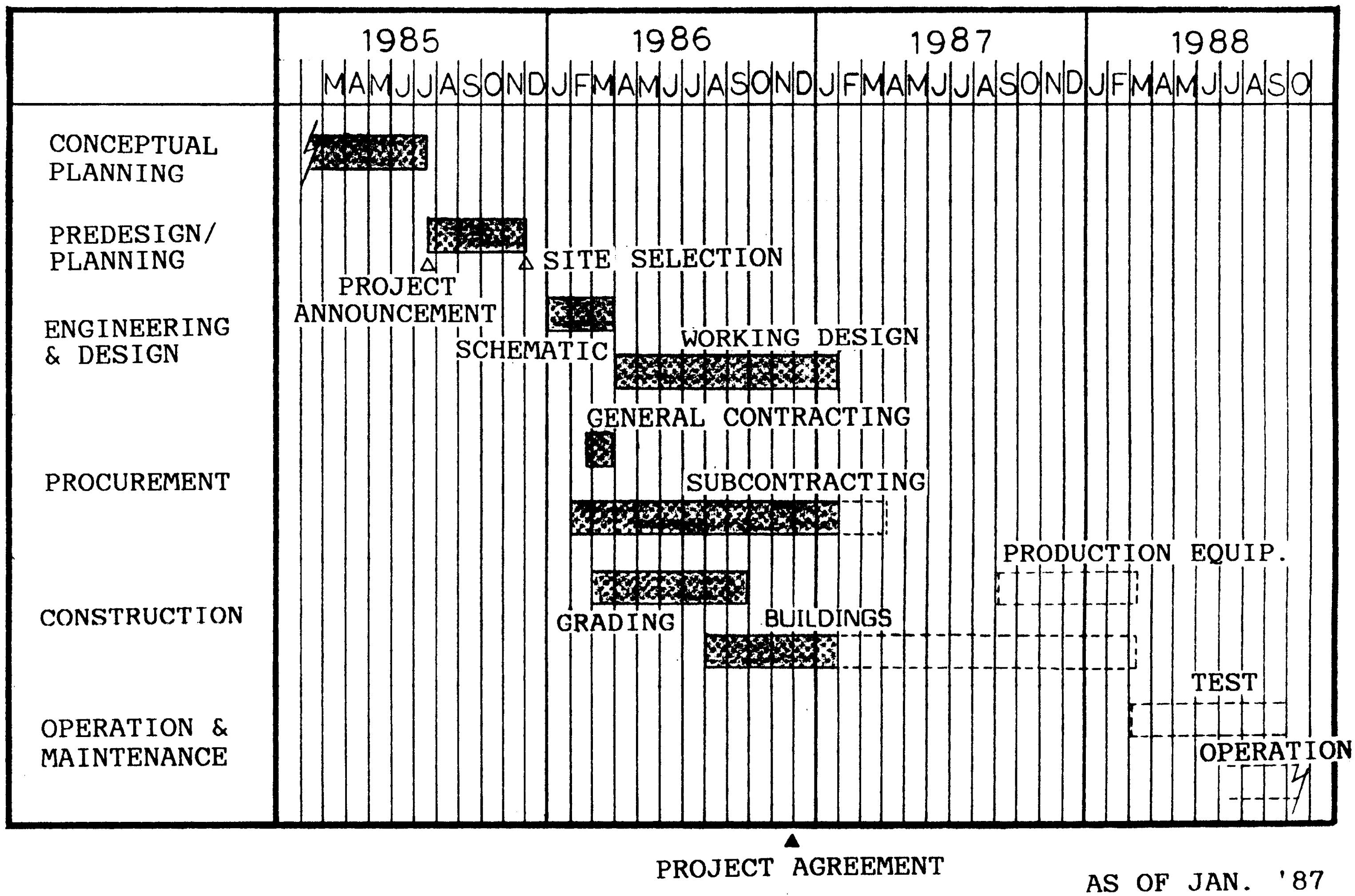


FIGURE 3-2-2
TOYOTA KENTUCKY PROJECT SCHEDULE (1) (OUTLINE)

Mar. 1986 and Building construction started in Aug. 1986. The construction is planned to be completed in early 1988. TMC plans to produce the first car in mid or late 1988.

Figure 3-2-3 shows the design and construction schedule. The schematic design (including design development phase) that began in Jan. 1986 took three months to complete. The construction documents phase began in Apr. 1986. During the schematic design and design development phases, the A/E made schematic drawings, outline specifications, and preliminary estimates of cost. During the construction documents phase, the A/E made working drawings, specifications, and bid documents.

Grading began in Mar. 1986 and was completed in Aug. 1986. Though building work was planned to start on Jun.20, the work actually began on Aug. 4 because of a delay in obtaining the Environmental Protection Agency's (EPA) permission. After the beginning of the piling and foundation work, the construction went basically smoothly until the end of Jan. 1987, when the effects of the project agreement with AFL-CIO have not appeared yet. Structural steel work in the Press, Welding, and Assembling shops began in Sep. 1986 and was finished in Jan.1987. Structural steel in the Paint shop began in Oct. 1986 and is planned to be completed in Mar. 1987.

As of the end of Jan. 1987, most of the structural steel frames have been assembled, and roof and wall work have started, but mechanical and electrical (M/E) work have not started yet. M/E work was planned to begin in Dec.1986, but the work will begin mid Feb. 1987 after two and half months delay from the

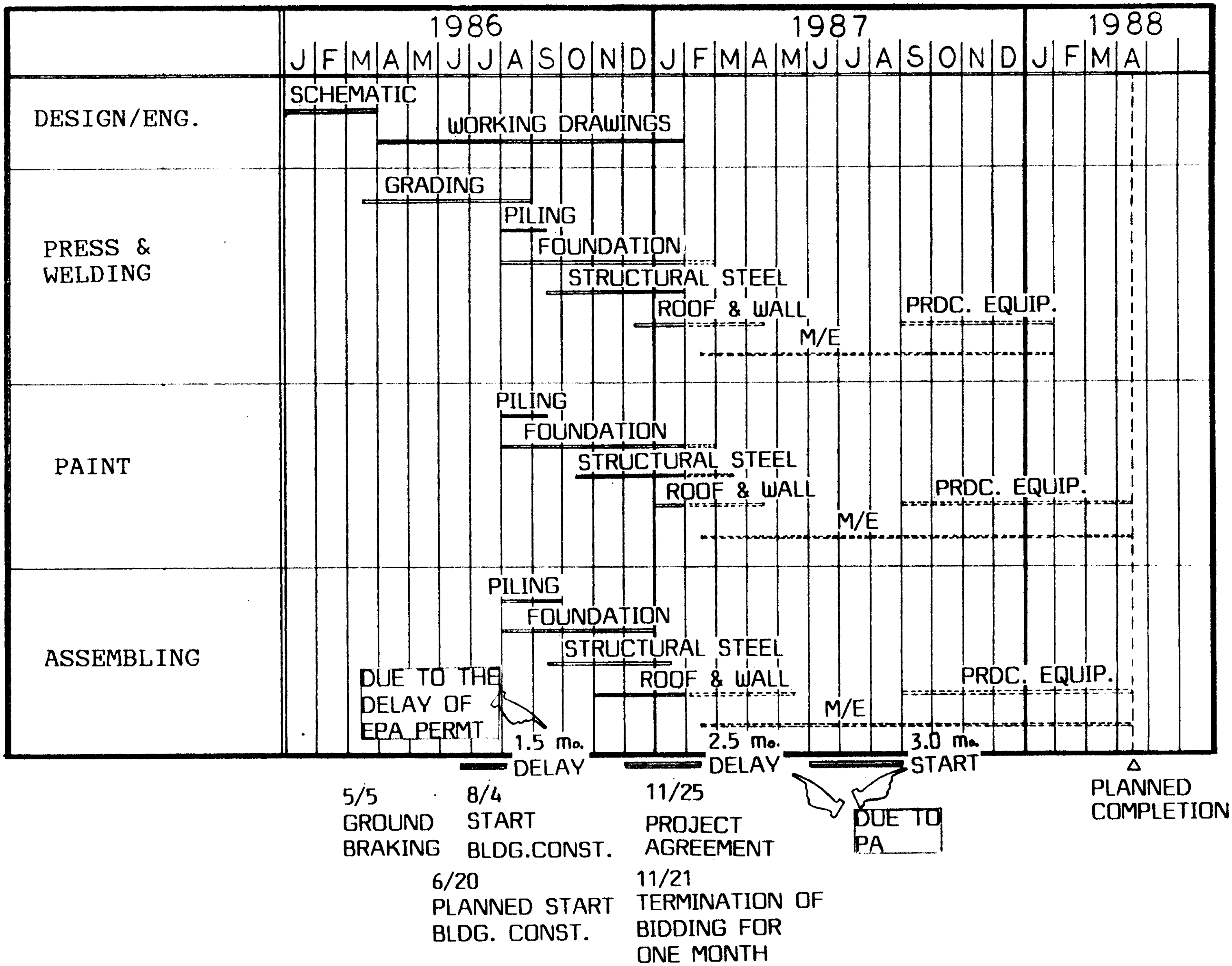


FIGURE 3-2-3
TOYOTA KENTUCKY PROJECT SCHEDULE 2
(DESIGN & CONSTRUCTION)

original schedule. This is because OHB terminated bidding for one month after Nov.21, 1986 due to the negotiation about the project agreement with the AFL-CIO. In addition to the one month termination of the bidding, it takes about one and half months to do re-bidding. The Project Agreement between TMC and the AFL-CIO became effective as of Dec. 1, 1986.

Finally, installment of the production equipment is planned to start in Sep. 1987. OHB plans to complete the construction in Mar.1988, which is a three-month delay from the original schedule due to the Project Agreement during the construction.

3-2-1 Planning/Pre-design Stage

Important events during the planning/pre-design stage are such as "Need for Facility,""Set up Strategy,""Selection of Site,""Selection of Design-Builder,"and "Selection of A/E" in Figure 3-2-1, the Development Process Chart. The main actor on this stage is TMC. This stage was begun in the late 70s, probably around 1977 when Honda Motor decided to build its motor-cycle manufacturing plant in the U.S.

Need for Facility:

TMC examined many factors to confirm the necessity for the new manufacturing facility in the U.S. TMC and Nissan studied the feasibility of direct investment into the U.S. in the late 70s, but they decided to postpone the investment. The problems[13] exceeded the advantages for TMC and Nissan at that time. The advantages were as follows:

1) Price of energy and materials such as Aluminum and glass was low due to the appreciated yen and the depreciated U.S. dollar.

2) TMC could avoid tariffs and save shipping cost.

3) TMC could avoid the U.S. government's protectionism by reducing the excessive export of Japanese cars.

The disadvantages were as follows:

1) Though in the long run, TMC could solve the cost inflation problem due to the appreciation of the yen, in the short run, TMC would certainly suffer from cost up for a 240,000 car/year production capacity plant.

2) TMC could not expect the similar suppliers' cooperation that TMC had enjoyed in Japan. Japanese suppliers could produce high

quality and low cost products constantly for TMC. Additionally, it was doubtful that TMC could apply the Toyota Production System in the U.S.

3) The labor wage of the UAW is higher than that of the Japanese, though the difference of the wages was reduced due to the appreciation of the yen.

4) Because of the differences of labor quality, labor relations, personnel management system, and corporate management style, the productivity of American labor was lower than that of the Japanese; additionally it was difficult to do Japanese-style quality control. TMC had strong fear of the UAW which held long-term strikes in some cases.[13]

Nikkou Research Center explains that considering these above factors, exports from Japan to the U.S. ware more profitable than production in the U.S. for TMC in late 70s, even if the yen continued to appreciate.

This analysis presents the most important considerations for TMC to define its need for the new facility in the U.S. In the late 70s, the industrial climate for TMC's direct investment into the U.S. was unfavorable, and also the Japanese government had a negative attitude against the direct investment.

In Dec. 1979, TMC announced that it was studying production in the U.S. to avoid tightening import restrictions. After a while, in Feb. 1980, several newspapers reported that TMC had no plan to build the U.S. plants despite threats of import restrictions. But even after the announcement, the Wall Street Journal, Apr.9,1980, reported TMC still studied the feasibility of building vehicles in the U.S. In July 1980, several newspapers reported that TMC negotiated with Ford Motor on a possible joint venture auto production in the U.S. Though the negotiation continued in 1981, they could not reach agreement.

Around 1981, trade friction between the U.S. and Japan emerged clearly and changed the situation of TMC's direct investment. Protectionism by the U.S. government appeared and the Japanese government changed its attitude for the Japanese corporations' direct investment in order to ease the trade friction.

After the cancelation of the planned joint venture with Ford Motors, TMC changed its possible strategic partner from Ford to GM. In Nov. 82, newspapers reported the possibility of GM's joint auto manufacturing venture with TMC in 1983. In Feb. 1983, newspapers announced that GM and TMC would jointly produce 200,000 subcompact cars/year at GM's idle Fremont plant. The name of the new joint venture is New United Motor Manufacturing,Inc. (NUMMI). In May 1984, NUMMI's plan of producing a Corolla-type car in Mar. 1985 was reported, though the biggest news about the auto industry in this month was the Nissan Motor Manufacturing, USA's new auto plant project at Smyrna Tennessee.

A joint venture approach is cautious enough for TMC to avoid the big risks of TMC's going to the U.S. According to Weekly Sankei, Eiji Toyoda had a policy that joint venture is a necessity at first to avoid big risks which might be associated with individual direct investment. Additionally, the Ministry of

International Trade and Industry (MITI) advocated the joint venture as one of the strategies to avoid trade friction. Kajiwara, an economist, explained that TMC had expected the U.S. government to ease import restrictions while TMC participated in NUMMI, but on the contrary to TMC's expectation, the pressure by the U.S. government became stronger in 1985. Around the beginning of 1985, TMC might have had to change its policy of building a new manufacturing plant individually in the U.S., or the collaborative effort with GM might be one calculated step for TMC's final plan to establish its plant in the U.S. Finally, TMC announced the new automotive manufacturing plant project on July 23, 1985, probably on the basis of political consideration.

Set up Strategy:

Along with the confirmation of the need for the new facility, TMC had set up the strategy for the new manufacturing plant's management, operation, and construction. Though TMC has learned about American auto manufacturing industry including the UAW through its experience in NUMMI, the joint venture established with GM in California, several problems related with the production and sales still remained. Especially the future automobile market situation in the U.S. is one of the most important factors for TMC's new plant.

The expected automobile market condition in the U.S. in 1988 or 1989 is very competitive for TMC because many Japanese car manufacturers plan to increase or start car production in the U.S.: Nissan plans to produce 120,000 car/year in 1987; Honda plans 300,000 car/year in 1988; Mazda and Mitsubishi plan to start production in 1987 or 1988. In addition to those Japanese companies' activities, GM also plans to produce compact cars in 1989 by the Saturn project. Hyundai's participation in the automobile market in the U.S. will enhance the keen competition.

Fear of a saturated market of small cars or Japanese cars in the U.S. is probably the main reason for TMC's setting fast construction as the first priority of the construction.

Because TMC has many staff for the plant construction, and has confidence in Toyota's production system, TMC's policy for the new construction may well be as follows: TMC tries to build a TMC-style plant in the U.S. using TMC's traditional construction management methods as much as possible even though using only American builders. Then, TMC decided to choose a Japanese design-builder who has much experience in the U.S. so that TMC can participate much in the design and construction process as well as avoid risks associated with projects in the new environment.

Site Selection:

Though TMC asked three American and Japanese companies to conduct feasibility studies, including possible site investigation in 1980, practical activities of site selection for the new project started with the official announcement of the project on July 23, 1985.

The interaction between TMC and KY can be summarized as[39] follos:

May, 1984; the first KY's Far-East office's contact with TMC regarding possible plant site.

May, 1984; representatives of KY visited TMC.

Jul. 1984; KY submitted basic information about KY to TMC.

Mar. 1985; Governor Collins visited Japan by the invitation of the Ministry of Foreign Affairs. Collins met Yamamoto, vice director of TMC.

Jun. 1985; KY submitted data for an industrial site in Georgetown.

Jul. 2, 1985; Nihon Keizai Shinbun (Japan Economic Newspaper), reported TMC's individual direct investment in the U.S. as the top news.

Jul. 9, 1985; Wall Street Journal mentioned Tennessee, Kentucky, Indiana, and Missouri as possible sites for the plant.

Jul. 23,1985; TMC officially announced the individual direct investment. TMC sent the first questionnaires to states governors.

Oct. 1985; TMC sent the second questionnaires to selected states.

Oct. 15, 1985; TMC's first investigation team arrived at KY, and stayed for two days.

Oct. 25, 1985; Collins met Toyoda, the president, Kusunoki, vice president, and others of TMC.

Nov. 8, 1985; TMC's second investigation team visited KY and stayed for nine days.

Nov. 14, 1985; Three of TMC's vice presidents, Tsuji, Kamio, and Kusunoki, visited KY and stayed for two days.

Dec. 3, 1985; TMC sent a third investigation team to KY and Tennessee, each team having 12 or 13 members. KY finally acquired the possible site near Georgetown at this stage. KY and

TMC had a final negotiation about incentives, while TMC seemed to do the same procedure with Tennessee.

Dec. 8, 1985; Mr.and Mrs.Toyoda, the director of TMC, visited Lexington,KY and met Collins.

Dec. 11, 1985; TMC officially announced the decision on the site in KY.

To invite TMC, KY offered a $125 million incentive package, the largest such deal in KY's history. KY amended the state law to offer these incentives.[69] According to Automotive News, the contents of the incentives is as follows: $10 million for land acquisition, $25 million for site preparation, $10 million for a training facility, $33 million for employee training, and $47 million for highway construction. The news also reported Collins' comment that the state expects to gain almost $500 million in taxes over 20 years as well as employment for 3,000 workers at the plant and more in related industries.

KY's incentives for TMC is the biggest as incentives from states to Japanese auto manufacturers as shown in Table 3-2-1. Though the percentage of KY's incentives over direct investment is not the highest, the absolute amount is the biggest. The AFL-CIO's legal challenges against KY's incentives, and the disqualification for TMC to get investment tax credit in the new tax law, possibly by the unions strong opposition against TMC, could be interpreted as the reaction against the possibly excessive incentives for TMC.

As TMC used three consultants for the feasibility study in 1980, TMC might well use several consultants including OHB for

TABLE 3-2-1

STATES' INCENTIVES FOR JAPANESE AOTOMOTIVE MANUFACTURERS

CORPORATION & STATE	(A) INVESTMENT ($ MIL.)	(B) PROJECT COMPLETION	(C) CAR/YEAR	(D) EMPLOYEE	(E) INCENTIVE ($ MIL.)	E/A (%)
TMC KENTUCKY	800	1988	200000	3000	125	16
MAZUDA & FORD MICHIGAN	450	1987	240000	3500	52	12
NISSAN TENNESSEE	450	1983	120000	2600	19	4
HONDA OHIO	250	1982	150000	2000	0	0
MITSUBISHI-CHRYSLER ILLINOI	500	1988	180000	2500	83	17

SOURCE: BUNGEISUNJUU, DEC.1986
BY TAKEO MIYAUCHI

site evaluation in 1985. As TMC's spokesmen said that TMC would decide on plant sites, considering such factors as quality of labor, parts procurement, etc., TMC evaluated possible sites from many points.

According to OHB's site evaluation sheet for the project, evaluated items in the questionnaires counted 97 classified in six areas, such as administrative regulations, labor quality, welfare and amenity for living, industrial transportation, site conditions, and incentives for the site.[84] These six areas could be further classified as follows:

1) Administrative regulations; tax, labor law, environmental regulations, building code, welfare charge, efficiency of the government.

2) Labor quality; labor, residents, wage rate.

3) Welfare and amenity for living; education and training, recreation, medical service, etc.

4) Industrial transportation; assembled cars, parts, raw materials, Complete Knock Down Box, accessibility to highway and railway.

5) Site conditions; building, public service, parcel, climate, other auto manufacturers' location, construction labor.

6) Incentives for industrial investment; financial assistance, education and training assistance, assistance in site development, etc.

Having gotten the responses to the second questionnaires from selected states, TMC sent the first and second investigation team to several states in order to get detailed information. At this stage, the following points were discussed: rezoning, permissions, industry tracks, geotechnical and geographical conditions, public utilities, and site development.

The project site was in the agricultural zone next to the industrial zone, and the planning department of Scott County had been working to change the zoning, including that of the project site, to the industrial zone. Though the usual procedure of rezoning begins from the application for rezoning by a landlord or his agent, Scott County allowed the county to rezone the area rather than by the TMC's application.

At the site selection stage, TMC investigated the details of regulations regarding city planning, environmental policy, and building and construction. The details are explained in the part of "project permissions" at the design phase.

Selection of Design-Builder:

Following the setup of TMC's strategy for the construction, it started negotiation with several general contractors including OHB to select the design-builder of the new project. Though it is not clear when TMC decided to choose OHB as the design-builder of the new facility, OHB assisted in TMC's site selection before the design-build contract. Because OHB has the longest relationship among the competitors with TMC, and has 20 years experience in U.S. construction, OHB was probably the most reasonable selection for TMC. Additionally, OHB's assistance for TMC's site selection using its all American subsidiary, Citadel, to gather information, was probably the key point for OHB to get the turnkey contract with TMC.

TMC and OHB use the AGC's turnkey contract form rather than the AIA form, because the AIA does not have a design-build type contract form. Though the AIA has a standard form of "Owner-Contractor Agreement Form - Cost Plus Fee," A111, TMC and OHB did not use this because TMC's first priority for the new construction is probably to choose a reliable contractor who is responsible for all the project process. Cost-plus-fee contract is basically unfavorable for TMC because it cannot guarantee the construction cost nor utilize price competition among possible prime contractors.

Because the design-build or turnkey contract has been developed from the negotiated contract, the nature of the AGC's design-build contract is the cost-plus-fee contract. Because the cost-plus-fee contract is rarely used in building construction in Japan, this is the first case for TMC and OHB to make this kind of contract. Based on the mutual trust through the long term relationship, OHB has proceeded to start the project without setting OHB's fee, nor with a definite completion date of the construction.

Because the shortest construction period at reasonable or cost effective price may well be TMC's goal for the project, TMC and OHB confirmed the shortest schedule on the best effort base as the first priority. They did not set the exact completion date because it was unrealistic to set the date because of many uncertainties at this stage.

Selection of A/E:

The first important task of OHB after the design-build contract with TMC was the selection of an architect and engineer (A/E), this may be one of the most important decisions on cost and quality of the building, as well as on the scheduling of the building development. OHB selected Gifles Associates, Inc. (GIF) in Nov. 1985.

After identifying ten potential candidate for A/E, OHB gathered important factors about them for the evaluation. The important considerations are as follows:

1) Location of design office.

2) Location of main design works.

3) Type of the firm; Architect/ Engineer, Engineer/Architect, and Architect/Engineer/Planner.

4) Specialization of works; manufacturing, building, power plant.

5) ENR ranking in 1984.

6) Current manpower and classification of the staff; architect, civil engineer, structural engineer, electrical engineer, mechanical engineer, and industrial engineer.

7) Current work load; backlog, total project amount in dollars, major projects.

8) Experience on major projects of automotive assembly; number of projects in the past five years, total floor area in this five years, main clients in this five years.

9) Experience with Japanese clients.

10) Proposed fee section; list alternate approach such as lump sum, hourly rate, cost plus fee, etc.

No selection process is foolproof, but gathering information in an organized manner can provide a clearer image of A/E candidates for the client.

GIF's outline according to OHB's evaluation sheet is as follows:

1) A/E's name; Giffles Associates, Inc.

2) Location of head office and branches; Southfield, MI, Troy, MI, Atlanta, GA.

3) Location of main design works; Midwest, West, and Southwest.

4) Type of the firm; Architect/Engineer.

5) Specification of the firm; manufacturing 66%, power plant 15%.

6) ENR ranking in 1984; 44th, 46.3 million dollars (design contract)

7) Current manpower and classification of staff; total 765, 125 architects, 40 civil engineers, 90 structural engineers, 83 electrical engineers, 147 mechanical engineers, and 54 industrial engineers.

8) Current work load; 24 projects. $1658 million (project amount), main clients are Ford and General Dynamics.

9) Experience on major projects of automotive assembly; 22 projects, 8 million SF, (clients) GM,Ford, VW, and Nihondensou (all in past five years).

10) Experience with Japanese clients; Nihondensou (Southfield), Mazda (Hiroshima plant), NEC (GA).

11) Fee, 3.25%

12) Other comments; the largest A/E among Detroit A/Es.

3-2-2 Design Stage:

Important events during the design stage are those such as "Engineering and Design," and "Building Permissions," in Figure 3-2-1, the Development Process Chart. The main actor on this stage is GIF. The main jobs of engineering and design began in Jan. 1986 and finished in Jan. 1987. KY is responsible for issuing various permits regarding city planning, environmental policy, and construction.

Engineering and Design:

After the architectural contract with OHB, GIF started schematic design through discussion with TMC assisted by OHB. Though GIF has had much experience both in automotive plants and with Japanese clients, OHB's role as a bridge between TMC and GIF is important because of communication difficulties, and TMC's higher involvement in design than other Japanese clients.

The schematic design phase began at the beginning of Jan. 1986 and almost finished in late Feb. 1986. Using the schematic design, OHB started the selection of general contractors from Feb. 27. Schematic design and design development phases finished in late Mar. 1986. After that, the construction documents phase began and finished in Jan. 1987. During this phase, GIF made working drawings, specifications, and bid documents. Working drawings total more than 1500 which are classified into five categories; architecture, steel structure, foundation, mechanical, and electrical. GIF does quantity survey and preliminary cost estimation. GIF divided the bid documents into 47 to manage the design process for the fast track program.

One of the peculiarities of TMC is that it has a large division for the facility environment including maintenance and construction (Shisetsu Kankyou Bu), which has about 200 staff members. In the division, TMC has a registered design and engineering office, which has about 100 staff. Because TMC has sophisticated planning and facility groups having the knowledge and ability to do everything of an A/E's functions for its plants in Japan, the level of TMC's involvement in and requirements for the plant design is one of the heaviest among GIF's clients. At the same time, TMC's heavy involvement in the Toyota KY plant design is one of the reasons to select a Japanese design-builder to cover the lack of experience of building development in the U.S.

Though TMC is a competent company in engineering and design for the facilities in Japan, it may well be an ordinary major industrial corporate client in the U.S. According to the classification of industrial clients by Lefebvre,[76] the major ordinary industrial client organization has a planning group representing the division requiring the facility, a corporate plant engineering, construction group, the coordinator of the development of the project among the division, top management, and A/E.[35] TMC's situation for the Toyota KY Project may well be like this ordinary client, though TMC communicates through OHB with GIF.

While TMC is famous for its just-in-time production system, it is one of the leading companies which employ the Total Quality Control program. TMC applies the TQC program to all phases of the company operations, such as management, sales, production, procurement, and construction.[22] Feigenbaum argued that QC programs should focus on defect prevention rather than inspection. Though his proposals did not impress American corporations, his basic ideas were accepted and modified in some parts by many Japanese corporations including TMC. Among many special features of the TQC program, the intensive use of value engineering (VE) for various steps in company's operations including its plant construction caused some stress between TMC and American construction industry during the project.

TMC's policy, applying the TQC program for its construction, is unusual even in Japanese automotive plant construction projects. TMC has developed the application of TQC for its management of construction by long time association with selected general contractors including OHB in Japan. OHB and other selected general contractors have developed their own programs to respond to TMC through long time experience with TMC's projects.

Because TMC's TQC program for the construction works well by the long term relationship with limited general contractors in Japan, the excessive application of the TQC program for the new project in the U.S. caused some stress among the project members. This aspect will be discussed further in section 3-2-4, Construction Stage. Even a Japanese contractor that has no prior experience of TMC's project would certainly have some difficulties in responding appropriately with TMC's requirements. GIF, supported by OHB, basically does its design and engineering works well, but certainly there are many surprising things for GIF in its interaction with TMC.

Possible reasons for GIF's surprises in the association with TMC are as follows:

1) GIF's lack of previous experience of TMC's projects.

2) TMC's lack of experience with the fast-track program and construction in the U.S.

3) Differences of business relationships of clients with the A/E between Japan and the U.S.

4) Group decision system of Japanese management system including TMC's.

5) Some conflicts between intensive VE as a part of the TQC program and the fast-track program.

Even though OHB works as a buffer between TMC and GIF, the inherent mismatch of intensive VE with the fast-track program generates some stress for TMC, OHB, and GIF at the engineering and design stage. Many change orders during construction are usual in fast-track program. Therefore the flexibility of the tentative drawings (though it costs a little) is more important than very detailed analysis for some items that have to include some undecided items.

Though TMC understands special features of the fast-tack program conceptually, it has had some difficulties in adjusting their traditional management style for its construction. For instance, space efficiency, which is a typical goal for Japanese auto manufacturers, has caused TMC to lose flexibility of tentative drawings for design changes. In the fast-track program, construction of the building shell begins without defining the building service equipment, such as HVAC, plumbing, and M/E. Though the building shell can be divided relatively easily into each shop, the building service equipment need to be connected as one system. Therefore, in the fast-track program, building layout should have enough space that gives flexibility for the connections of building service equipment that will be designed during the shell construction. TMC tried to get space efficiency through intensive VE on the early stage of design. As a result, this caused costly joints of building equipment between buildings.

The slow decision making procedure of TMC and less commitment of authority to OHB and GIF creates some inefficiency in the fast-track program. Intensive use of V/E in the TQC framework has many advantages in the office or in plant development especially in the traditional construction process that needs minimal change orders, but in the fast-track program , delay of decision from appropriate timing by the excessive use of VE and group decision process may well cause more disadvantages than advantages by VE.

Besides the complexity of the fast-track program, cultural difference may cause some frustrations between the client and A/E. Some cause for difficulties at the design stage related to cultural differences are as follows:

1) The complicated process for the A/E to ask Japanese clients to provide some information or to give permissions.

2) Japanese clients' unorganized manner to request design

changes.

3) Difference of language.

4) Different conceptions on the same words.

For OHB, TMC's policy of heavy involvement in the design and construction of the Toyota KY Project is one of the most important reasons to become the design-builder by itself rather than to have Citadel do the design and construction of the project. OHB's goal is to satisfy TMC by not only providing the new facility of satisfactory quality within the budget and schedule but also offering appropriate service that fulfills TMC's requirement. Coordination between TMC, GIF, and the general contractors is a very complicated matter; this may well be the most important factor why OHB got the project from TMC.

Project Permissions:

Kentucky state and Scott County governments are responsible for approving the project, checking various issues such as city planning, environmental policy, and building design and construction. Time and the complexity of obtaining permits are very important for a short-schedule project. Even at the site selection stage, all permissions were studied carefully by TMC and OHB. Assistance and some simplification of permission procedures by KY were considered as an important part of incentives for TMC.

1) City Planning Act:

As explained in the site selection stage, Scott County decided to rezone the project site area by itself. Actually, the planning commission, consisting of Scott County, Georgetown, Sadieville, and Stamping Ground, administers comprehensive plan, zoning, building permits and others. Only the zoning ordinance has a direct influence on the Toyota KY project; the regulating for industrial zone (I-1) includes such factors as minimum lot size (more than or equal to five acres), building coverage (at most 50 %), set back (50 feet for front and side, 25 feet for back), and allowable facility usages. No serious obstacles exist in the zoning ordinance for the project.

2) Environmental Protection Act:

Environmental protection regulations are complicated and very important for industrial building developments. Through time and complexity to obtain environmental regulation permits at the site selection stage, the start of building construction was delayed by one and half months because of the delay of obtaining EPA permission.

KY does not have a State Environmental Policy Act (SEPA), which many other states have legislated. Therefore, TMC does not need to make an Environmental Impact Statement (EIS) or to go through the time-taking procedures (public announcement, public hearing, etc.) which are required by SEPA in some other states.

KY requires developers to get the permissions shown in table 3-2-2 (not including those at the plant operation stage) from the Department of Environmental Protection in KY. These are based on Federal law, such as the Clean Air Act, the Clean Water Act, and the Resource Conservation and Recovery Act. The Division of Air Pollution Control, of Waste Management, and of Water evaluate applications and issue permissions individually. The

Table 3-2-2
Required Permissions Regarding Environmental Policy or Construction Stage in KY

Administrative Division	Persmissions	Comments
A. of Air Pollution Control	1. Construction Permit	Air pollution source and construction of air pollution control facilities.
	2. Prevention of Significant Deterioration (PSD) Construction Permit	Similar permission to the above. Some criteria are different from 1. PSD permission is applicable for facilities that prodece more than 250 ton/year pollution.
B. of Waste Management	3. Hazardous Waste Generator Registration	Sources of non-poison waste 1 ton/month or poisonous waste 1 kg/month.
	5. Hazardous Waste Facility Permit a. Storage b. Treatment c. Disposal	The following facilities' construction and operations.
C. of Water	1. Waste Water Facility Construction Permit	Construction of waste water treatment facilities.
	2. Waste Water Facility Operating Permit	Operation of waste water facilities.
	4. Flood Plain Construction Permit	Change of natural waterway or flood plain.

Source: OHB's internal paper.

construction permit (A-1) is the most important permission for TMC to obtain before the start of building foundation work.

3) Construction Permissions:

The KY state government and the local government check and issue building permits. The applicable law is the Kentucky Building Code, the National Electrical Code, and others. To achieve TMC's short construction schedule, TMC and OHB studied the time and complexity of obtaining building and construction permits as well as the possibility of the fast-track program at the the site selection stage. During the design or construction phase, GIF applies for permissions; on the other hand, the Department of building of the KY government is responsible for issuing most permissions.

A fast-track program is possible in KY because developers can get partial permits according to the design progress. The following six permits are needed for developers to get individually:

1) Foundation permit; This permit is for the building foundation, machine foundation, and foundation pile. Preliminary fire sprinkler plan drawings and plumbing drawings related to the foundation are required for the application. Getting all permits regarding environmental regulations before the application is necessary. Individual application for building foundation from the machine foundation, or individual application for each building in one project that has several buildings is possible,too.

Given that the Department of Building in KY and GIF keep continuous and close contact, the Department Building will issue permits within several days after GIF's applications. This condition is applicable for the following permissions:

2) Shell Permit; This permit is for the building shell that does not include interior finish works. Further divided applications, such as structural steel, roof, or exterior wall, are possible.

3) Interior Improvement Permit.

4) HVAC Permit.

5) Fire Sprinkler Permit.

6) Electrical.

The department of Building does not do plan to check for building service electrical equipment or production electrical equipment. Resident inspectors inspect and approve the electrical works.

Another advantage for TMC is the non-requirement for a grading permit in KY, that is, site clearing, grading, and excavation can proceed without permission.

KY appointed an officer for the project to facilitate the clerical procedure of permissions. KY also suggested that TMC submit applications to the local government and the state government simultaneously though usually developers submit applications only to the local government. This simultaneous application facilitated the permission procedure because approval by the state government is necessary for the local government to issue permits.

Permissions for the installment of production equipment is flexible. If KY judges the site safety by OHB's submission of machine layout and by the signs of safety methods at the site, installment can start without the occupancy permit. Japanese equipment that has some past records in the U.S. or has a certificate of Japanese authority is no problem.

Other important permissions or the procedures during design and construction are as follows: TMC needs the permissions of the Department for Environmental Protection for plumbing and waste water drawings; TMC can start the production by obtaining the Temporary Occupancy Permit before the Occupancy Permit; KY examines drawings of boilers, compressors, and fuel tanks; land scape work does not need permission; the retention pond won't be necessary; the state government sends all resident inspectors.

3-2-3 Procurement Stage (including labor relations)

Important events during the procurement stage are those such as "Selection of General Contractors," "Bidding Out," and labor relations shown in Figure 3-2-1, the Development Process Chart. On this stage, OHB assumes a very important role in coordinating GIF, GCs, and Subs, and in negotiating with the AFL-CIO and the KY government as an agent of TMC. Different objectives of TMC, OHB, KY, and the AFL-CIO are a cause of a labor-management battle.

Selection of GCs:

OHB selected six general contractors from 13 as area general contractors in late Mar. 1986, after the finishing of the schematic design. Before the selection of GCs, OHB defined itself as a design-manager who does not employ any hourly wage construction workers directly on its payroll. OHB also decided a hiring plan as the merit shop after the investigation of labor relations in KY. All selected GCs except for Gray Construction, an open shop contractor in KY are merit shop contractors. All contractors are capable of dealing with self-performance by non-union workers in case of troubles with the union.

OHB contracts with the general contractors by cost-plus-fee with guaranteed maximum cost. Appendix 1 shows a contract draft between OHB and NIC, a general contractor. This form is based on the AIA form. In the contract, Schedule A means the contractor's overhead and profit; Schedule B means personnel cost; Schedule C means site office expenses.

OHB uses a procedure manual in contracts with general contractors. The procedure manual, "Toyota Automotive Manufacturing Facility Project Procedure Manual," includes the following items:

1) Scope and Procedures - Project Purchasing.

2) Provided Project Services.

3) Cost Code Requirements.

4) Planning and Scheduling.

5) Document Control.

6) General Contractor Invoice and Application for Payment.

7) Accounting Report (Forms and Instructions for Submission of Monthly Progress Report).

8) Cash Forecasting.

9) Quality Control Procedure.

10) Contractor/Subcontractor New-Hire Safety Orientation.

11) Site Security Scope and Responsibilities.

Advantages for OHB to select the six general contractors are as follows:

1) it can reduce the risks of losing control over a general contractor that might act freely, in case of the single general contractor.

2) in the case of a strike or a slow down by the union, OHB can limit the damage and cope with it relatively easily because the unit of area is smaller.

3) OHB can reduce the risk of collusion among general contractors. The possibility of collusion will increase if the number of general contractors is two or three.

4) Dividing the project into six areas, OHB could choose GCs from

13 selected general contractors. Because most contractors that could contract the whole project are closed shop contractors, merit shop contractors capable of contracting the whole project are very limited.

The disadvantages for OHB to select six general contractors are as follows:

1) OHB's coordination work between the general contractors is necessary. For instance, joints between areas, especially of building service equipment, need OHB's coordination.

2) Redundancy of common information for all areas appears. OHB has to explain or provide the same information to six contractors.

3) Increased difficulties in getting a consensus regarding labor relations became apparent at the project agreement with the AFL-CIO during construction.

OHB defined itself as a design-manager because it tried to avoid an unnecessary political attack from the American construction industry by cutting off the operational or executional part of construction to American contractors, and probably because OHB does not have enough Japanese managers, engineers, or own forces for the self performance. OHB's project organization is explained in section 3-3, Project Organization.

Bidding Out:

OHB set the procurement policy of the general contractors as all subcontracting rather than general contractors' self perform. Therefore most subcontracts are fixed price contracts such as lump sum and unit price. Usual bidding process of the project is as follows:

1) A general contractor selects several qualified bidders.

2) The general contractor evaluates the bids.

3) OHB checks the evaluation and makes the report of the bid for TMC. All reports to TMC should be written in Japanese and most of them should have data or value engineering reports.

4) TMC approves the bidder.

Report making work of 3) above, account for a substantial amount of OHB's work. As TMC's tradition in Japan, it uses price competition of suppliers and contracts in every case, but sometimes price competition principles do not work in a fast-track program because general contractors cannot get more than or equal to two bidders in some cases, because of the strong linkages of several jobs. Then, some future work that is part of some sequential work may automatically be done by the contractor of the up front works. This kind of situation is new and surprising for TMC, so the phenomenon may well cause TMC's possible frustration.

The basic principle to decide the bidder is, of course, the lowest price. But OHB's hiring plan was affected by the AFL-CIO, even before the project agreement (PA) in Nov. 1986 that changes the project from a merit shop to an almost union shop. The original hiring plan before the PA actually favors union participation by guaranteeing that at least 50 percent of bidders should be union contractors.[45]

Labor Relations:

A strong construction union is a special feature of the

American construction industry. A labor-management battle is an important aspect of the Toyota KY Project. Though the analysis of the labor relations of the project is out of the scope of the thesis, this covers from the beginning of the negotiation between OHB and the AFL-CIO to the project agreement (PA) that changed the project from a "merit shop" to a closed shop in Nov. 1986. TMC, OHB, KY, and the AFL-CIO have different objectives which make the labor relations of the project complicated.

The "merit shop" reflects a market where union and non-union contractors work side be side. Figure 3-2-3-1 shows the[81] schematic structure of a merit shop.

As a background of the labor relations of the project, the Nissan Smyrna Project, Tennessee, was built with a merit shop, but the GM Saturn Project signed a project agreement with the AFL-CIO that made the project practically a closed shop. The Saturn project pact is "all execution contractors of whatever tier shall sign, accept and be bound by the terms of this project agreement."[55] This includes agreeing "to recognize the union(s) as the sole and exclusive bargaining representative for all craft employees on the project" and using their hiring halls.

Figure 3-2-3-2 shows the difference between a merit shop and the Saturn project pact.[81] Because non-union workers can register for the project in a union hiring hall, they have a chance to work for an open shop contractor in the project, but the open shop contractor has to use both union and non-union workers. Though union workers have a chance to work in the project, they will be assigned to the jobs after all union workers are assigned

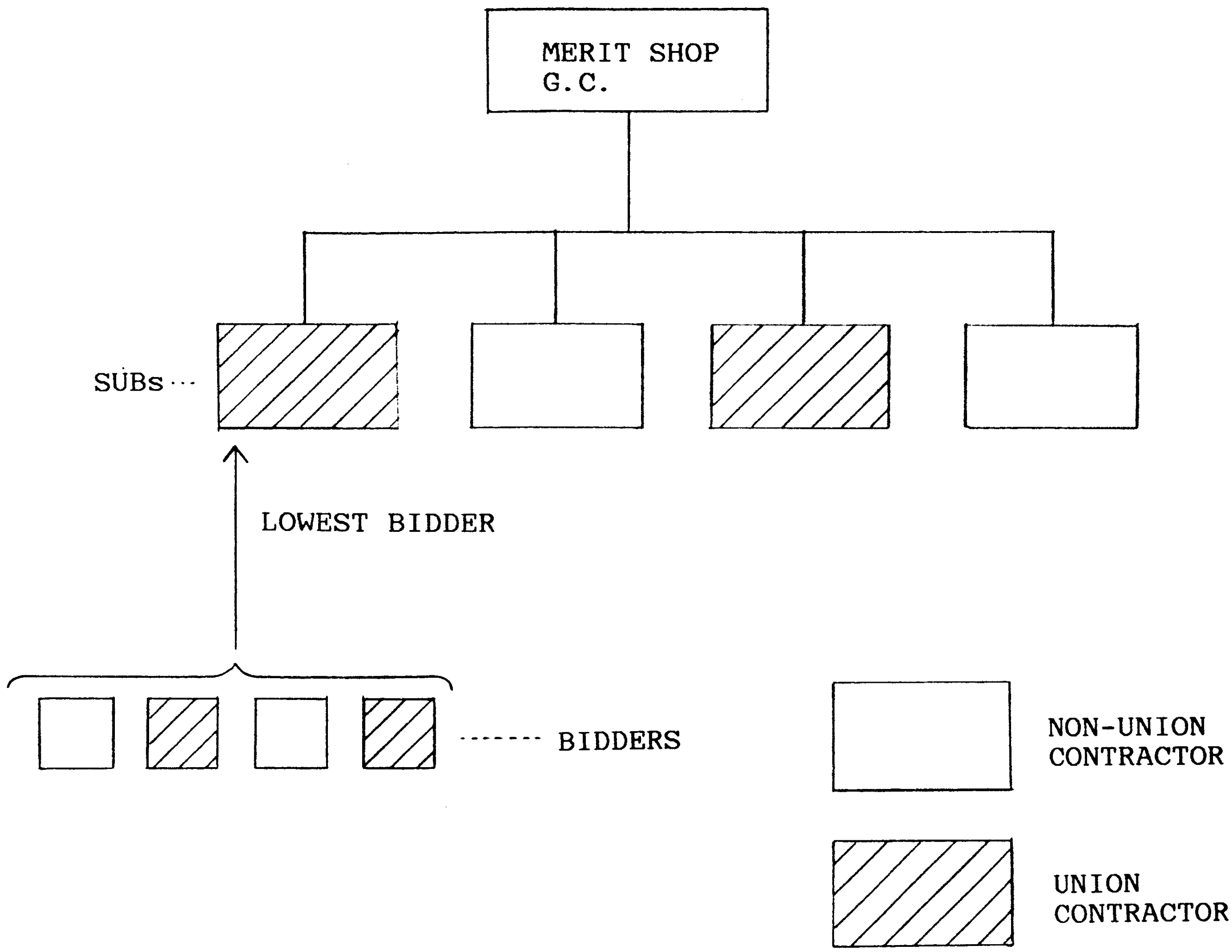


FIGURE 3-2-3-1: DIAGRAM OF MERIT SHOP

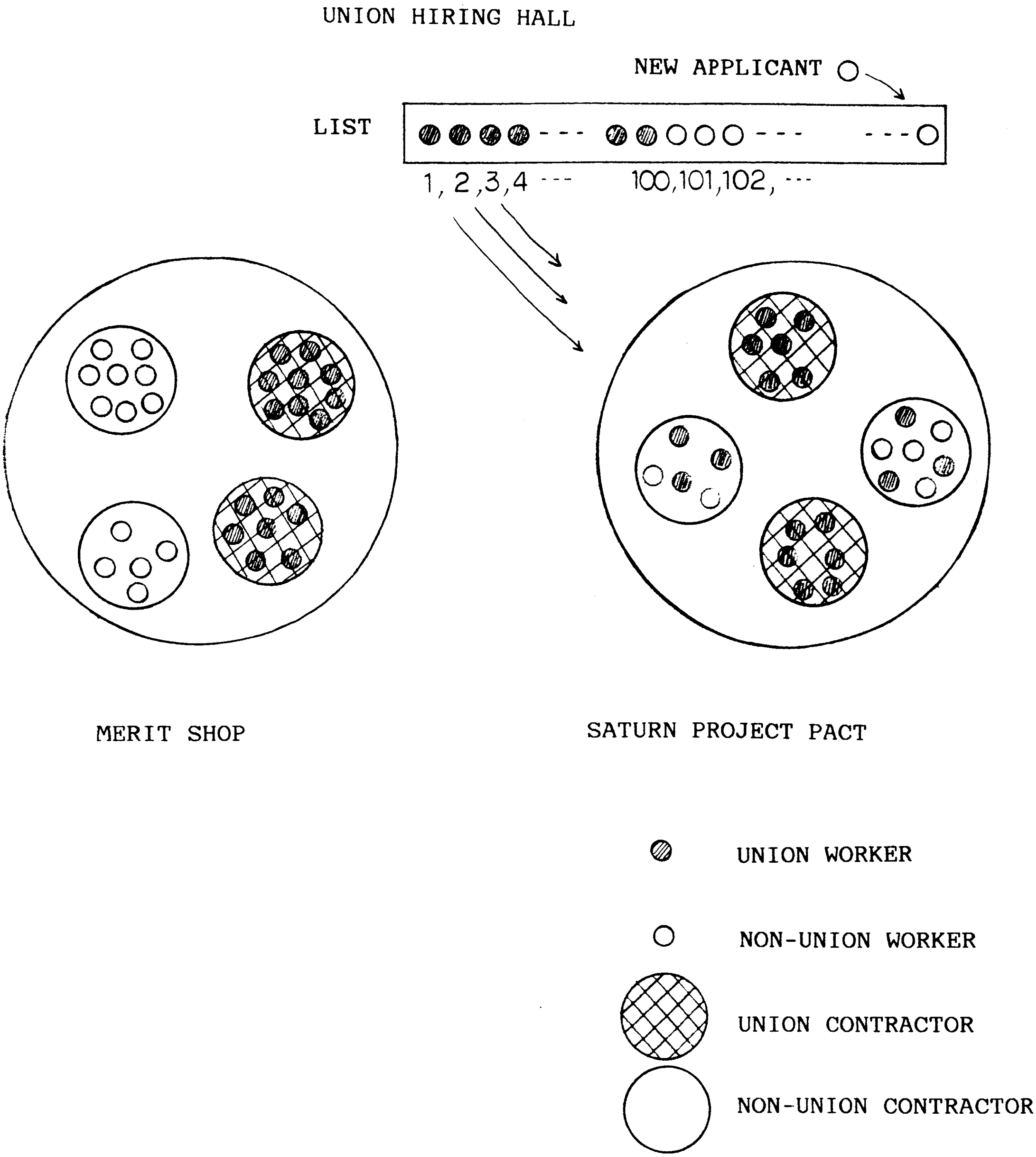


FIGURE 3-2-3-2
DIAGRAM OF MERIT SHOP AND SATURN PROJECT PACT

because union workers share the top portion of the waiting list in a hiring hall. For open shop contractors, they lose a chance to hire their affiliate workers, but on the contrary, they have to use many union workers who have no previous experience or loyalty to the companies. Open shop contractors also dislike their long term affiliate workers being unionized. A higher wage rate for their affiliate workers than the usual open shop rate is another cause for the open shop contractors to hesitate to participate in the project.

The nature of a project agreement between OHB and the AFL-CIO is very similar to that of the Saturn pact. From the beginning of the negotiation about the Toyota project pact, the union's policy was to use the contents of the Saturn pact for the Toyota pact. Finally, the AFL-CIO got it.

As the Saturn project pact does not match the labor situation in middle Tennessee where about 95% of construction is performed by open shop contractors,[55] the Toyota pact does not match the labor situation of the Lexington, Kentucky, area where 75% of the construction work force is non-union now, up from about 30% a decade ago.[42] Some estimates indicate that open shop construction accounted for 60% of the national total in 1980, compared with only 30% as recently as 1973;[12] the national trend of labor relations in construction is similar to that in KY.

Though many meetings have been held between OHB and the AFL-CIO, and between other related parties, some important events or national publications regarding labor relations of the project from the beginning of the construction to the project agreement are as follows:

Dec. 1985; OHB decided the hiring plan of the project as a merit shop. OHB made the decision after a careful survey of the qualified labor in KY and also after several talks with KY and TMC. Building trades did not oppose the merit shop so much at this stage.

May, 1986; Local union were going to sign OHB's proposed project agreement that included non-strike, non-lockout, free hiring of labor, no contesting employers' enforcement, permission for TMC or suppliers' installment of production equipments, and non-objection against prefabricated construction methods. On the other hand, the AFL-CIO sued the Budget Director of KY about the legality of the state incentives for TMC on May 7.

June, 1986; The Building and Construction Trades Department (BCTD) of the AFL-CIO rejected OHB's project agreement. Then, it decided a project boycott on June 19. Georgine, the president of BCTD, sent appealing letters to the president and senators. In KY, two building tradesmen petitioned the court to allow them to intervene in the court about the union's suit against KY. On the other hand, local unions proceeded to sign a revised local agreement that included most of OHB's proposals.

July, 1986; BTCD's objections against the local unions' movement towards the agreement with OHB became active. OHB held meetings with Georgine from July 2 to July 9, however, they failed to reach agreement. After the meeting with BCTD, OHB decided to continue the project with the merit shop based on the agreement with TMC, KY, and six area general contractors. OHB issued a letter of intent of caisson and foundation works on July 15. On ENR, July 17, Krizan reported "Building trades target Toyota."[33] He explained the negative reactions of local unions against Georgine. He cited a union contractor executive's comment that "local trades are agreeable to building it merit shop." According to the article, BCT's policy was that it would not give Toyota anything better than Saturn. In the Saturn pact, the union had the right to refer workers to jobs only through union halls.

Sep. 1986; Noble reported the project as "Town's Industrial Rebirth Mired in Labor Dispute," in The New York Times, on Sept. 8.[42] He explained the basic differences of the objectives between OHB and BCTD, though both parties express that their objectives are for Kentucky workers. According to his article, several members of the Labor and Industry Committees of the Kentucky House and Senate complained that the union effort could mar Kentucky's effort to improve its business image. Around this time, urged by Georgine, the sheet metal workers announced a national campaign against buying Toyota products.

Oct. 1986; The construction progressed smoothly despite the continued pressure by the AFL-CIO.

Nov. 1986; The union drew 500 for a rally to protest OHB and TMC's labor policies in front of the Japanese embassy in Washington on Nov. 17. The union also drew 1,500 to demonstrate against TMC in New York on Nov. 21. The union continues legal challenges to the plant's waste water discharge permit by KY, and KY's incentives for TMC. Kraker reported the project progress as

"Toyota plant plows ahead with no sign of union pact," in ENR, Nov.27.[31] The project had progressed at a high pace regardless of the union's pressure on this state. He states "Kentucky plant has more than 1,100 workers on site, some union despite boycott," as a comment with a picture of assembled steel structure frames.

Suddenly, OHB and the AFL-CIO reached an agreement calling for the hiring of union workers for the project (except contracts already held), on Nov. 25. On The New York Times, Nov. 26,[43] Noble reported the agreement as "Toyota Agrees on Union Workers To Construct a Plant in Kentucky." He cited a comment of Bennet, executive vice president of the Associated Building and Contractors (ABC), reporting that the agreement would create "a great deal of discrimination." Three provisions of the agreement are as follows:

1) It "makes a strong commitment to the preference to employment of Kentucky residents."

2) It "confirms that there will be no discrimination on any basis with regard to applicants to employment."

3) It "contains a unique three-member employment review board, one each from management and labor, with an impartial chairman, to assure that any questions regarding employment referral will be resolved expeditiously and fairly."

Dec. 1986; The project agreement was to take effect Dec.1. Recio, Usui, and Krizan wrote the agreement as "Toyota flip-flops, signs union pact at KY plant," in ENR, Dec.4.[49] They reported Georgine's and OHB's comments, ABC's comments, and sources' comments in Japan. Krizan and Schwartz reported the impact of the PA as "Toyota pact breaks new ground," and also stated "Kentucky project may be the largest ever to have a project agreement implemented mid stream." The article reported former Secretary of Labor John T. Dunlop would chair the employment review board.

TMC's comment on the accord is as follows: "We are very happy that an understanding has been reached between our Kentucky Project Manager, the Ohbayashi Corporation, and representative of the Building and Construction Trades Department. We look forward to continuing our Kentucky project in a spirit of cooperation and harmony."[51]

OHB's explanation of the reason for the agreement with the union is as follows: Though the merit shop had gotten strong support by the local construction industry and workers, OHB was afraid of an escalation of the union's attack against TMC or possibly other Japanese corporations in the U.S. OHB would have continued the merit shop if the union attacks against TMC/OHB had not expanded beyond the border of KY. Additionally, OHB does not want the labor disputes developing into a political problem, such as trade friction in the construction industry between Japan and the U.S. Finally, OHB tried to avoid KY's continuing to be the place of labor disputes.[50]

3-2-4 Construction Stage

The application of TMC's TQC program to the fast-track program is probably the most interesting topic at the construction stage of the project. Though this project is relatively simple in terms of physical aspect in construction engineering, the construction management is complicated because of the fast-track and many contractors. The project is easy to construct because buildings are accessible from many directions and the structure is a one story structural steel frame, but management of change orders, cost control, and quality control are complicated. The construction has progressed smoothly in comparison with the Nissan Smyrna Project, as of Jan. 1987. But there is some friction between the TQC program, the fast-track program, and the American construction system.

TMC tries to use value engineering (VE) in every change order to get the maximum cost efficiency, though in many cases it is practically unable to apply VE. If the cost of loss time or waiting time due to the delay of the decision on a VE case exceeds the cost down by the VE, TMC will suffer from not only the cost but also the bad effects caused by de-motivation of the construction workers, the subcontractors, and the general contractors. This mechanism is clearly different in automotive manufacturing than in construction. Because automotive manufacturing is a very repetitive production cycle, even if the cost of loss time exceeds the cost down by VE in one or several cycles, the total cost savings by VE in most case will exceed the one time loss by VE. This multiplier effect of VE is very rare in construction and varies tremendously with the subjects of the VE.

In a fast-track program, importance of instant decisions is emphasized to eliminate delay of construction and de-motivation of workers waiting for decisions. The priority of decision making on the production process between automotive manufacturing and construction may well be different. During the construction execution stage, especially after the completion of work drawings, the priority of supervisor's decision making may well be as follows:

1) promptness of the decision; quick and sufficient (not necessary to be the best).

2) avoiding rework; preventing from overdoing.

3) safety, cost effective, high quality, etc.

On the other hand, priority of the auto-manufacturing supervisor's decision making may well be as follows:

1) the maximum cost efficiency; the lowest cost/quality, or the highest quality/cost.

2) quality.

3) safety, etc.

In any case, automotive manufactures never give priority to promptness of decisions. In construction sites, most promptness of decisions guarantees cost savings and good quality of buildings because it promotes productivity and motivation of construction workers. All managers and engineers in construction sites both in the U.S. and Japan will certainly agree on the importance of quick decisions in construction. Samelson and

Borcherding's study about "Motivating Foremen on Large Construction Projects"[53] supports this idea. They summarizes after many interviews with foremen that the most important problems for foremen are waiting for decisions and rework.

TMC's tradition of pursuing maximum cost efficiency prefers bidding for any purchase, so general contractors bid out most jobs, and make lump sum or unit price contracts with subcontractors. But general contractors have to negotiate the cost of change orders with subcontractors rather than bidding out. Sometimes the costs of change orders counts for 50 % of the original contract in the project. Though the principle of VE and TQC is recently widely accepted by Japanese construction companies including OHB, it is not popular for American general contractors. Their unfamiliarity with VE and TMC's slow decision on VE cases may well cause a negative response against VE by American contractors and sometimes even by OHB.

The differences of the Japanese quality control system from the American system cause some friction between TMC, OHB, and the general contractors. OHB does not try to use its QC program in the U.S. because OHB knows the differences between the American QC system and the difficulties in applying the Japanese system for American subcontractors or general contractors. If the quality of the final products in the U.S. were apparently inferior to that in Japan, OHB would use its QC program actively.

One of the special features of Japanese-style QC is process control methods that require many checks during the production process rather than inspecting the final products only. American general contractors do not accept or understand the concept of process control. American general contractors try to avoid unnecessary responsibilities for the subcontractors' jobs by general contractors' inspections on subcontractors jobs during the tasks. If a general contractor approves some defective jobs of a subcontractor through the inspections, the general contractor will be responsible for the jobs that the subsequent subcontractor will definitely claim. In most work, a subsequent subcontractor's inspection of the previous subcontractor's works at the beginning of the former's job functions as a quality control system in American construction. For example, accuracy of the setting of anchor bolts for structural steel columns will be checked by erectors before their work, if the bolt setting is done by another subcontractor. In Japan, general contractors are expected to check the setting of anchor bolts before and after the concrete works. General contractors should keep the record of inspection quantitatively in many cases. Moreover, many big general contractors do statistical analysis of the data to evaluate subcontractors and to improve construction process using the Japanese QC program.

In the Toyota KY Project, OHB uses inspection firms or test labs for structural steel, geotechnical, and concrete. These services are quite usual because these works are not checked by other subcontractors in the construction process, and they are a part of the legal requirement. OHB also provides basic survey control.[79] General contractors are responsible for other quality control work and OHB witnesses their works. This system is quite usual for general contractors and a construction manager in the U.S. construction. But TMC tries to use its QC program in the construction process.

For the client satisfaction, OHB tries to use TMC's QC program as much as possible (maybe responding to 30% of TMC's requests). As expected, the general contractors reactions are very negative. This causes TMC's frustration. Then, TMC asks OHB to inspect several works directly as OHB does in Japan, however, OHB does not do so by itself because it has to avoid unnecessary responsibility by approving subcontractors jobs, and avoid disorder at the site.

3-3 Project Organization

This section explains the project organization including contract types. Three organizational charts of the project are used to explain the organizational structure. Especially OHB's project organization is explained in detailed organization charts showing the roles of each member. Appendix 2 shows the operation charts at every project development stage. These charts summarize the interaction between TMC, OHB, GIF, GCs, Subs, KY, and the AFL-CIO. Because the history of organizational formation including contract types is explained in 3-2-1, Planning /Pre-design stage, and 3-2-3, Procurement stage, this section mainly describes the structure of the project organization and roles of the members in OHB.

Figure 3-3-1 shows the outline of organizational structure and contract types of the project. Though detailed explanation of the definition of the project organizational systems is done in section 4-1, this structure is a design-build and design-manage type. General contractors also have some functions of construction management because they basically do not use their own forces, either. A contract between TMC and OHB is a cost-plus-fee contract because of the fast-track program. OHB contracts GIF by a percentage fee contract with a fee-adjustment clause for the project cost changes by change orders. Contracts between OHB and general contractors are a cost-plus-fee with guaranteed maximum general contractors' cost. All subcontracts by the general contractors are a lump sum or unit price contracts.

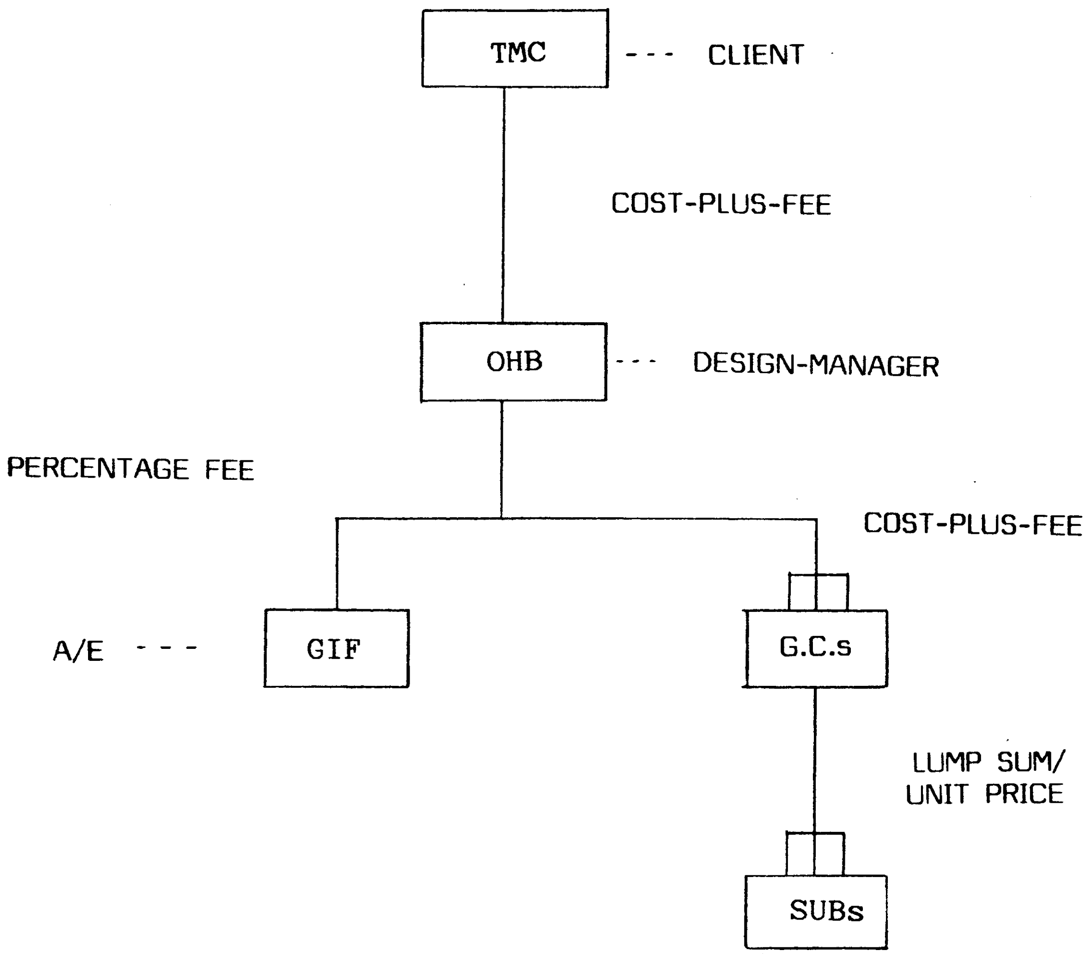


FIGURE 3-3-1
OUTLINE OF PROJECT ORGANIZATION AND CONTRACT TYPE
OF TOYOTA KY PROJECT

Though OHB is responsible for the project completion to TMC, OHB takes no risks of uncertainties of the project cost, that is, OHB never loses money on the project. Important factors of OHB's motivation are to keep or obtain its good reputation in the U.S. and in Japan's construction industry. OHB contracts with general contractors by a cost-plus-fee contract, too. Because OHB and general contractors contracted just after the schematic design phase (without construction documents), a cost-plus-fee contract was the most reasonable contract. By the contracts with general contractors, OHB has passed out some portion of construction management tasks to them.

Contracts between OHB and GIF, and between general contractors and subcontractors, are the usual types in a fast-track program in the U.S. For example of a fee adjustment method, calculation of a total price after change orders in a unit price contract is as follows:

1) in the case of cost increase change orders, the new total price is the base price plus additional quantity times 20 percent above the unit price.

2) in the case of cost decrease change orders, the new total price is the base price minus the decreased quantity times 20 percent less of the unit price.

Because TMC has used a lump sum contract with its general contractors, TMC's experience of checking the project cost during construction must be limited practically to the check of progress payments of the lump sum contract for general contractors. TMC has a very detailed cost checking system for its construction, however, it may not be able to apply cost checking to a cost-plus-fee contract during construction. The number of items to be checked in a cost-plus-fee contract is much more than that of progress payments. Moreover, large number of change orders probably are a new experience for TMC. In Japanese construction, OHB sometimes accepts TMC's change orders without extra charge. But in this project, OHB charges all costs and cost changes of change orders to TMC. It may be upset because of OHB's very different operations in the U.S. from that in Japan, though TMC conceptually understands this mechanism.

Figure 3-3-2 shows the organization structure of OHB for the project. All important decision making functions of OHB regarding the project are in KY, but OHB's project organization has some staff in the Tokyo office because TMC's important decision making functions are in Toyota City. OHB is the general manager of all TMC's projects by OHB in Japan because of the large amount of TMC's orders and because of the importance of TMC as a client for OHB in the long-term relationship. Because GIF's main office is located in Detroit, OHB has the design team in Detroit, to coordinate TMC and GIF. OHB also has the project design staff for the project in a design department in the Tokyo head office.

Figure 3-3-3 shows the organizational structure of OHB's site office. There were 21 Japanese and 36 American staff working in the Georgetown site and Lexington offices in Jan. 1987. According to the organizational structure chart, the Japanese and American staff seems to be well integrated. The

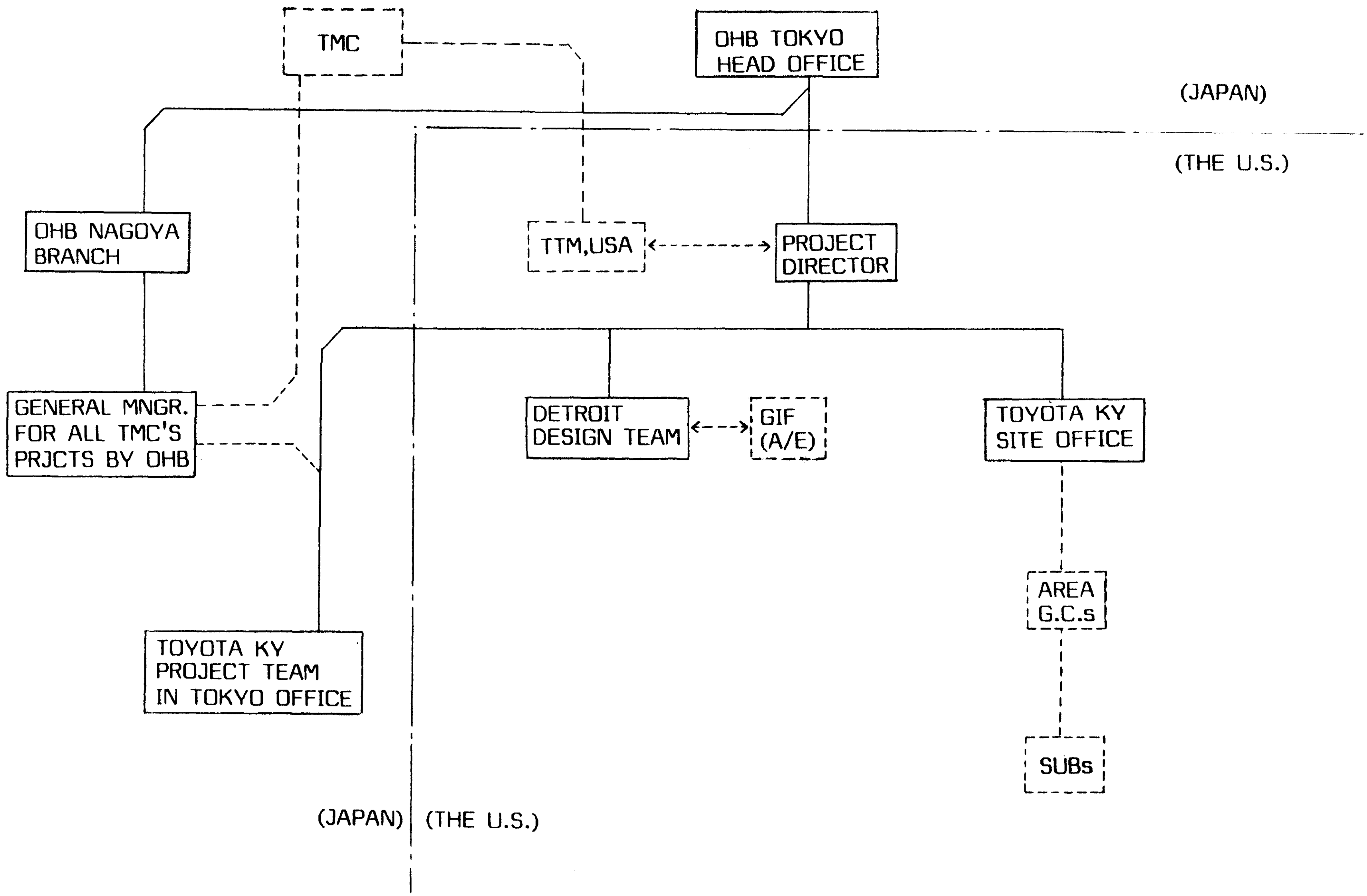
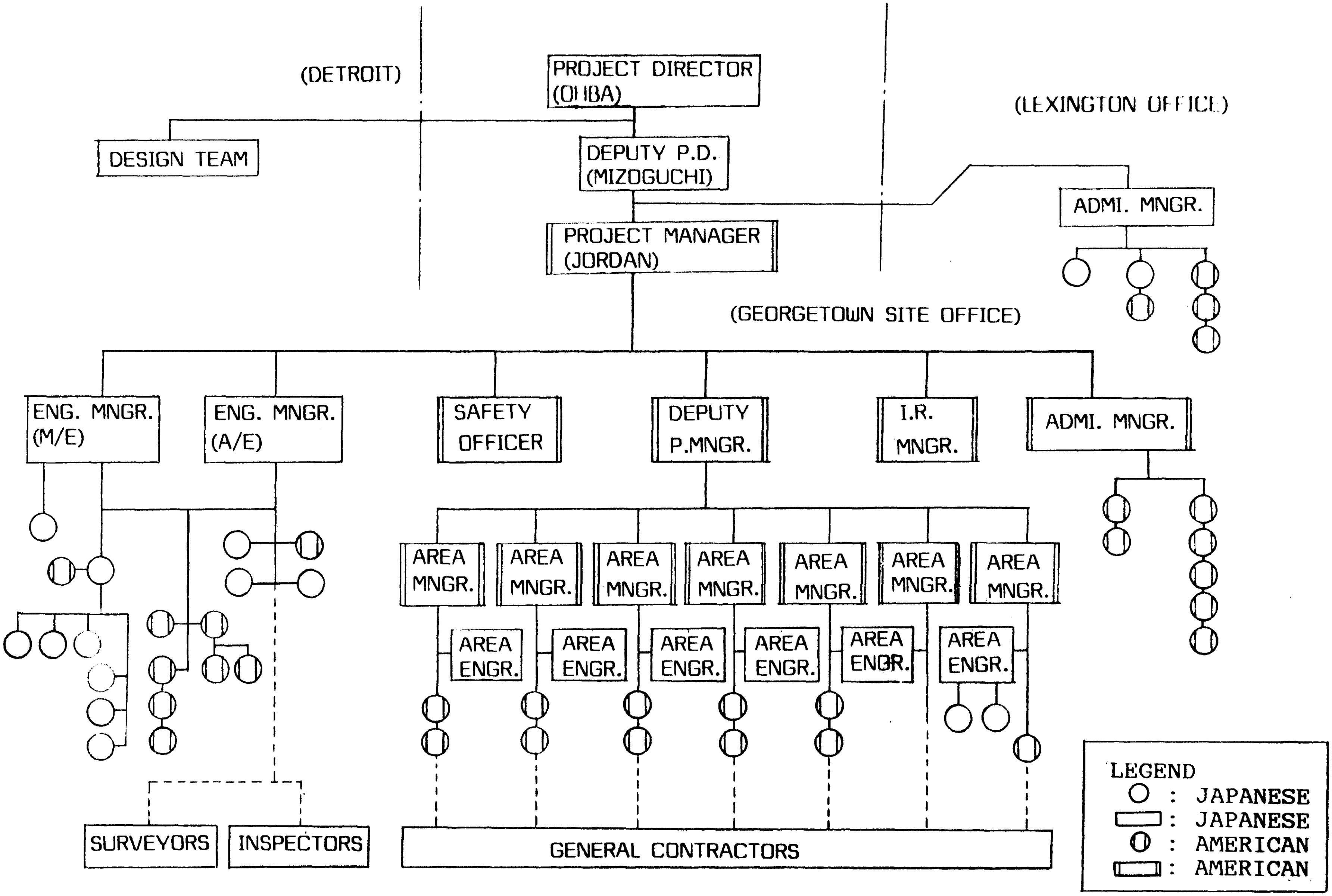


FIGURE 3-3-2
OHB'S ORGANIZATION CHART FOR TOYOTA KY PROJECT (1)



(AS OF JAN.1987)

FIGURE 3-3-3
ORGANIZATION CHART OF OHB'S TOYOTA KY SITE OFFICE (2)

organization basically works well as a construction manager that coordinates the client, the A/E, and the general or sub contractors. Because OHB has to adjust to the large gap between TMC and American contractors, OHB's organization has two substructures; the Japanese staff structure and the American staff structure. The substructure of the Japanese staff is mostly dealing with correspondence with TMC. The other American staff substructure is mostly dealing with the management of general contractors and suppliers. The Engineering section, which has two Japanese engineering managers, could be described as the junction of the two substructures in OHB's organization.

The Project director, Ohba,[81] seems to have two direct subordinates in the site office; Mizoguchi,[77] the Deputy Project Manager, and Jordan,[73] the Project Manager. Mizoguchi is at the top of the Japanese staff substructure and Jordan is the leader of the American staff. Because of communication difficulties and the tendency of members' following only a substructure, or simply because of the matter of their personality, some difficulties of cooperation between Area Managers and Area Engineers seem to be the weakest point of the organization. On the other hand, from the viewpoint of learning experience for the Japanese staff, Engineering Managers[79] and Area Engineers[78] are in an excellent situation because of the necessity of cooperation with American Managers, and actually in several areas they cooperate well.

Appendix 3 describes the detailed roles of some managers in OHB's site organization. Except for the Area Engineers in the organization, the basic structure of OHB's organization in the

Toyota KY Project is very similar to that of Daniel's site organization in the Nissan Smyrna Project.

4 Alternative Procurement methods (including classification of the four automotive plant development projects).

Because of lack of consensus or standards on terminology of procurement methods, such as construction management, design-build, and prefabrication systems, it is necessary to define it to discuss the advantages and disadvantages of each method. Because of the popularity and explicitness, the author chooses Barrie and Paulson's (B&P) Professional Construction Management[1] as the text book to define alternative construction management methodologies. Based on B&P's definition, the author developed a framework of project organizational systems in a triangular shape in Figure 4-1-3. Because Minden's[38] procurement methodology is used to examine automotive plant construction projects in Chapter 5, his terminology is summarized here in comparison with B&P's that the author mainly uses to classify the four projects in this section. After a brief review of terminology, the Toyota KY, Nissan Smyrna, Toyota Tahara, Fuji Gunma projects are classified according to the framework.

The author does not intend to cover the detailed variation of the project organization but to present simplified contractual approaches. If we try to define alternate organizational structures of projects, the description will easily overflow one chapter. For example, Walker uses 42 alternatives including two types of clients, three types of design teams, and seven types of contractor's appointment in Project Management in Construction[14]. B&P uses six main types including a traditional, two types of turnkey, an Owner-Builder, and two types of construction management. Minden uses five major classification, such as traditional, design-construction-management, contractor-construction-management, design-build, and systems.

Basic elements to classify project organization or procurement methods are project participants, relationships between members, and timing of project members' participation. Project participants are those such as an owner, a designer, a general contractor, subcontractors, own forces work, a construction manager, design-builder, and a systems contractor (manufacturer). Important relationships between project participants are contractual rather than normative. Cost-plus contracts, an important construction contract, are further classified according to J.P.Frein,[4] as follows:

1) Cost plus a percentage fee.

2) Cost plus a fixed fee.

3) Cost plus award fee.

4) Cost plus a fixed fee with guaranteed maximum.

5) Target estimate with incentive fee and penalty.

6) Turnkey proposals (variable conditions).

7) Construction management contracts.

Timing of the project members' participation is another important element to define procurement methods though B&P do not explicitly introduce this idea to their definition but rather treat the timing as a consequence of the procurement methods. Minden uses this concept indirectly in his definition by combining organizational structure and its phasing. Especially Minden's definition of the traditional method is more explicit than B&P because he clearly states that the key feature of the traditional method is total separation between the design and construction phases. If the concept of the timing of the project members' participation is employed explicitly, the key feature of the traditional feature of the traditional method will be described as follows: the key feature of the traditional method is the timing of an appointment of a prime contractor after the completion of construction documents by the A/E. This concept is very important because the Nissan Smyrna Project organization may well be classified as a traditional method if the timing of Daniel's participation is ignored.

B&P's definition of procurement methods is as follows:[1]

The Traditional Approach: Members of the Associate General contractors of America (AGC) have generally advocated and operated under the traditional method. Here the owner employs a designer (Architects, Architects/Engineers, or Engineers) who first prepares the plans and specifications, then exercises some degree of inspection, monitoring, or control during construction. Construction itself is the responsibility of a single general contractor under contract to the owner. Much of the work may actually be performed by individual trade contractors under subcontract to the general contractor. Although the subcontractors normally bid upon a portion of the owner's plans and specifications, their legal contractual relationships are directly with the general contractor; the latter, in turn, is responsible to the owner for all the work, including that which is subcontracted.

Design-Construct or Design-Manage (Turnkey): Some authorities differentiate between "design-construct" and "turnkey." General usage, however, treats them interchangeably. In this method, all phases of a project, from concept through design and construction, are handled by the same organization.

In the case of design-construct, the constructor acts as a general contractor with single-firm control of all subcontractors. Usually, but not always, there is some form of negotiated contract between design-constructor and owner. In the case of design-manage, construction is performed by a number of independent contractors in a manner similar to the professional construction management concept. Under either design-construct or design-manage, construction can readily be performed under a phased construction program to minimize project duration. this form of completing project has been used for the majority of

process-oriented heavy industrial projects constructed in the United States in the last few decades. Reference to Engineering News-Record's annual list of the 500 largest designers shows that the design-constructors are heavily represented in the top 20.
Professional Construction Management: Professional construction management unites a three party team consisting of owner, designer, and construction manager in a non-adversary relationship, and it provides the owner with an opportunity to participate fully in the construction process. It is competitive in overall design-construct time with a negotiated contract under the traditional method and with the turnkey (design-construct/design-build) approach. It usually features a number of separate lump-sum or unit-price construction contracts which, under certain circumstances, may prove more competitive than either the general contract or the cost-plus-a-fee approach. If phased construction is used, it, like phased construction under other methods, involves the owner in some degree of risk in overrunning budgets.
(The author omits B&P's definition of "The Owner-Builder" because of little application in automotive plant construction.) 38

A summary of Minden's definition of procurement methods is as follows:

Traditional Method; Typically this is the "default" method selected in the absence of unusual project requirements or market constraints by owners without significant management capability, particularly if they are risk adverse and/or required to competitively bid work.
Construction Management (CM); At the very minimum, some degree of cost estimating and contractibility feed back construction management services are useful on almost any project where cost and time are significant constraint, even if a conventional schedule and single responsibility contract is used. However, if fast-track scheduling, multiple work packages or systems are used, some form of CM, either in-house or by an outside CM is generally called for.

However to use CM in this way, the owner either has to be prepared to accept most risk associated with multiple contracts directly, as with in-house or design-CM, or he must be able to effectively negotiate with the CM to avoid an inflated risk premium as in contractor-CM with a guaranteed price. In either case the owner should have sufficient management capability in-house to "manage the managers." If these conditions cannot be met, the owner is limited to design-CM with a single responsibility general contractor, (which is essentially the traditional method with enhanced value engineering), or, in some cases, he may use design-build.
Design-Build; The main contingency factor governing the decision to use design-build is the extent to which the project can be defined in terms of scope and generic standards, as opposed to prescriptive detail, without compromising quality or other requirements. Because the designer works directly for/with the

contractor, not the owner, the owner must have the management capability and/or the negotiation power to ensure that the project meets technical requirements at a fair price. If these conditions are met, then design build may offer not only a means of obtaining an early, competitive, fixed price, single responsibility contract, but also optimal fast-track scheduling and value-engineering, owing to the high level of design and construction integration.
(The author omits Minden's explanation of "Systems Methods" because of little application in automotive plant construction.)

Though there are several minor differences between Minden and B&P's definition regarding procurement methods, three basic categories, traditional, design-build (design-construct/turnkey), and construction management, are similarly defined. The concept of the traditional method is common between them. Because of Minden's orientation to public agencies that need accountability, especially of spending, his definition of design-build and contractor mode CM are relatively narrow because of the emphasis of possible fixed price contracts in these methods. In this sense, B&P's definition is more flexible and easier to classify various procurement methods or project organizations than Minden's. Therefore, B&P's definition is employed in this section, and supplementally Minden's definition is used to explain the relation with B&P's.

In order to classify four automotive plant construction methods, such as the Toyota KY, Nissan Smyrna, Toyota Tahara, and Fuji Gunma, Figure 4-1-1, a Flow chart for the Classification of Procurement methods, is used. The first check is whether the project uses different A/Es from a single contractor appointed after the completion of detailed design. If the answer is positive, the project will be a traditional method that has some variations, especially in its contract types, between an owner

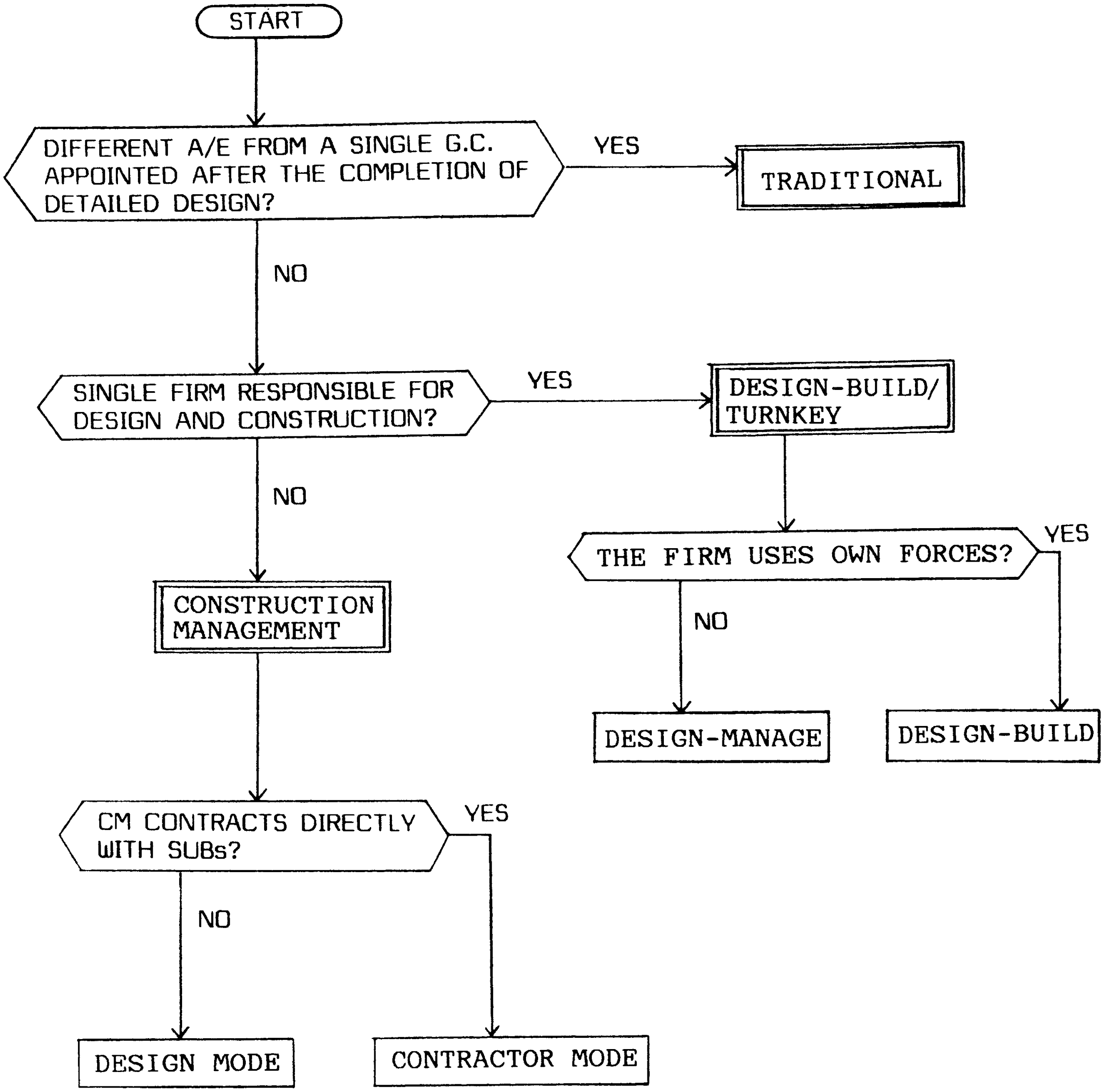


FIGURE 4-1-1
FLOW CHART OF THE CLASSIFICATION OF
PROJECT ORGANIZATIONAL SYSTEMS

and a general contractor. If the project is not traditional, the second question is whether the project has a single firm responsible for design and construction. If the answer is positive, the project will be a turnkey/design-build that is further classified as design-build or design-manage. If the project is not turnkey, the project will be classified as a construction management that has two modes, Design/CM mode and Contractor mode. Though this chart may give an impression of definitive classification, each project organizational system can be adjustable to some extent to have some characteristics of other systems.

Figure 4-1-2 gives a simplified B&P's project organization[1] chart of each major approach (the author has modified graphical expression, added comments on the traditional model, and omitted the owner-builder model). The most confusing methods are the traditional and contractor mode CM methods. Though a lump sum contract between an owner and a general contractor is the most popular in the traditional method and a cost-plus-fee contract is usual in the contractor mode CM, it is still possible for both methods to form a similar contract type. The most distinctive difference of these two methods is the timing of the appointment of the general contractor. Early appointment of a general contractor to enhance design construction integration or to manage a fast-track program is an important aspect of the construction mode CM.

Other confusing contractual approaches may well be design-build and design-manage in design-build/turnkey. If a design-

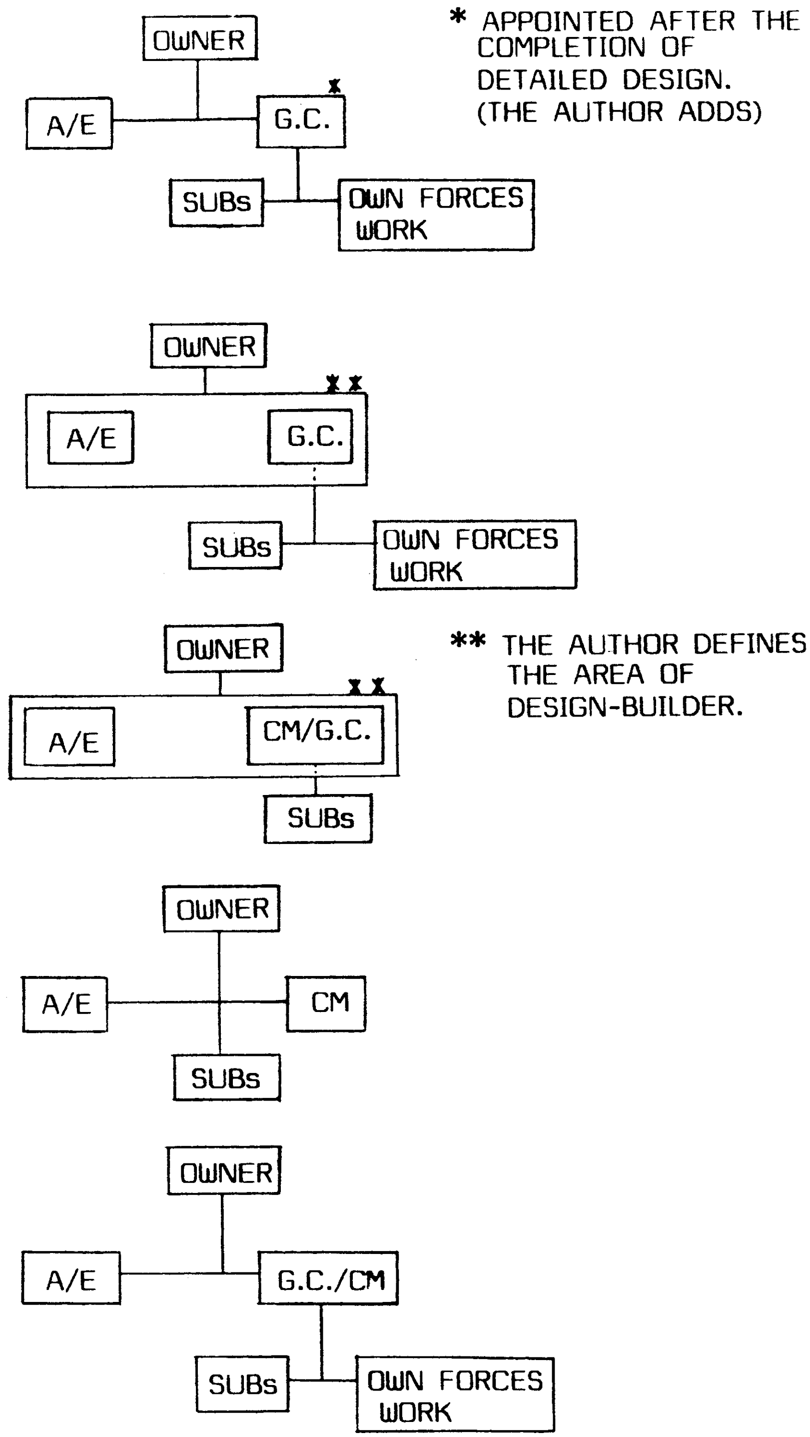
TRADITIONAL

TURNKEY/DESIGN-BUILD
1) DESIGN-BUILD

2) DESIGN-MANAGE

CONSTRUCTION MANAGEMENT (CM)
1) DESIGN/CM MODE (AIA MODE)

2) CONTRACTOR MODE (AGC MODE) (POSSIBILITY OF GMP BY GC/CM)



AFTER BARRIE & PAULSON

FIGURE 4-1-2
BARRIE & PAULSON'S OUTLINE OF ALTERNATE CONTRACTUAL APPROACH

builder does self performance, that is, if it uses its own forces' work, the method will be design build because the design-builder acts as a constructor in the construction phase. If a design-builder or the prime contractor of design and construction does not execute self performance, the firm will be classified as a design-manager because its major function in the construction phase is as a manager rather than as a builder. It can be said that the design-build method corresponds to the contractor mode CM and that the design-manager does design/CM mode CM.

Figure 4-1-3, a framework of the project organizational systems, gives the relationships of alternate procurement methods. To construct the diagram, the author uses loosely the idea of the Mintzberg's contingency theory of organization. For the simplification, the contract types and the timing of general contractor's participation are selected as contingency factors. The most conventional procurement method is located at the top of the diagram as a lump sum contract with a general contractor after competitive bidding. Some variations, such as a negotiated contract with a general contractor and early decision on a general contractor will pull the location of a procurement method downward. Turnkey/design-build and Construction management are located at the same level because their advantages, such as design and construction integration, and the possibility of a fast-track program, are the common features. The fixed price contract pulls the location of a turnkey or CM method upward, that is, approaching a traditional method. As exogenous factors, the necessity of a fast-track program or

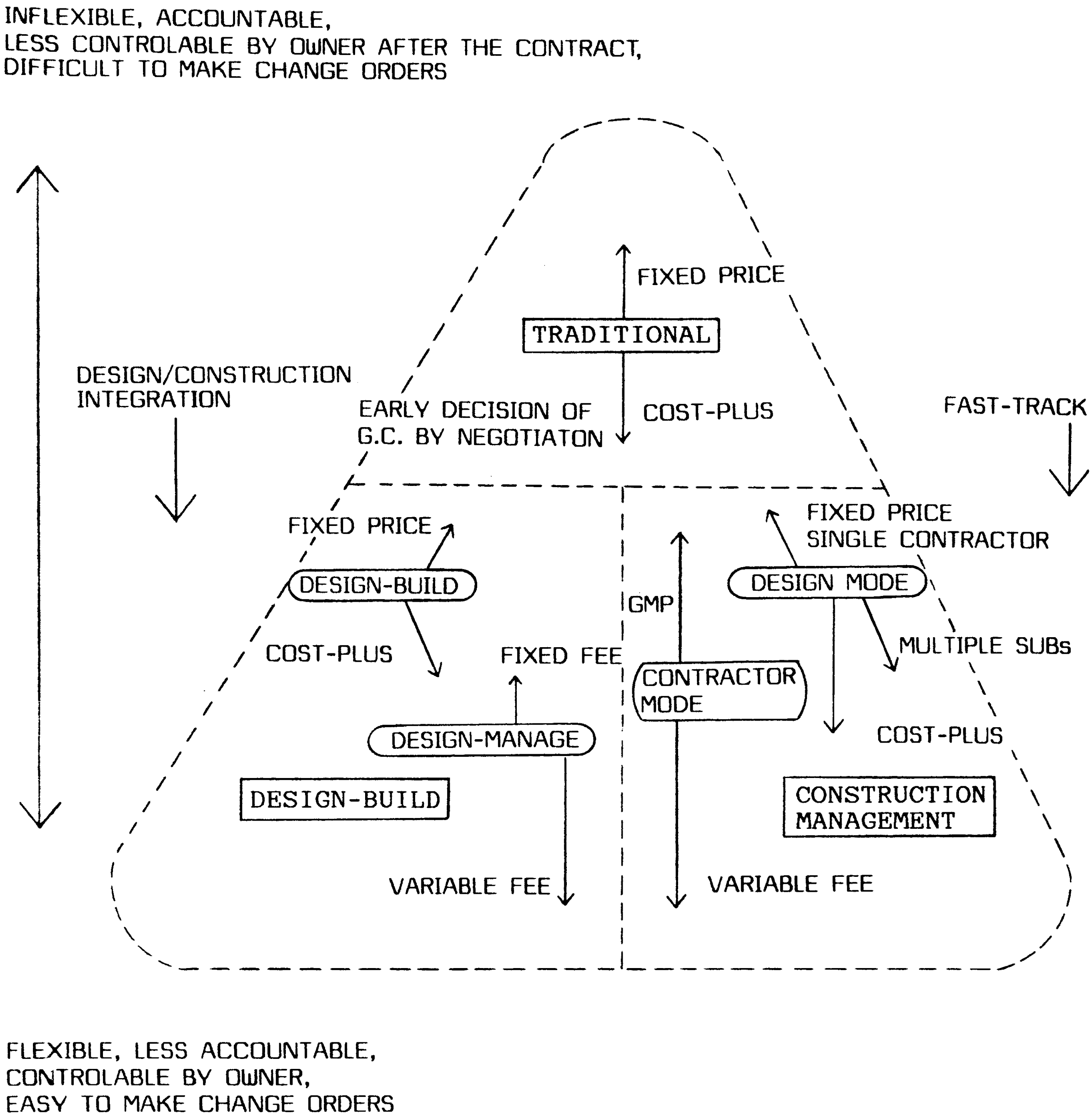


FIGURE 4-1-3
FRAMEWORK OF PROJECT ORGANIZATIONAL SYSTEMS:
RELATIONSHIPS OF PROJECT ORGANIZATIONAL SYSTEMS

higher design/construction integration requires a system in the Design-Build or Construction Management. Generally, the higher part of the diagram indicates systems of inflexible, accountable, less controllable by owner after the contract, and difficult to make change orders.

Minden's definition of design build with fixed price and his contractor mode CM are located in the upper part of the design-build and construction management areas. Because Minden tries to build the decision making model of procurement methods presumably for public institutions, and he may well think that the most practically applicable alternative methods are design-build and contractor mode CM with a fixed price contract, his definition of the two methods may be excessively strict for general purposes. Figure 4-1-4 illustrates these relations.

Classification of the Four Automotive Plant Development Projects:

The procurement methods of the Toyota KY, Nissan Smyrna, Toyota Tahara, and Fuji Gunma projects are classified based on the framework presented in the previous part. Figure 4-1-5 shows the procurement methods of the four automotive plant construction projects. Because of the lack of cost-plus-fee contract practice and no fast-track program, the procurement methods in Japanese construction industry are practically limited to traditional and design-build methods using a lump sum contract. Actually, there is no explicit concept of construction management in Japanese construction practice, though Japanese automotive manufacturers have in-house A/E and perform some functions of construction management. Therefore, the projects in Japan are located in the

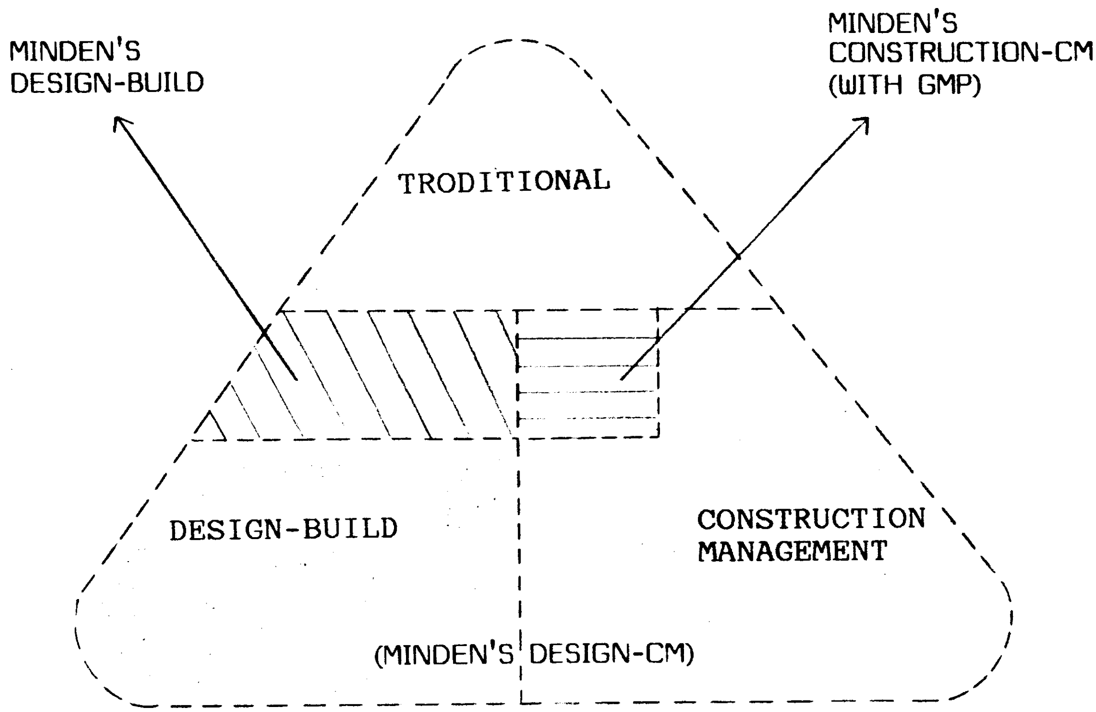


FIGURE 4-1-4
MINDEN'S DEFINITION OF DESIGN-BUILD AND CONSTRUCTION-CM
IN THE FRAMEWORK OF PROJECT ORGANIZATIONAL SYSTEMS

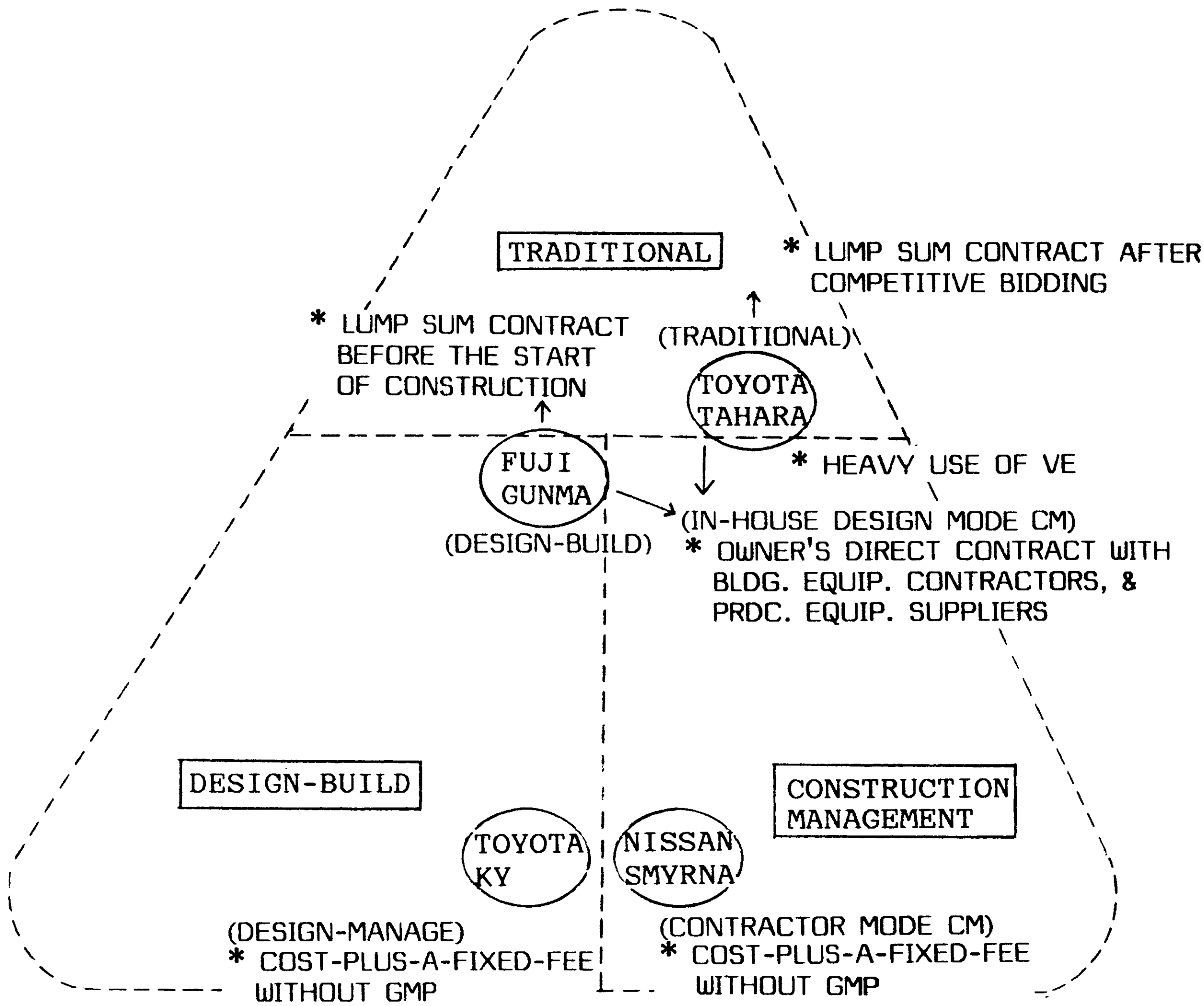


FIGURE 4-1-5
PROJECT ORGANIZATIONAL SYSTEMS OF THE FOUR AUTOMOTIVE PLANT CONSTRUCTION PROJECTS

traditional or upper part of design-build area.

Despite the differences in the project organizational structures of the Toyota KY and Nissan Smyrna projects, their location in Figure 4-1-5 is adjacent. This means that the characteristics of the two project organizations are similar. Both projects are located in the lower part and near the border of design-build and CM in the diagram. Both projects have a contractor mode construction management function and cost-plus-fee contracts between the owner and the design-builder or general contractor. The most influential independent variable (contingency factor) may well be the requirement of the fast-track program for both projects.

The Toyota KY Project is classified as design-manage in Figure 4-1-1, the Flow Chart for the Classification of Procurement Methods. The contract type between TMC and OHB is a cost-plus-fee whose fee will be fixed during the construction phase. As of Jan.1987, TMC and OHB are under negotiation about a fixed fee and OHB's cost. Because the construction progressed about 50% in Jan. 1987, TMC had taken most cost variance risks until this time. On the other hand, OHB had not taken the risks of cost variance though it had taken business risks as a contractor and professional.

According to Figure 4-1-1, the Nissan Smyrna Project is classified as contractor mode CM. The contract type between Nissan and Daniel is a cost-plus-a-fixed-fee. Though Daniel's fee for its construction management service is fixed, the total fee associated with Daniel's own forces work varies because this fee is regarded as a part of the construction cost. Through this mechanism, Daniel has the possibility to raise additional profit without big risks. Regarding the use of its own forces' work, Daniel takes a very strong stance against a closed shop compared with OHB in the Toyota KY because Daniel's forces' work is a very effective arm for Daniel to handle the complexity of the fast-track program, and it consists of open shop workers.

The Toyota Tahara Project is classified as traditional in Figure 4-1-1, though TMC has some in-house construction management function because TMC contracts directly with the building equipment contractors and the production equipment suppliers. Additionally, TMC has an in-house A/E that performs intensive value engineering through the procurement and construction phase. Therefore, the project organization of the Toyota Tahara Project has some features of design mode CM even though the general mode of the project is traditional.

The Fuji Gunma Project is a design-build. Fuji contracts with OHB by a lump sum contract after the completion of the detailed design. Fuji also has an in-house construction management function because Fuji contracts directly with the building equipment contractors and the production equipment suppliers. Therefore, the location of the project in Figure 4-1-5 is on the upper right in the design-build area with some overlap with construction management.

In short, through the classification of the project types of the four automotive construction projects, the similarity between Toyota KY and Nissan Smyrna, and between Toyota Tahara and Fuji

Gunma become clear in Figure 4-1-5. One of the most significant factors used to divide two groups is a fast-track program. The procurement methods of Toyota KY and Nissan Smyrna are very flexible but less accountable. The Toyota Tahara and Fuji Gunma projects (one of the most flexible types in Japanese construction) are less flexible but more accountable than the two projects in the U.S.

5. Evaluation of the development process and the organizational systems of the Toyota KY Project.

In this chapter, the development project process and the organizational system of the Toyota KY Project are analyzed. Critical questions are as follows:

1) What are the differences in the development process and organizational systems for automotive plant construction in Japan and the U.S.?

2) What kind of project organizational system (including project members' internal organization) do TMC and OHB build to cope with uncertainties, such as many change orders caused by a fast-track program?

3) What kind of conceptual model and design methodology of project organizational systems should be used or developed for future projects?

Several alternative strategies employed by TMC and OHB to manage uncertainties in the new environment are examined to define possibly optimal procurement methodology for TMC and OHB. Comparative studies using the Nissan Smyrna Project, Toyota Tahara Project, and Fuji Gunma Project are used to find these answers.

Though there are many text books and articles about construction management or procurement methods, they do not have a rational general theory of the selection for an optimal procurement method. Then, for a theoretical framework, Minden's[38] procurement method decision making model is used because its purpose fits this chapter and probably this is the first attempt to build a theory of procurement methodology.

Although the main purpose of this chapter is not to build a procurement theory, application and another interpretation of his theory including some recommendation to improve it will be presented here. As his thesis title, "Design-Build in The Public sector: A Case Study of The Commonwealth of Massachusetts Division of Capital Planning and operations (DCPO) Design-Build Project For Three Correctional Facilities," indicates, his theory is based on a case study of public project management as well as logical analysis of procurement methods. Therefore, the nature of his matrix is relatively normative rather than predictive. To analyze TMC's strategy for the Toyota KY Project, similarities and differences between public agencies and TMC will be examined as well as the comparison between TMC in the KY Project and Nissan in the Smyrna Project.

For a framework for organizational analysis of TMC and OHB, the concepts built by Henry Mintzberg,[9] Bronfman Professor of Management Policy at McGill University, is used. This theory provides a framework for the classification of organizations and for defining independent variables known as contingency factors, to change or formulate organization structure. Henry Irwig's summary of Mintzberg's framework[27] is used to show the results of the analysis on the Irwig's pentagon diagram after Mintzberg.

The first section examines the differences in development process and organizational system for automotive plant construction in Japan and the U.S. referring Minden's contingency factors. The second part analyzes the four automotive plant development projects based on Minden's "Procurement Method Design Matrix (presented in Appendix 4)." The actual methods are compared with the theoretically optimal methods by the Design Matrix. The third section analyzes TMC's strategy for the Toyota KY Project. The project organization including contract types and the TMC's organization for the Toyota KY Project are studied. Finally, OHB's strategy for the Toyota KY Project is examined. In the evaluation of TMC and OHB's strategy for the project, their learning process in the new business environment and the difficulties of technology transfer in the construction industry are supplementally examined.

5-1 Differences in the development process and organizational systems for automotive plant construction in Japan and the U.S.

The differences in the development process and organizational systems for automotive plant construction in Japan and the U.S. are examined in this section. As mentioned in several parts of the thesis, special constraints of the Japanese Building Code, inflexible administrative procedure regarding the Code, and the owners' strong preference for fixed price contracts requires the sequential construction method. Limitation of strong independent subcontractors and the relatively unilateral relationships between clients and contractors (caused mainly by the historical relationships of stronger clients in the Japanese construction practice) are other constraints. Consequently, the concept of construction management service is not well developed in the Japanese construction industry though currently the concept of value engineering is widely accepted in Japan.

The construction environment in the U.S. is more flexible and allows more alternative procurement methods than in Japan. To extract the differences of project organizational systems between Japan and the U.S., Minden's framework of procurement methods formation[38] is used here. He summarizes the procurement method decision model variables in Figure 5-1-1, which is well organized and covers most factors though they should include variables regarding labor relations, an important factor in U.S. construction.

Because detailed analysis of Minden's decision model is out of the scope of the thesis, only a brief explanation about

Figure Procurement Method Decision Model Variables

(CONTIGENCY FACTORS)	(PROCUREMENT METHOD VARIABLES)	
INDEPENDENT VARIABLES	INTERMEDIATE VARIABLES	DEPENDENT VARIABLES
PROJECT REQUIREMENTS *delivery time *size/ complexity/ environmental risk *cost	SCHEDULING *sequential ☆ *fast-track *pre-engineering	MANAGEMENT METHOD *traditional ☆ *CM -design mode -contractor mode *design/build *systems
OWNER ATTRIBUTES *management capability *bid/ negotiating constraints	WORK PACKAGING *single responsibility *early work pkgs w/ transfer *multiple work packages	CONTRACTOR SELECTION *bid *negotiate
MARKET CONSTRAINTS *bidding climate *risk aversion *benefits of project disaggregation * available systems *aggregation potential	SYSTEMS APPLICATION *develop new system *apply existing system	PRICING *fixed ☆ *shared savings/ incentive *cost plus

A RATIONAL THEORY

☆ NOT EXIST IN JAPAN

SOURCE: MINDEN'S THESIS AT MIT, 1986

FIGURE 5-1-1: MINDEN'S PROCUREMENT METHOD DESIGN MODEL VARIABLES AND UNFAMILIAR VARIABLES FOR JAPANESE CONSTRUCTION INDUSTRY several terms, rather than full explanation, is presented here. He uses three factors, project requirements, owner attributes, and market constraints, as contingency factors. These factors are further divided into ten items. All independent variables are applicable for Japanese construction. In project requirements, environmental risk includes factors such as unknown site, weather, logistic, and the economic and political conditions affecting a project. In market constraints, risk aversion means the contractors' ability to bear different types of risk, notably cost risks. This is reflected in the patterns of contractors' risk premiums in case of fixed price contracts. Benefits of project disaggregation, and aggregation potential are applied for very large projects or small projects respectively. Available systems are related to prefabricated building systems. The author advocates adding local labor relations as a variable of market constraints and also adding types of shop (open shop, merit shop, and closed shop) to dependent variables.

Supplementally, explanation of some confusing terms in the procurement method variables in Figure 4-2-1 are as follows:

1) Shared savings/incentives; this is one of cost-plus-fee contracts where the contractor receives reimbursement for actual costs plus compensation based on a special formula for sharing in actual costs over or under target costs. A sample formula is as follows:[4]

$$Fee = x(2P-C)$$

where: P - target price
C - actual cost
x - base percentage

Using this formula, a contractor can get a higher fee in case of a lower cost, and a lower fee in case of a higher cost based on the target price.

2) Pre-engineering; this concept is associated with some kind of systems application. If "off-the-shelf" systems are available, the effects of pre-engineering, such as reduction of design and construction time, are usable.

3) Work packaging; this refers primarily to construction work. Variations are single responsibility, early work packages with transfer, and multiple work packages.

4) Single responsibility; this means a contract between an owner and a single contractor responsible for the construction usually associated with a fixed or guaranteed price for an entire project. For example, a traditional general contractor, design build, and contractor CM with CM holding specialty contractors are main actors.

5) Early work packages with transfer to single responsibility; this is a compromise that can sometimes satisfy the requirements using a fast-track approach while minimizing the owner's risk and the management requirement.

6) Multiple work packages; this refers to the owner's direct hold of multiple separate package contracts throughout the project. The decision to use these packages may be dictated by the use of fast-track and/or an attempt to enhance competition and manage risk by desegregating the project.

Among procurement variables, fast-track, construction management, shared savings/incentives, and cost-plus are not applicable for the Japanese development project. These variables are exactly the differences in procurement methods, broadly the development process and organizational systems, between Japan and the U.S. Construction management is not well developed in Japan, though some owners, such as TMC and Fuji, and A/E have the capability to provide some part of design mode CM services such as value engineering, contracting, cost control, and quality control.

Figure 5-1-2 gives the graphical image of the Japanese construction procurement methods in the project organizational systems framework. Because the area of Japanese construction procurement methods is the combination of Minden's design-build and the traditional method, his matrix is supposed to be applicable for Japanese construction with some restrictions, such as no fast-track and no cost-plus.

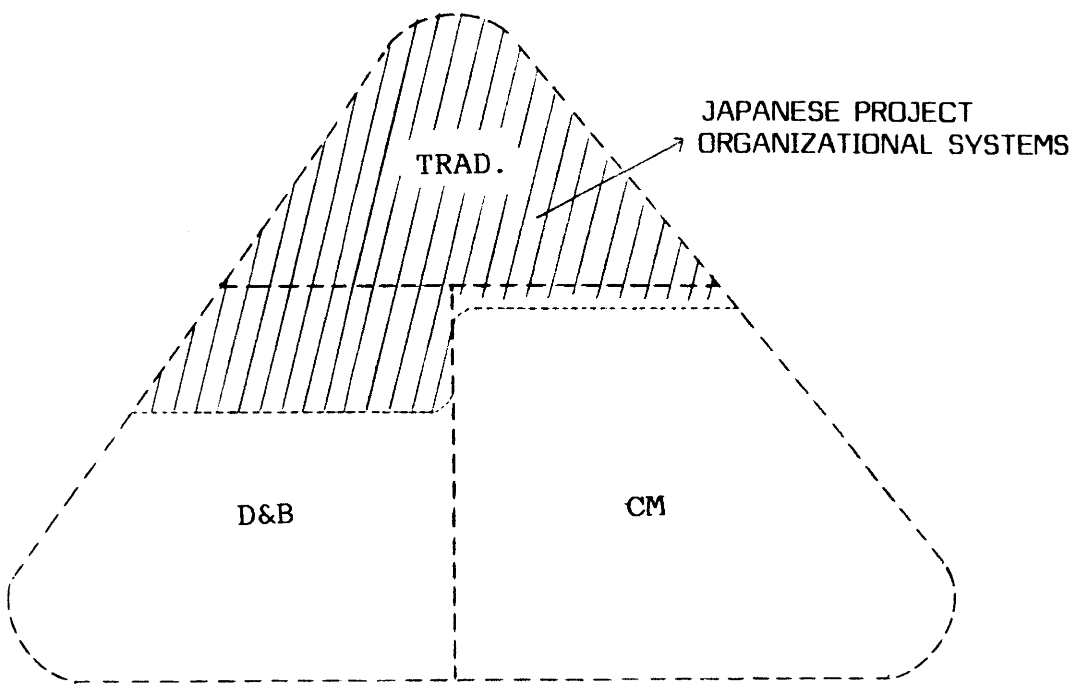


FIGURE 5-1-2
JAPANESE PROJECT ORGANIZATIONAL SYSTEMS
IN THE PROJECT ORGANIZATIONAL SYSTEM FRAMEWORK

5-2 Evaluation of the Four Automotive Plant construction Procurement Methods.

The project organization of the four automotive plant development projects, the Toyota KY, Nissan Smyrna, Toyota Tahara, and Fuji Gunma, are analyzed here based on Minden's theoretically optimal methods. The applicability of Minden's "Procurement Method Design Matrix"[38] for automotive plant projects is also examined. Because Minden's design matrix is developed based on the close examination of design-build projects by DCPO of Massachusetts and the theoretical reasoning, the nature of his matrix is relatively normative rather than predictive. After the application of the matrix for the projects, the validity of the matrix is supported by the well matched results with the actual methods employed in the successful projects. Consequently, the well matched results between the optimal method and the actual method in the Toyota KY Project suggest that only fine tuning rather than a surgical operation of the project organizational system is necessary to improve it in the project.

First, Minden's procurement method design matrix is applied to the four projects. Then, a comparison between the optimal methods and actual methods is done, while applicability of the design matrix is examined. Minden's whole "Procurement Method Design Matrix" is presented in Appendix 4.

Figures 5-2-1 includes contingency factors of the four automotive plant projects. Figures 5-2-2-a contains the results of the application for the Toyota KY Project. Figure 5-2-2-b, -c, and 5-2-2-d, contain the results of the application for the

A: TOYOTA KY
B: NISSAN SMYRNA
C: TOYOTA TAHARA
D: FUJI GUNMA

*** WEIGHT IS EVEN ON EACH VARIABLE.

SOURCE: MINDEN, 1986

Figure Procurement Method Design Matrix

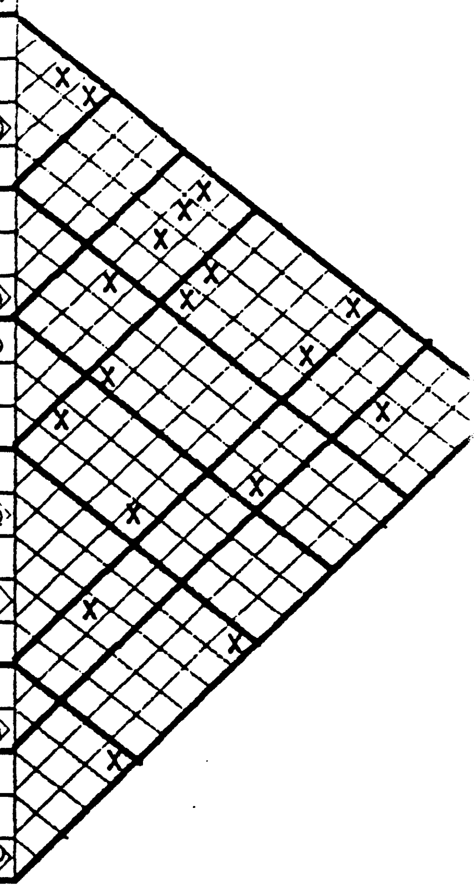
Weight				Procurement Method Contigency Factors		
A	B		D	Early Accelerated Delivery Required	delivery time	Project Requirements
		C		Normal Sequencing Adequate, Delivery Time Not Critical		
A	B			Project Large &/or Complex &/or High Risk &/or Poor Definition	size/complexity/risk	
		C	D	Project Moderate in Size &/or Complexity		
				Project Simple, Straightforward, Governed by Generic Standards		
		C	D	Based on Scope/Quality/Time, Budget Appears Tight	cost	
		C		Owner has Sophisticated,Capable & Extensive Management Resources	management resources	Owner Constraints
A	B		D	Owner has Sophisticated but Limited Management Resources		
				Owner lacks Management Resources & Know-how		
A		C	D	Type I Owner, Weak Negotiating Position, or Required to Bid	bibbing/negotiating constraints	
	B			Type II Owner, Strong Negotiating Position, No Bidding Restraints		
		C	D	Requires Fixed Price Before Commiting to Bid	risk aversion	
A	B			Able to Bear Most Cost Risk		
A	B			Weak Competition, Limited Qualified Contractors	bidding climate	Market Conditions
		C	D	Good Competition, Bidding Viable		
A	B			Qualified Contractors Unable to Offer Fixed Price w/o High Premium	contractor risk aversion	
		C	D	Qualified Contractors Can Offer Fixed Price w/o Excessive Premium		
A	B			Competition May Be Improved or Risk Managed by Disaggregating Project	advantages of disaggregation	
		C	D	No Significant Benefit by Disaggregating Project		
				Building Systems Meeting Project Requirements Available	building systems availability or market potential	
				Building Systems Not Available but Potential Market Aggregations May Justify		

FIGURE 5-2-1: MINDEN'S PROCUREMENT METHOD DESIGN MATRIX (part a) AND CONTINGENCY FACTORS OF THE FOUR AUTOMOTIVE PLANT PROJECTS

c ☆

	Procurement Method Attributes	Score	Rank	Compatable	Selection
scheduling	Normal Sequential Design/ Bid/ Build Schedule	-1			
	Accelerated Design &/or Construction	1	▽		
	Fast-Track	1	▽	√	◇○
	Pre-Engineering	-1			
work packaging	Single Responsibility Contract	0			
	Early Work Packages w/ Transfer	1	▽		
	Multiple Work Packages	2	▽	√	◇○
systems applica-tions	Use Existing System	1	▽	√	○
	Develop New Building System	-1			
	Use Open Systems or Conventional Technology	0			
generic procure-ment method	Traditional Method	-2			
	Design-CM	2	▽	√	◇○
	Construction-CM (CM w/GMP)	1	▽		
	Design-Build	1	▽		◇
	Systems	0			
con-tract award	Bid Competitively*	-1			
	Negotiate*	1	▽	√	◇○
pricing/ risk allocation	Fixed or Unit Price*	-2			
	Shared Savings*	2	▽		
	Cost Plus*	2	▽	√	◇○

d ☆



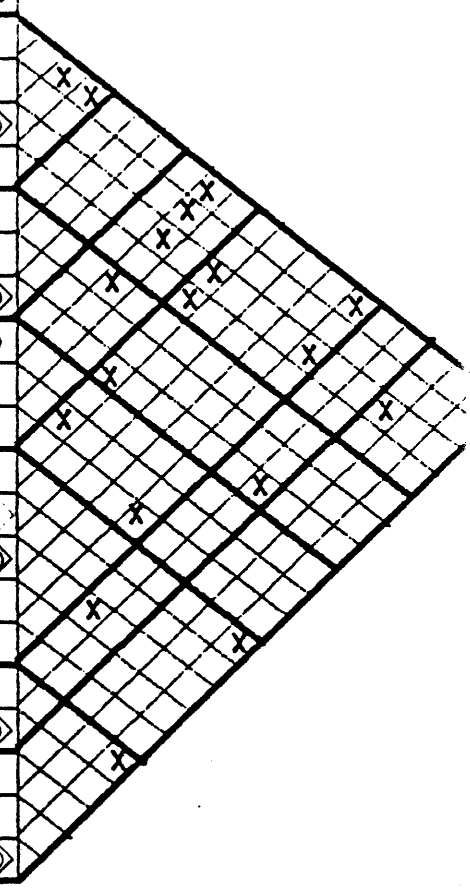
* *For overall project, not necessarily seperate work packages*

LEGEND:
▽ : POSSIBLE CONSIDERATION
○ : RECOMMENDATION BY THE MATRIX
◇ : ACTUAL METHODS IN TOYOTA KY

SOURCE: MINDEN'S THESIS AT MIT, 1986

FIGURE 5-2-2-ai : MINDEN'S PROCUREMENT METHOD DESIGN MATRIX (part c) AND ITS APPLICATION FOR TOYOTA KY PROJECT

Procurement Method Attributes		Score	Rank	Compatable	Selection
Normal Sequential Design/ Bid/ Build Schedule	scheduling	-1			
Accelerated Design &/or Construction		1	▽		
Fast-Track		1	▽	✓	◇
Pre-Engineering		-1			
Single Responsibility Contract	work packaging	0			
Early Work Packages w/ Transfer		1	▽		
Multiple Work Packages		2	▽	✓	◇
Use Existing System	systems applications	1	▽		O
Develop New Building System		-1			
Use Open Systems or Conventional Technology		0	▽		
Traditional Method	generic procurement method	-2			
Design-CM		2	▽	✓	◇
Construction-CM (CM w/GMP)		3	▽	✓	◇
Design-Build		2	▽		
Systems		0			
Bid Competitively*	contract award	-2			
Negotiate*		2	▽	✓	◇
Fixed or Unit Price*	pricing/ risk allocation	-2			
Shared Savings*		2	▽		
Cost Plus*		2	▽	✓	◇



* *For overall project, not necessarily seperate work packages*

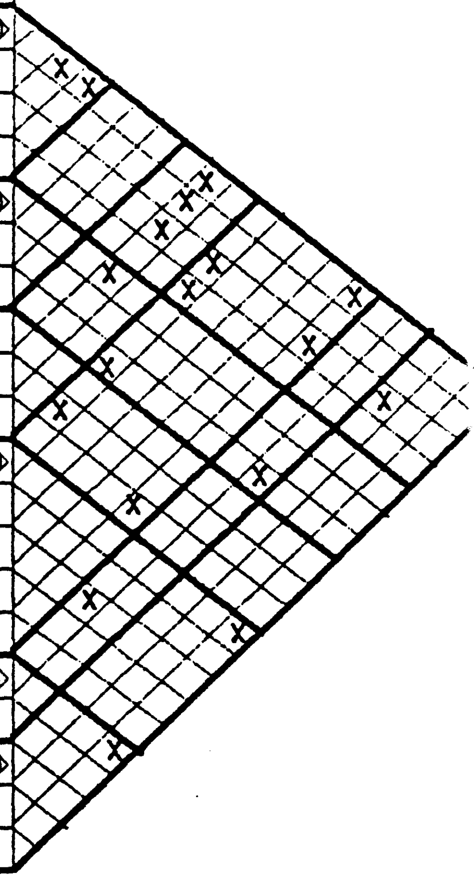
LEGEND:
▽: POSSIBLE CONSIDERATION
O: RECOMMENDATION BY THE MATRIX
◇: ACTUAL METHODS IN NISSAN SMYRNA

SOURCE: MINDEN'S THESIS AT MIT, 1986

FIGURE 5-2-2-b: APPLICATION OF MINDEN'S MATRIX FOR NISSAN SMYRNA PROJECT c ☆

Procurement Method Attributes		Score	Rank	Compatable	Selection
Normal Sequential Design/ Bid/ Build Schedule	scheduling	1	▽	√	◇○
Accelerated Design &/or Construction		0			
Fast-Track		0			
Pre-Engineering		1	▽		
Single Responsibility Contract	work packaging	2	▽	√	◇○
Early Work Packages w/ Transfer		-1			
Multiple Work Packages		-1			
Use Existing System	systems applica-tions	0			
Develop New Building System		0			
Use Open Systems or Conventional Technology		0			
Traditional Method	generic procure-ment method	3	▽	√	◇○
Design-CM		2	▽		
Construction-CM (CM w/GMP)		0			
Design-Build		1			
Systems		0			
Bid Competitively*	con-tract award	3	▽	√	◇○
Negotiate*		-2			
Fixed or Unit Price*	pricing/ risk allocation	3	▽	√	◇○
Shared Savings*		0			
Cost Plus*		-1			

d ☆



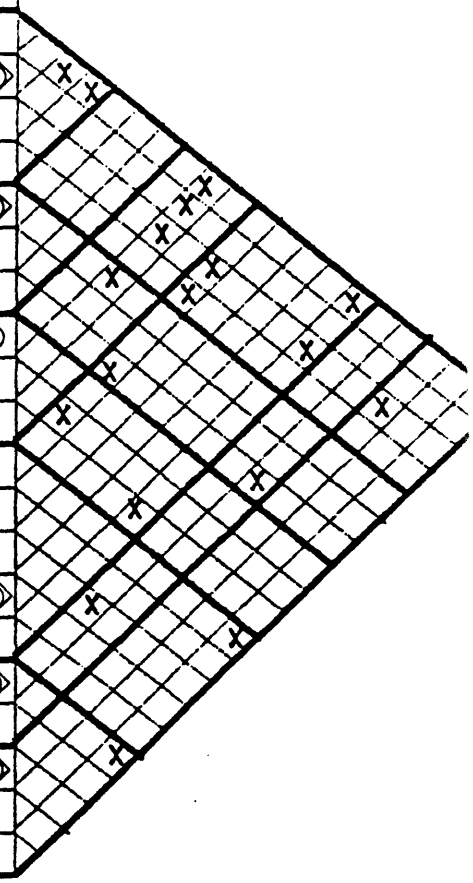
* *For overall project, not necessarily seperate work packages*

LEGEND:
▽: POSSIBLE CONSIDERATION
○: RECOMMENDATION BY THE MATRIX
◇: ACTUAL METHODS IN TOYOTA TAHARA

SOURCE: MINDEN'S THESIS AT MIT, 1986

FIGURE 5-2-2-c: APPLICATION OF MINDEN'S MATRIX FOR TOYOTA TAHARA PROJECT

c ☆ Procurement Method Attributes		Score	Rank	Compatable	Selection
Normal Sequential Design/ Bid/ Build Schedule	scheduling	-1			
Accelerated Design &/or Construction		1	▽	√	◇○
Fast-Track		0			
Pre-Engineering		-1			
Single Responsibility Contract	work packaging	2	▽	√	◇○
Early Work Packages w/ Transfer		-1			
Multiple Work Packages		-1			
Use Existing System	systems applica-tions	1	▽		○
Develop New Building System		-1			
Use Open Systems or Conventional Technology		0			
Traditional Method	generic procure-ment method	1			
Design-CM		2	▽		
Construction-CM (CM w/GMP)		0			
Design-Build		3	▽	√	◇○
Systems		0			
Bid Competitively*	con-tract award	3	▽	√	◇○
Negotiate*		-2			
Fixed or Unit Price*	pricing/ risk allocation	3	▽	√	◇○
Shared Savings*		0			
d ☆ Cost Plus*		-1			



* *For overall project, not necessarily seperate work packages*

LEGEND:
▽: POSSIBLE CONSIDERATION
○: RECOMMENDATION BY THE MATRIX
◇: ACTUAL METHODS IN FUJI GUNMA

SOURCE: MINDEN'S THESIS AT MIT, 1986

FIGURE 5-2-2-d: APPLICATION OF MINDEN'S MATRIX FOR FUJI GUNMA PROJECT

Nissan Smyrna, Toyota Tahara, and Fuji Gunma projects respectively. The section of the project procurement method shown in the figure is especially important to evaluate project systems. As explained in the previous section, Minden's definition of Construction-CM and Design-Build is quite strict for general purposes, so the optimal results represented by the model may be strictly evaluated against these two methods. Actually, the optimal results seem to be different somewhat from the actual methods in the Toyota KY and Nissan Smyrna cases, but, in the framework of Figure 5-2-3, the discrepancy of the optimal or sub-optimal methods from the actual methods is found to be very small. Minden's decision matrix seems to be favorable for Design-CM probably because Minden uses Design-CM as a default-option for alternative methods.

The Toyota KY Project is a Design-Build project using a cost-plus contract without guaranteed maximum price, and the project is classified as design-manage by B&P's definition. Minden's design-build does not contain the concept of design-manage that will be classified as design-CM according to his definition. Therefore, it can be said that the optimal recommendation matches the actual method in the Toyota KY Project. Additionally, design-build and construction-CM are possible options or sub-optimal of the matrix.

Contrary to the Toyota KY Project, the actual procurement methods of the Nissan Smyrna Project seem to match perfectly with the optimal methods of the matrix, but the project is not exactly Minden's construction-CM (with GMP) because Daniel, the

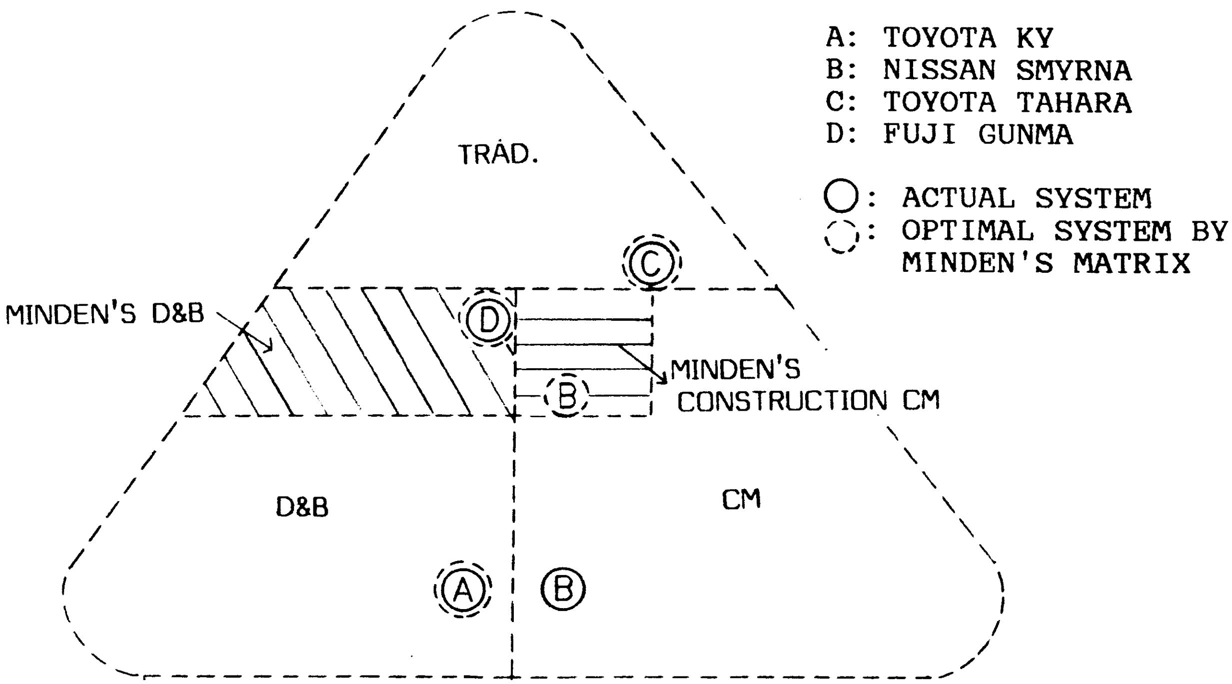


FIGURE 5-2-3
ACTUAL AND POSSIBLY OPTIMAL PROJECT SYSTEMS OF THE FOUR PROJECTS IN THE PROJECT ORGANIZATIONAL SYSTEM FRAMEWORK

constructor-CM, did not set a GMP. Therefore, the actual methods of the Nissan Smyrna Project should be classified as a design-CM, which is second best in the matrix, according to his definition.

In the contingency factors, the difference between the Toyota KY Project and Nissan Smyrna Project is only the bidding/negotiating constraints in the owner constraints. Though TMC's classification as the Type 1 Owner is quite certain, Nissan's one as the Type 2 Owner is not so certain considering the strong negotiating position of Daniel with NMMC. If Nissan is classified as the Type 1 Owner, the optimal project system of the Nissan Smyrna Project will be the design mode CM because the contingency factors of Nissan Smyrna and Toyota KY become exactly the same by this change. In this case, the actual method of Nissan Smyrna matches the optimal method by the matrix.

Considering that Minden's theoretically optimal methods cover the four successful automotive plant development projects very well, small differences between the actual and the theoretically optimal methods in Nissan Smyrna projects may suggest the possibility of the improvement of the project's organizational, system or of the misjudgment on the contingency factors, rather than the possibility of the improvement of his model.

As predicted in the previous section using Figure 5-1-2, actually, in the cases of Toyota Tahara and Fuji Gunma, the optimal methods by the matrix and the actual methods coincide perfectly. This may well support the validity of his algorithm and suggest applicability for other public projects in the U.S.

5-3 Analysis of TMC's strategy for the Toyota KY Project.

TMC's strategy for the Toyota KY Project, which contains the project organizational system and the TMC's organization for the project, is studied. First, a brief overview of the TMC's strategy for the development project is presented. Then, the project organization of the Toyota KY Project, especially its cost control mechanism is studied, comparing it with the Nissan Smyrna Project. Next, TMC's organization for the KY Project is analyzed. For a framework of organizational analysis for TMC, Mintzberg's theory,[9] summarized by Irwig,[27] in his pentagon diagram is employed. Finally, alternative methods or possible improvements for TMC for a risky/large/complex project are studied. Critical questions in this section are as follows:

1) How does TMC cope with uncertainties in the new environment?

2) What are the alternatives or possible improvements for TMC for a risky project like the Toyota KY Project?

TMC's strategy for the Toyota KY Project:

Though there are no clear statements by TMC about its strategy for the Toyota KY Project, it must have set up a new strategy rather than using a standard manual for the project because it is large, complex ,and risky. The strategy seems to be classified into three steps: general strategy for the management of the new subsidiary, the strategy for the site selection, and the strategy for the design and construction of the project. TMC's general strategy may well be typical of Japanese corporations having overseas subsidiaries that rely on Japanese management to run the subsidiaries. Though it is not clear about the degree of the new subsidiary's autonomy for its operations, TMC retains most control until the construction phase.

In order to choose the plant site, TMC formed a site investigation team, though the team did not continue to the design and construction phase. Through the intensive negotiation with KY in a competitive environment of several states, TMC succeeded in getting $125 million in incentives from KY.

For the plant construction, two of the most important TMC objectives are to make a Toyota style plant in KY and to make it in the shortest duration. Additional requirements are reasonable cost and higher involvement of TMC in construction management (especially technically) using TMC's methods as much as possible.

Because of the large scale, complexity, and uncertainties of the construction environment in KY, TMC must have decided to use OHB as a buffer against the risks. TMC tries to be involved in the design and construction through OHB, so TMC contracted design-build with OHB by negotiation. By contracting design-build with OHB, TMC can avoid any possible contractual troubles with American A/Es or contractors. Through the negotiation with OHB, TMC contracts with OHB by a cost-plus contract because of the necessity of a fast-track program to achieve the shortest project duration. Consequently, TMC assumes the financial risks of the project (this enables to TMC to control the project) and to be involved heavily in the project because of the necessity of many change orders, a special feature of a fast-track. Presumably, TMC's intention in its involvement in the project is mainly for quality control but not cost control during construction, because TMC traditionally prefers competitive bidding and a lump sum contract.

Because probably TMC did not expect the complexity and necessity of large amount of change orders caused by the fast-track program, TMC did not adjust its organization for the intensive cost control in the KY Project. This causes a potential problem of delay of the project because of the mismatch of TMC's traditional cost control system with the fast-track program in the KY Project.

The Cost Control Mechanism in The Project Organization of the Toyota KY Project.

As analyzed in chapter 4 especially shown in Figure 4-1-5, the project organizational type of the Toyota KY and Nissan Smyrna are very similar and classified as one of the most flexible types, but some potential friction between TMC and OHB, which did not exist between NMMC and Daniel, seems to exist especially in the cost control. Both projects generally have progressed smoothly and successfully in the similar contractual type between owners and contractors but in the different mechanism of the cost control.

Figure 5-3-1 illustrates the mechanism of the cost control system in the Toyota KY and Nissan Smyrna projects. Regarding subcontracting, both projects use basically fixed price contracts, so the owners do not assume cost variance risks or need to control costs after the subcontracts if the owners make no change orders. Different cost control mechanisms between the

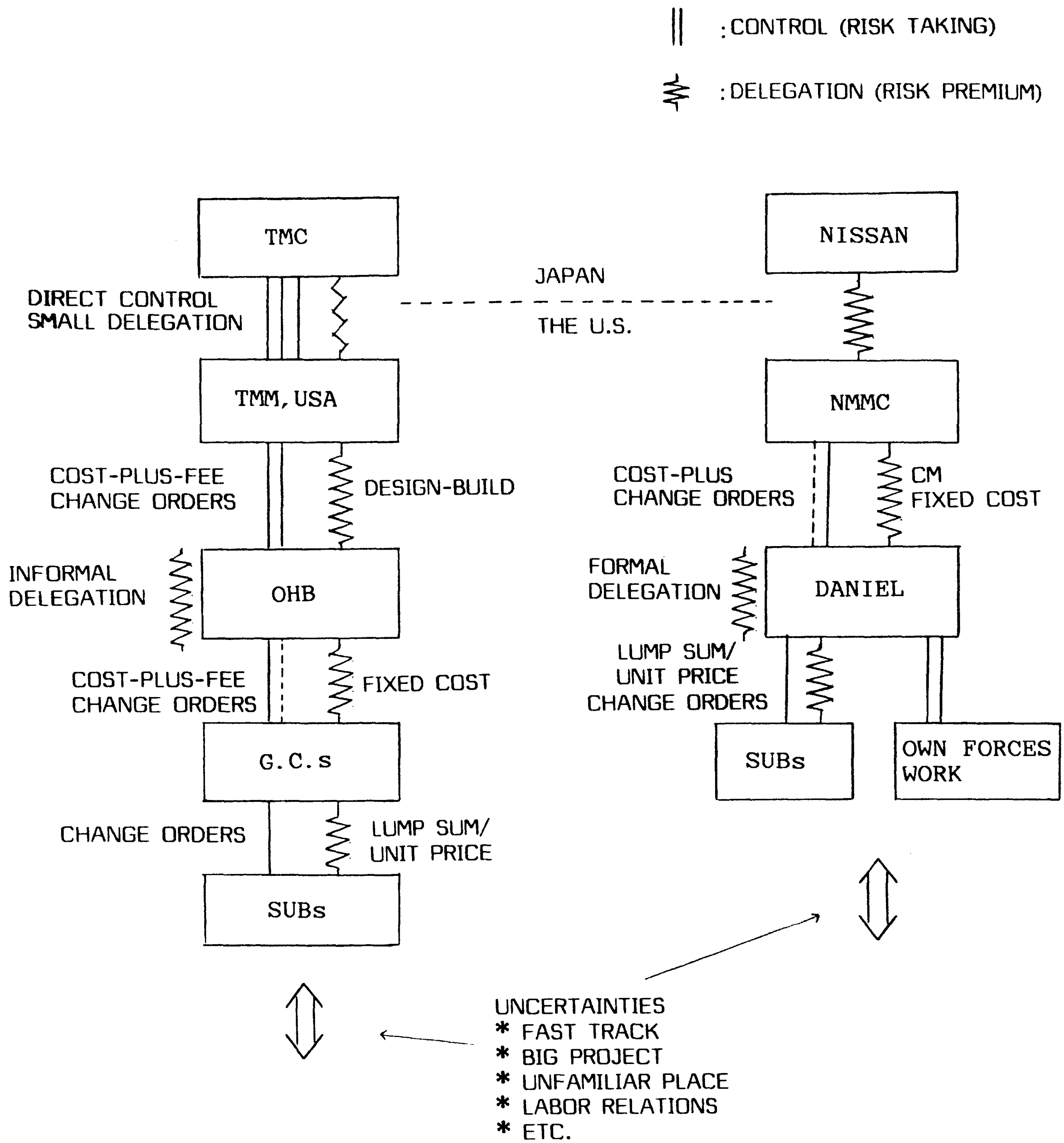


FIGURE 5-3-1
DIAGRAM OF COST CONTROL MECHANISM IN THE
TOYOTA KY AND NISSAN SMYRNA PROJECT

two projects appear in the case of change orders. In the Toyota KY Project, TMC does not delegate any authority of change orders to OHB and TMC controls the subsidiary directly. Therefore, many change orders go to TMC's head office in Japan. As is the nature of a fast-track program, TMC is required to make quick decisions on change orders, but it seems to be difficult because TMC is just using the traditional cost control system for the project. In the actual project, OHB acts as a safety valve to facilitate the flow of works by deciding emergency work without getting the TMC's approval before the start of the works, though this function is informal. Certainly, TMC may feel uncomfortable to approve OHB's individual decision making after the start of this work. Despite the very cooperative contract type between TMC and OHB, TMC has had to keep excessive distance from OHB perhaps because of the traditional unilateral relationships between them in Japan.

In the Nissan Smyrna Project, Daniel is in a much more flexible position than OHB in the KY Project because of NMMC's formal delegation of decision making and permission of Daniel's use of its own forces. The project management team, NMMC, Kahn, and Daniel, seems to cooperate well. One of the disadvantages for NMMC is less accountability of the cost effectiveness of the work done by Daniel's own forces. From Nissan's viewpoint, though, its learning opportunities are limited only through the C-30 task force about the development process. It has succeeded in utilizing the American development system fully.

Compared with TMC and Nissan in each project, TMC has more opportunities for its Japanese managers to learn American construction or general business through the project than has Nissan.

Though TMC's higher involvement in the project has certain advantages, OHB's informal function as a safety valve regarding decision on urgent change orders suggests the possibility of some improvements of the project organization. Regarding the possibility of the setting of GMP by OHB or Daniel, it can be said that Daniel is in a position to offer less risk premium to the owner than OHB because Daniel's formal latitude and less risks associated with the owner's cooperation with the project. Coincidentally, this analysis corresponds to the theoretically optimal method by the Decision Matrix that recommends construction-CM with GMP for the Nissan Smyrna Project.

TMC's organization for the Toyota KY Project.

Though TMC's total organizational analysis is not the subject of the thesis, Mintzberg's theory summarized by Irwig in his pentagon diagram, is employed for the analysis of TMC's organization regarding the Toyota KY Project.

Because of the strictly functional configuration of TMC's departments, a high demand for accountability of cost effectiveness, and highly standardized manual for operations in most areas by the TQC program[11], TMC has many common characteristics with the public institute. Despite its large size and old age, TMC's organization for the KY project is classified as a fairly pure type of machine bureaucracy in Mintzberg's framework. For reference, Nissan's organization regarding the Smyrna Project is classified as a divisionalized form because of NMMC's total autonomy.

Figure 5-3-2 gives Mintzberg's framework[9] for organizational analysis, as summarized by Irwig.[28] Special features of Mintzberg's five pure types of organization are as follows:

1) The Simple Structure; this has centralized authority that executes direct supervision. Typical operations are relatively undifferentiated. For example, the small owner-managed company is this type.

2) The Professional Bureaucracy; this has considerable delegation of authority to professionals. Less direct supervision is a character of this type. For instance, a university is this type.

3) The Machine Bureaucracy; this has departments that are strictly separated by their functions. This relies heavily on standardized procedures for the coordination and control of activities. For example, a mass-production firm is this type.

4) The Divisionalized Form; this has some segments which are strongly related to market and relatively independent of each other and of the headquarters. For instance, Sloan's General Motors is this type.

5) The Adhocracy; this has matrix lines which typically include project groups. Coordination within these groups is relatively informal. For example, a large construction company using a field based project manager system is this type.

Because in addition to less delegation to the subsidiary in KY, TMC does not have an inter-departmental consistent project team, TMC's organization for the project is removed from the two

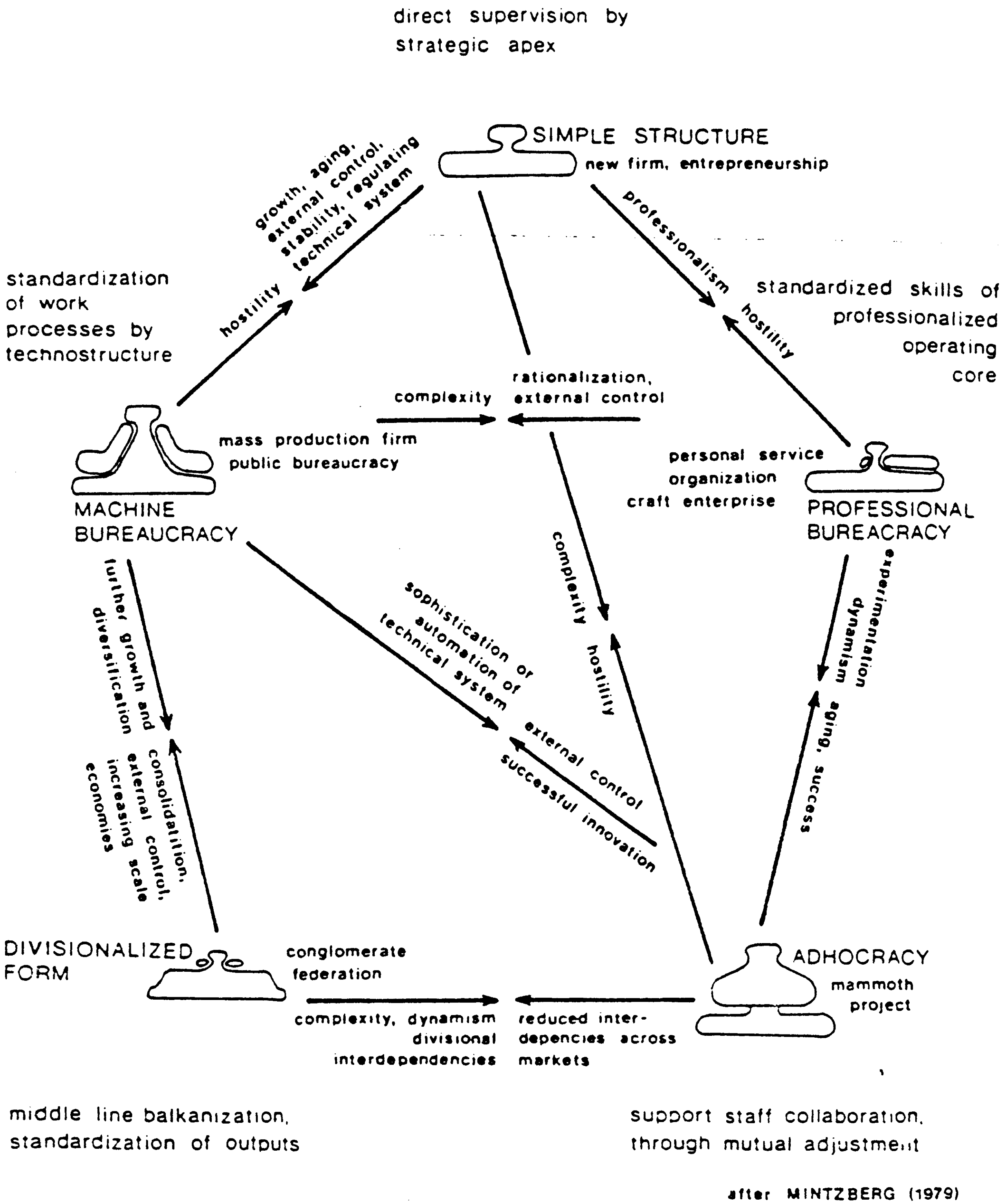


FIGURE 5-3-2: MINTZBERG'S FRAMEWORK FOR ORGANIZATIONAL ANALYSIS SUMMARIZED BY IRWIG

more desirable organizational types, divisionalized form and adhocracy, for a big and risky development project that requires dynamic, flexible, and prompt actions.

Figure 5-3-3 illustrates TMC and Nissan's organization for their projects in the U.S. in Mintzberg's framework.[9] The dot arrow under TMC gives the recommended movement of TMC's organizational type for risky projects.

Alterative Methods or Possible Improvements for TMC to a Risky Project.

Given that TMC 's strategy for the project is unchanged, there will be several alternatives, though the actual method generally works well. As studied in section 5-2, Design-CM, whose nature is almost the same as the actual Design-Manage, is a feasible alterative. Other variations are to set the Guaranteed Maximum Price (GMP), the Construction-CM, using shared savings contract, and early work packages with transfer to single responsibility. If TMC maintains the current project organization, possible adjustments are to add more flexibility to TMC's organization for the project by delegating considerable authority to the subsidiary or structuring the inter-departmental project team. Another adjustment is to utilize OHB more actively by delegating some authority about change orders.

Because the actual design-build, OHB is classified as design-mange, the additional merits of TMC's using design-CM in the actual method is questionable. Because Japanese companies who can provide construction management services in the U.S. are extremely limited, though there are many American CMs, as long as

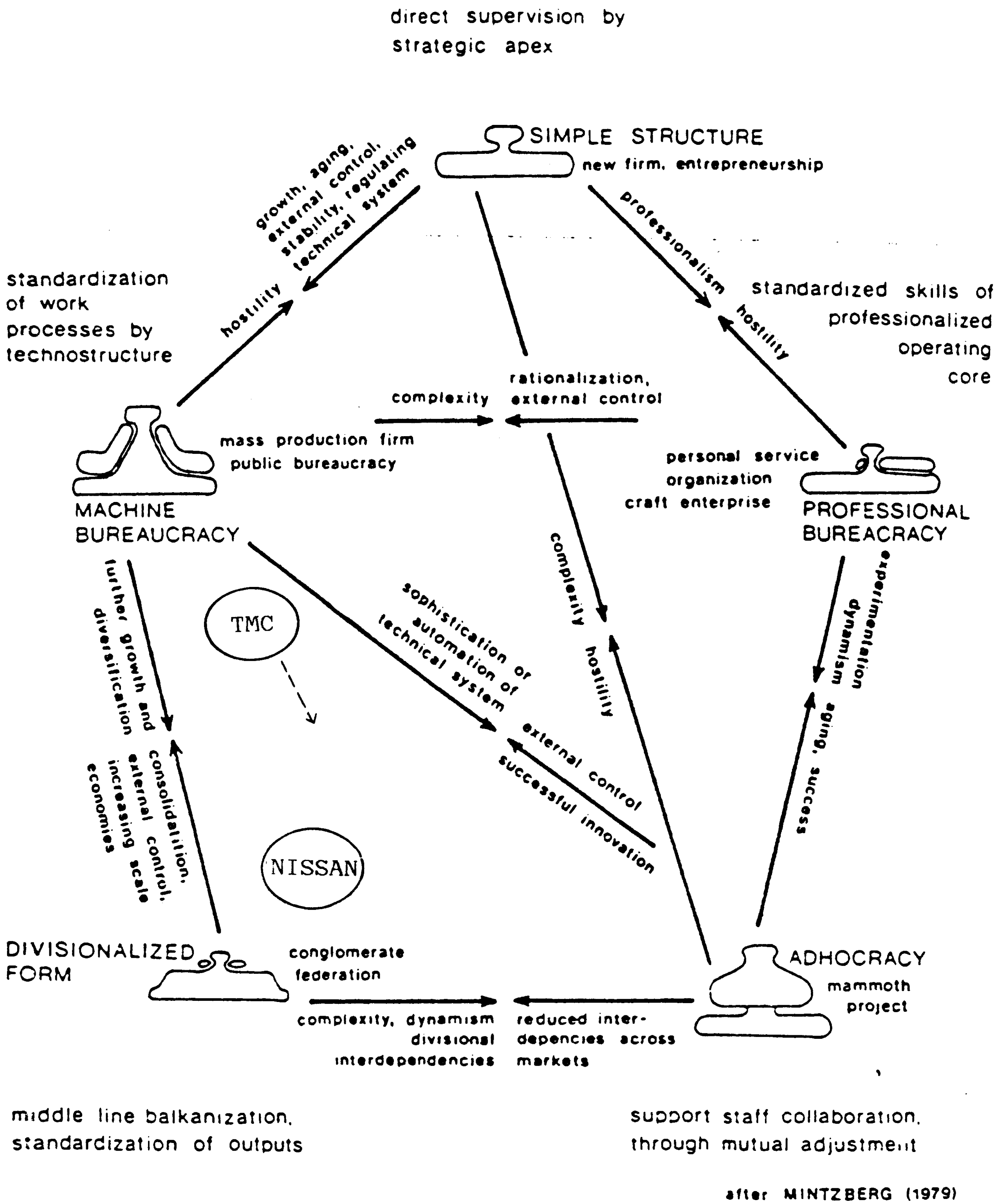


FIGURE 5-3-3: TMC AND NISSAN'S ORGANIZATION FOR THEIR PROJECTS IN THE U.S. IN THE MINTZBERG"S FRAMEWORK SUMMARIZED BY IRWIG

TMC expects communication in the Japanese language with CM, this alterative will have practically no benefit for the actual method. If TMC accepts English communication with the CM, TMC can select the design-CM from several American CMs. The experience of the development project with the American CM may provide good learning opportunities about American style of construction management although it may well be inconvenient and risky for the first project.

Other alternatives regarding procurement methods are mostly related to the setting of the GMP. Because of the many uncertainties associated with it, such as fast-track, big project, unfamiliar place, labor relations, and TMC's reactions with the design-builder, it is very hard for TMC to get the GMP from OHB without big risk premiums. Even if TMC had gotten the GMP from OHB, various scope changes and the change of labor relations during construction would have made it invalid. Nevertheless, setting the GMP will be attractive for TMC because the action changes the organizational system to be similar to the TMC's familiar traditional one. In the conceptual framework of the project organizational systems in Figure 4-1-3, the setting of the GMP pulls the organizational system toward the traditional system.

One of the most practical ways for TMC to get the GMP from OHB or the design-builder is to apply the methods used by public agencies for design-build where making an excellent request for proposals (RFP) is the key point. The RFP must be performance specifications and generic standards rather than prescriptive specifications to get optimal quality and delivery time without any control by the owner after a lump sum contract with the design builder that should be set before the construction. To get the shortest project duration, some public institutions made a lump sum contract with a design builder even at the design development stage.[38] This means, after the contract, the owner's monitoring work becomes minimum but at the same time, the owner loses the chance to be involved in the design and construction.

Because even The Commonwealth of Massachusetts Division of Capital Planning and Operations (DCPO), which used the fixed price design-build (minimum requirements for the owner's involvement in the project after the contract), formed a "special unit" (inter-departmental project team)for the design-build project to implement the entire process, the formulation of a project team for the entire development process will certainly improve TMC's organization for large and risky projects. In Mintzberg's framework,[9] the formulation of a project team pulls TMC's organization toward adhocracy that has flexibility for complex and risky projects. Another possible improvement for TMC's organization for the project is the delegation to the TMM, U.S.A., because this adjustment promotes prompt decision and facilitates the project based decision making. In Mintzberg's organizational framework, this delegation pulls TMC's organization toward the divisionalized form that is usually effective for overseas operations.

In short, possible alternatives for TMC to the Toyota KY Project are the use of the design-CM, design-build with the GMP, the formation of an inter-departmental project team in TMC, and the delegation of authority to the subsidiary.

5-4 Analysis of OHB's strategy for the Toyota KY Project.

OHB's strategy for the Toyota KY Project is studied. Because the alternative methods of the project organization are examined in the previous section 5-3, this section includes a summary of OHB's strategy, OHB's organization for the project, and alterative methods for OHB to avoid a risky project.

Critical questions in this section are as follows:

1) How does OHB cope with uncertainties in the new environment?

2) What are the alternatives or possible improvements for OHB for a risky project like the Toyota KY Project?

Through the evaluation of OHB's strategy, its learning process in the new environment and the difficulties of technology transfer in the construction industry are supplementally examined.

OHB's strategy for the Toyota KY Project:

After OHB got a design-build contract from TMC, OHB defined itself as a design-manager in the project following the general strategy of using construction management or joint venture with local contractors actively to ease friction with the local construction industry in the U.S. As is inherent with a contractor, its strategy for a project is greatly influenced by the client's requirements. The Toyota KY Project is not an exception but OHB had more latitude to select project organizational systems than usual because TMC was more flexible in the negotiation about the contract with OHB than usual.

Before OHB defined itself as a design-manager, OHB had choices of operation style, such as structuring a joint venture and using Citadel, OHB's subsidiary in the U.S. The joint venture plan was not favorable because this style did not make a good impression on TMC and there was some possibility that OHB might have had difficulties to control joint venture partners. Moreover, OHB's using Citadel was a much more favorable and practical method than the joint venture. If OHB had gotten the project from an American automotive manufacture, OHB would have used Citadel to manage the project. But the high requirements of TMC's involvement in the design and construction and the Japanese language requirement determined OHB's direct participation in the project rather than using Citadel. In addition to this reason, OHB also expected that it would be able to hire an excellent American project manager who could manage the project because of the big size of the project and OHB's information network through Citadel.

OHB succeeded in hiring Jordan and gave him the widest possible latitude in structuring OHB's site organization and to manage the project. This strategy is similar to Nissan's with Runyon. Based on Jordan's rich experience in American construction, including fast-track programs and construction management, OHB negotiated with TMC and made a cost-plus-fee contract using AGC's design-build form.

Though analysis of labor relations is out of focus of the thesis, it is very important and has a big influence on this kind of project. Based on the local labor relations and discussion with TMC and KY, OHB decided to build a merit shop for the project. Consequently, the possible general contractors (not subcontractors) are limited to merit shop contractors and open shop contractors. Because many large general contractors who can contract this kind of big project are union shop contractors, the decision of the merit shop limits the availability of capable general contractors significantly.

OHB decided to divide the project to six areas to reduce the risk of possible labor problems with unions and to increase market opportunities of capable general contractors. The disaggregation of the project also increased the accountability of the selection of general contractors for TMC.

OHB's organization for the Toyota KY Project:

Though OHB's total organizational analysis is out of the scope of the thesis, Mintzberg's[9] theory summarized by Irwig[27] in his pentagon diagram, is used here as was the TMC's organizational analysis.

Because of the almost total field autonomy for the KY Project, OHB's organization regarding this project is classified as a divisionalized form like Nissan's regarding NMMC. In terms of overseas operations, OHB's organization is a fairly pure divisionalized form because of less interaction with its main engineering or administrative departments, though OHB's operations in Japan are done through relatively adhocratic organization because of its matrix lines using the field based project manager system. Figure 5-4-1 gives OHB's organization for the Toyota KY Project and for its operations in Japan in the framework of Irwig's pentagon, after Mintzberg.

Because of the large size of the project and the relatively low technical requirements, OHB's field autonomy for the project

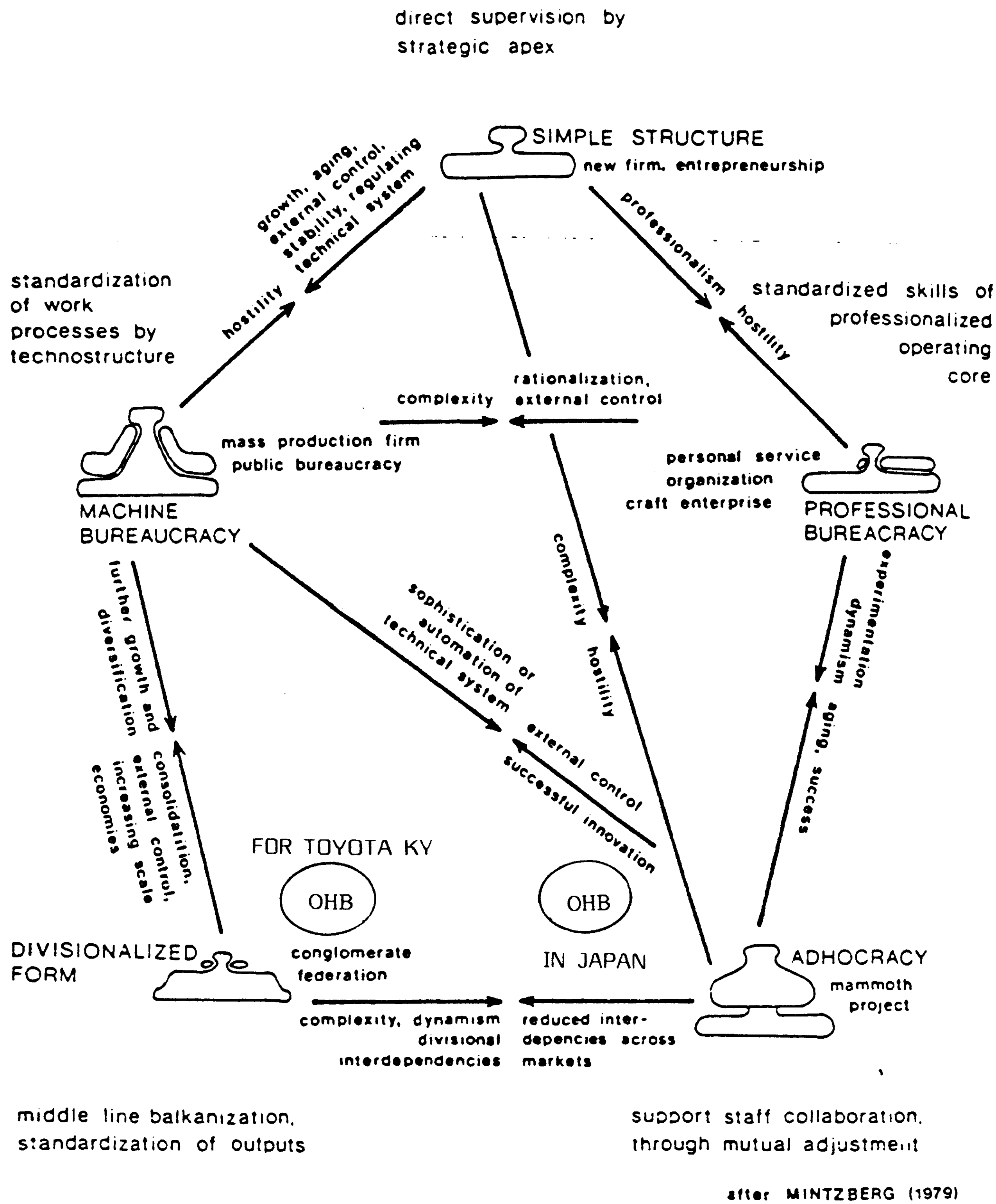


FIGURE 5-4-1: OHB'S ORGANIZATION FOR THE TOYOTA KY PROJECT AND FOR ITS OPERATIONS IN JAPAN IN MINTZBERG'S FRAMEWORK SUMMARIZED BY IRWIG

will certainly be optimal to promote quick and project based decision making. But in case of technically-complex projects or prefabricated system buildings, OHB's divisionalized form for overseas operations may well be inefficient to utilize the full potential of OHB.

As described in section 3-3, Project Organization of the Toyota KY Project, there are two subsystems in OHB's e organization. Thorough Jordan's leadership, OHB's American staff is controlling general contractors and suppliers, and by Ohba and Mizoguchi's leadership, OHB's Japanese staff is corresponding with TMC. These two subsystems are integrated in the organization especially at the engineering section.

This functional division of American and Japanese staff works well and provides an excellent environment especially for Japanese engineers and managers to learn extensively about the American construction business.

Alternate methods or possible improvements for OHB to a risky project:

Many of TMC's alternatives, explained in section 5-3, overlap with those of OHB because OHB's roles in the Toyota KY Project are similar to TMC. In this respect, OHB should have informed TMC more closely of the complexity of a fast-track program and the owner's responsibilities and roles in OHB's design-manage mode project organization. Especially the strong suggestion of TMC's inter-departmental project team assuming wide latitude in the U.S. might well have been beneficial for TMC and OHB. As analyzed in section 5-3, OHB acts as a safety valve informally regarding the decision process of change orders for the sake of smooth project progress. This function is very important and should have been authorized at the beginning of the project, that is, OHB should have gotten some authority to decide change orders without TMC's permission. This delegation will definitely improve the relationship between TMC and OHB in the project formally, to facilitate the fast-track program, and to activate OHB's construction management functions, such as value engineering and quality control.

The disaggregation of the project to six contractors might not be the optimal strategy for OHB. As a result of the project agreement with the AFL-CIO during construction, OHB had to coordinate six general contractors regarding the change from the merit shop to the union shop. Actually the strategic decision between disaggregation of the project and the single package contract depends on the trade off between market opportunities for general contractors and OHB's additional coordination of the general contractors.

Though analysis of labor relations of the project is out of focus of the thesis, the selection of a merit shop was a really important decision at the procurement stage. The selection of the union shop at the beginning of the project is the alternative for OHB. Assessment of benefit and cost of the alternative decision is complicated, but at least, OHB' selection of the union shop at the early stage of the project could have avoided the labor disputes with the AFL-CIO. The impacts of the project agreement on the contracts are very big. The agreement made most of the fixed price contract between OHB and the general contractors invalid, and a change in the original conditions of the contracts.

Setting the GMP (not guaranteed maximum cost) may well be unrealistic in the project because of so many uncertainties including labor relations, but it is still a considerable alternative. OHB may well be able to have the general contractors offer the GMP the during the construction stage. Then, OHB will be able to propose the GMP for TMC. If TMC does not make big scope changes, this offer will make sense for the project participants. In this case, OHB can get the widest latitude on the project management after the setting of the GMP.

Finally, the technical investigation of American construction by OHB's special team is an option that OHB could take. Though OHB creates a good environment for the managers to learn American construction management, OHB does not utilize the good opportunity to learn the engineering aspect of American construction. Though the direct transfer of the Japanese quality control program to American construction is impossible because of the differences of business conventions, there is some possibility for Japanese contractors to apply the QC program by some adjustments, and to learn some engineering details from the American construction industry to improve the program. OHB's structuring of a special unit, including staff from its technical research institute and engineering department for the project, apart from the actual site organization, may well have been a good idea. Probably, too much of a divisionalized form of OHB's organization for overseas operations hinders this kind of attempt. Therefore, some shift of the organization form of the overseas operations toward adhocracy by the overseas division's collaborating with other departments, such as the technical research institute and the engineering department, may ameliorate OHB's overseas operations.

6. Conclusions and Further Research.

Through the case study of the Toyota KY Project and the other three comparable projects, Nissan Smyrna, Toyota Tahara, and Fuji Gunma, the differences of the development process and project organizational systems between Japan and the U.S., it is found that the American development environment is more dynamic than the Japanese environment. Japanese project organizational systems can be recognized as a part of the American systems. A fast-track program, a dynamic phased construction process, exists in American construction but not in Japan primarily because the Japanese Building Code strictly requires the traditional sequential development process. A fast-track program requires high-level coordination of design and construction that cannot be managed by the traditional organizational system.

Some alternative project organizational systems, such as design-manage and construction management that has a design-mode and a construction-mode, exist in the U.S. but not in Japan. Design-build with a lump sum contract exists in Japan and this project organizational system is the most flexible and best system for short duration projects in Japan. Another important advantage of the design-build is the higher integration of design and construction. Because design-manage is a hybrid of design-build and construction management, it can be said that Japanese project organizational systems are the residual of the all American systems minus all construction management type methods. All construction management types usually employ cost-plus-fee contracts that also do not exist practically in Japanese building construction.

Considering one of the most important advantages of construction management is the use of a fast-track program associated with early delivery of a facility, influences of the lift off of the strict requirements of the sequential development process in Japan on the elaboration of formal construction management may be beneficial for the Japanese construction industry. Though limitation of strong independent subcontractors and special relationships between owners and contractors are a potential reason for the immaturity of the construction management, deregulation of the construction process may well promote the development of management skills of Japanese contractors and contribute to the effective use of limited resources by allowing the owners' choosing possibly financially optimal project development methods.

A framework of the project organizational systems is developed to define the project organizational systems clearly and to facilitate the design of appropriate systems for various projects. Using the framework of the project organizational systems presented in Figure 4-1-3, the project organization types of the Toyota KY and Nissan Smyrna are found to be very similar because they are very flexible (controllable by owners) but less accountable systems despite the different configuration of their project organizations. In the framework, Toyota Tahara is classified as traditional, with some owner's in-house construction management functions, and the Fuji Gunma is classified as a design-build with a lump-sum, also with some owner's in-house construction management functions.

In order to figure out the theoretically optimal project organizational systems or procurement methods, Minden's[38] "Procurement Method Design Matrix" is applied for the four automotive plant construction projects. Well matched results of the theoretically optimal procurement methods with the actual methods employed in the four successful projects support the validity of his design matrix, at least for automotive plant projects. Because his matrix is presumably made for public projects originally, his definition of design-build and construction-CM seems to be excessively strict for general purposes, however, if some adjustment of the definition for project organizational systems is made, the design matrix will be useful for many types of projects.

Despite TMC's tendency (or presumably its policy) to use its traditional methods for its construction in Japan in the KY Project, the project organization is unusual for TMC. This implies that OHB's suggestion was implemented regarding the project organizational systems to achieve possibly the shortest project duration. Though the project organizational system will definitely be one of the optimal methods analyzed in Minden's design matrix, many factors of the development process and organization seem to be undesirable for TMC because instant decision making and many change orders during construction required by the fast-track program contradict TMC's traditional construction management methods. Further, the cost-plus-fee contract does not guarantee the final project cost for TMC, and many change orders increase the uncertainties of the final cost.

The project organizational systems in the KY Project is good for the fast-track program because it is flexible for TMC to make many change orders (though TMC assumes cost variance risks for its sake), but OHB's informal function as a safety valve for decision making on some urgent change orders implies the necessity of some adjustments between TMC and OHB. Because of the cost-plus contract and many change orders, TMC's headquarters in Japan seems to hold excessive authority regarding cost control. Because of TMC's machine bureaucratic organization (in Mintzberg's framework) for the project, less delegation to the subsidiary in KY regarding the development, and less delegation to OHB about change orders, TMC's decision making process on change orders may not work smoothly. To activate OHB's construction management function more, TMC's delegation to OHB regarding decision making on change orders to some extent will certainly work as motor oil in this cost control mechanism. In addition, formation of an inter-departmental project team for the project may well be a good prescription to give some flexibility to TMC's organization to cope with uncertainties associated with this kind of big, complex, and risky project.

Setting the GMP by OHB, which changes the type of the actual organizational system greatly to a more inflexible type, is probably not the optimal procurement method for the Toyota KY Project and is not practical in this risky project environment, but TMC may well prefer it because it is accountable. One of the most practical ways for TMC to get a reasonable GMP from OHB is to apply the methods used by public agencies for design-build. If TMC makes an excellent requirement for proposals (RFP) that should be performance specifications and generic standards rather than prescriptive specifications, TMC will be able to get optimal quality and delivery time without the owner's control after a lump sum contract.

In reality, even if TMC had gotten the GMP from OHB, it would have become invalid because of the project agreement with the AFL-CIO during construction that changed the original conditions. Actually, the labor relations are big uncertainties in the Toyota KY Project.

From the viewpoint of the learning experience for TMC and OHB about the American construction business, the project organization provides an excellent environment for them because of the higher involvement (associated with higher risk taking) in the design and construction. Though they may well encounter many surprising things, these experiences are vital for their next steps. Especially, OHB's site organization is good for Japanese managers to learn American construction business because of the rich interactions between American managers and Japanese managers.

The autonomy of OHB's site organization seems to work well, probably because of the big size of the project and the relatively low engineering requirements. The functional division of American and Japanese staff into two subsystems works well for American managers to manage the general contractors and suppliers and for the Japanese managers to correspond with TMC.

Although OHB manages the project well and actively learns the American construction business, it seems to be relatively indifferent to engineering. The Toyota KY Project provides good opportunities to study engineering as well as American management. Despite OHB having enough staff to study aspects, such as construction methods, quality, productivity, and quality control system, OHB has not formulated this kind of study team. Though the Toyota KY Project may not be appropriate to study the engineering phase because of its quite simple structure, OHB seems to have lost a good opportunity. Probably, its too divisionalized form (in Mintzberg's organizational framework)[9] for overseas operations prevents OHB from structuring a study team consisting of staff in non-overseas departments. Therefore, some shift of OHB's organizational systems from divisionalized form toward adhocracy by collaboration between the overseas division and other departments would be beneficial for OHB. Hopefully, this kind of adjustment would improve OHB's organization for overseas operations and will contribute to the promotion of technology transfer between Japan and the U.S.

Further Research:

This thesis studies a very limited aspect of a real development projects. Even in one project, for example, in the Toyota KY Project, there are several interesting topics remaining, such as, relations, engineering, site selection, and the social and economic impact of the project on the region. Theoretical development of methodology to define optimal project organizational systems or development process in various conditions, though this thesis does evaluate Minden's theory as a firm step toward the general theory.

Extensive studies are necessary both for understanding the differences and similarities between the U.S. and Japan, and for developing a general theory for project organizational systems. Comparative case studies between the U.S. and Japan of several kinds of projects, such as public projects, the third sector (public private partnership) projects, urban renewal projects, housing, shopping center developments, and usual office building developments should be carried out.

Boyd Paulson[48] predicted in 1979, after his research on Japanese transportation construction, that "the distant clouds of concern may gather into a storm of protectionist to (Japanese contractors') participation in the U.S. market;" the "distant clouds" are approaching. A two-way flow of information and commerce between the U.S. and Japan is really necessary for the benefits of consumers and the construction industry in both countries because of the presumable existence of comparative advantage.

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Appendix 1

OHBAYASHI CORPORATION

AGREEMENT BETWEEN CONTRACTOR AND CONSTRUCTION MANAGER FOR CONSTRUCTION

Contract No. 200

Contract Date June 26, 1986

PROJECT: Toyota Automotive Manufacturing Facility

LOCATION: Scott County, Kentucky

CONSTRUCTION MANAGER: Ohbayashi Corporation, a foreign corporation of Osaka, Japan - authorized to transact business in the Commonwealth of Kentucky with offices at Suite 200, 880 Corporate Drive, Lexington, Kentucky 40503-2749

For the Contract Price herein stated, CONTRACTOR agrees to perform and complete the work in accordance with Drawings and Specifications prepared or which shall be prepared by

ARCHITECT/ENGINEER: Giffels Associates, Inc.
Architects and Engineers
25200 Telegraph Road
Southfield, MI 48037
Ernest R. McCamman, PE
Arthur O. Moran, Jr., AIA

or such other or additional Architect/Engineer(s) as the CONSTRUCTION MANAGER may select.

WORK TO BE COMMENCED: July 1, 1986

WORK TO BE COMPLETED: August 30, 1987

THE CONTRACT PRICE: See Article (3) three.

THIS AGREEMENT made the ______ day of ______________, by and between National Industrial Constructors, a ______________ corporation, having its principal offices at 1130 South 22nd Street (P.O. Box 101), Birmingham, Alabama 35201, hereinafter called the "CONTRACTOR", and the aforesaid Ohbayashi Corporation, hereinafter called the "CONSTRUCTION MANAGER."

WITNESSETH, that the CONTRACTOR and the CONSTRUCTION MANAGER, for the consideration hereinafter named, agree as follows:

ARTICLE 1 - SCOPE OF THE WORK

The CONTRACTOR shall furnish or cause others approved by the CONSTRUCTION MANAGER to furnish all of the materials and perform or cause others approved by the CONSTRUCTION MANAGER to perform all of the work shown on Drawings prepared by the Architect/Engineer or hereafter prepared by the Architect/Engineer and furnished to the CONTRACTOR by the CONSTRUCTION MANAGER with respect to the paint building (hereinafter "the Work") at the Project. The Work shall be completed in accordance with the directions of the CONSTRUCTION MANAGER with such changes, modifications, additions and corrections as the CONSTRUCTION MANAGER may hereafter impose; provided, however, the CONSTRUCTION MANAGER presently anticipates the Work will generally be as follows:

Paint Building (the "Work")

Approximately

606,000	Sq. Ft. floor area
	Tons structural steel
	Cu. Yds. concrete

The Paint Ship is founded on both solid rock and engineered soil-rock fill. Dependent upon subsurface conditions, building foundations will be spread footings and/or drilled caissons. The slab on grade is anticipated to be an eight (8) inch thick unreinforced slab with surface hardening. The building structure is a typical structural steel column, beam and truss construction. The roof system is a ply built-up roofing installed on insulation and metal deck. Sidewalls will be architectural profile insulated sandwich panels and masonry.

The facility environment will be controlled by roof mounted air handlers which will be gas fired for heating and contain cooling coils for circulating chilled water for cooling. The air handlers and roof mounted substations will be enclosed within a continuous roof monitor, the areas between these units will be utilized to allow for infiltration of natural light. The primary side of the roof mounted substations will be cable fed, the secondary distribution will be by means of both buss duct and cable. Internal to the building will be fire walls as well as a mezzanine structure for support of future process air supply house(s). Lighting will be high pressure sodium vapor fixtures.

Included within the Paint facility area will be a major process pit/equipment foundation x x depths varying from - and several smaller process related pits.

The following process and utility headers will be installed in the building: high pressure air, pressurized industrial waste, natural gas, potable water, deionized water, chilled water, steam, storm sewer and sanitary sewer.

There will be several toilet facilities located within the area and other related employee facilities.

The Paint Shop bay spacing is .

The facility will be fully sprinkled at a rate of . GPM/Sq. Ft. The paint storage and mix area will have either CO_2 or Halon space flooding in addition to being sprinkled.

ARTICLE 2 - TIME OF COMPLETION:

The Work to be performed under this Agreement shall be commenced July 1, 1986, and shall be completed on or before August 30, 1987, and during the period of construction the CONTRACTOR agrees to complete portions of the Work as follows:

Portion of the Work:	Completion Dates:
Start Foundations	7/01/86
Start Equipment Pits & Foundations	7/01/86
Start Steel Erection	9/01/86
Start Roof Closure	11/01/86
Mechanical & Electrical Installation	12/01/86
Building Closure Completed	1/01/87
Paint Shop Ready for Selected Process Installation	4/1/87
Equipment Trial Runs	11/01/87

ARTICLE 3 - THE CONTRACT PRICE:

The Contract Price shall be the sum of the following:

(a) A lump sum fee of to cover the CONTRACTOR'S overhead and profit, which amount shall be (i) increased by of the amount by which the costs included in the Contract Price pursuant to subparagraph (d) of this Article 3 exceeds or (ii) reduced by of the amount by which the costs included in the Contract Price pursuant to subparagraph (d) of this Article 3 are less than

(b) Reimbursement for the CONTRACTOR'S "actual costs", as hereinafter defined, of such management and supervisory personnel in the employ of the CONTRACTOR as may be necessary to supervise the CONTRACTOR'S contractors and subcontractors if and only if such personnel have been approved in writing by the CONSTRUCTION MANAGER, which approval by the CONSTRUCTION MANAGER shall not be unreasonably withheld as long as the total of such "actual costs" pursuant to this subparagraph (b) does not exceed .

(c) Reimbursement of such general overhead items as defined in Schedule C to the bid submitted by the CONTRACTOR as the CONSTRUCTION MANAGER approves in writing, which approval shall not be unreasonably withheld as long as the total cost pursuant to this subparagraph (c) does not exceed .

(d) The "actual costs", as hereinafter defined, to the CONTRACTOR of completing the Work, with the exception of elements of "actual costs" included in subparagraphs (a), (b) and (c) of this Article 3. Such "actual costs" of completing the Work shall include the "actual costs", as hereinafter defined, of all labor and materials necessary to complete the Work other than with respect to labor or materials for which the CONTRACTOR is to be compensated pursuant to subparagraph (a), (b) or (c) of this Article 3. Notwithstanding anything contained in this or any other agreement to the contrary, (i) such "actual costs" of completing the Work shall be included in the Contract Price only to the extent all elements of such "actual costs" of completing the Work, including, but not limited to, all contracts, subcontracts, and cost of materials and labor, have been approved in writing by the CONSTRUCTION MANAGER and (ii) no amounts paid or payable to the CONTRACTOR, officers, directors or employees of the CONTRACTOR or persons or entities owned or controlled by or which own or control the CONTRACTOR shall be included in the Contract Price pursuant to this subparagraph (d) except to the extent such payment is specifically approved in a writing signed by the CONSTRUCTION MANAGER, which writing also acknowledges such relationship.

The term "actual costs" as used in this Article 3 shall mean the aggregate amount of all expenditures actually paid with respect to labor, materials and supplies employed in the completion of the Work with the CONSTRUCTION MANAGER to receive the benefits of all discounts, credits, rebates, similar arrangements and other benefits, except as otherwise limited in this Agreement. The term "actual costs" shall, however, not include the following:

(i) Compensation of the CONTRACTOR'S executive or administrative officers.

(ii) Overhead or general expenses of any kind, except any such expenses specifically mentioned in subparagraphs (b) and (c) of this Article 3.

(iii) Services and expenses of the CONTRACTOR'S executive, administrative, estimating, purchasing, cost, and accounting departments.

(iv) Any and all costs of capital employed or money borrowed.

(v) Any and all costs of taxes, fees or charges imposed on the CONTRACTOR relating to receipts, income, either net or gross, licenses or similar items.

(vi) Any and all costs of insurance acquired by the CONTRACTOR, except as otherwise specifically provided in the General Conditions.

(vii) No expenses or costs shall be included as "actual costs" to the extent paid more than once, thus, by way of illustration, if the CONTRACTOR makes a payment to a Subcontractor, Sub-subcontractor or supplier for services or materials and a lien is subsequently filed by a Sub-subcontractor for an item included in such payment, the CONTRACTOR will be required to pay such Sub-subcontractor the amount due in order to release the lien and the expenses of such payment shall not be included as an item of "actual costs."

(viii) Any and all costs and expenses of attorneys and others in connection with any claims or litigation, reviewing of agreements, or similar matters relating to the Work except as otherwise provided in this Agreement or in the General Conditions.

(ix) Any and all liability, cost or expense the Contractor might incur in connection with breach of or failure to perform or claimed breach of or failure to perform in accordance with this Agreement, the General Conditions or the Contract Documents described in the General

Conditions, whether relating to a warranty, breach of contract or any other matter.

(x) Any costs and expenses incurred after the earlier of (A) the termination of the Agreement pursuant to Article 18 of the General Conditions, or (B) final payment as provided in Article 14 of the General Conditions.

(xi) Any and all matters, costs and expenses which the General Conditions provide are to be borne by or at the expense of the CONTRACTOR, including, but not limited to those relating to uncovering, replacing and correcting work pursuant to Article 18 of the General Conditions.

(xii) Except to the extent the CONSTRUCTION MANAGER has otherwise agreed in writing, any and all payments, expenses and costs of or relating to any item, compensation or other matter in excess of the lowest amount specified for such item, compensation or other matter in either (A) the CONTRACTOR'S bid, including Schedules B and C thereto; (B) written representations and correspondence between the CONTRACTOR and CONSTRUCTION MANAGER; or (C) Exhibits "A" and "B" attached hereto and incorporated herein.

ARTICLE 4 - PROGRESS PAYMENTS AND FINAL PAYMENT:

The CONSTRUCTION MANAGER shall make payments on account of the Contract as provided in the General Conditions.

ARTICLE 5 - THE CONTRACT DOCUMENTS:

The Contract Documents consist of this Agreement, the General Conditions attached hereto as Exhibit "C", reflecting a last revision date of June 12, 1986, and incorporated herein by reference, any supplementary or other Conditions added pursuant to the General Conditions or by agreement of the parties, such written construction procedures and guidelines as the CONSTRUCTION MANAGER may hereafter reasonably adopt, the Drawings, the Specifications, and all Addenda issued prior to and all Modifications issued after execution of this Agreement, and all are as fully a part of this Agreement as if hereto attached or herein repeated.

ARTICLE 6 - CONDITIONS FOR UNION CONTRACTORS:

The CONTRACTOR represents and warrants it has attached to this Agreement true and correct copies of any and all written agreements and a detailed summary of any and all non-written agreements or other obligations entered into between the CONTRACTOR and any union contractor the CONTRACTOR intends to involve in the Work and all unions which the CONTRACTOR or any such other contractor recognizes as bargaining agents for its employees on this project. In the event of a violation of any of the provisions of the attached agreement by a signatory union, the CONTRACTOR agrees to promptly and aggressively pursue all available legal remedies against the union. The CONTRACTOR agrees not to subcontract or allow any Subcontractor or Sub-subcontractor to subcontract any portion of its work on this project to any other contractor who recognizes any union as the collective bargaining agent of its employees on this project who has not, prior to being assigned such work, entered into collective bargaining agreements (a) identical to the form of a collective bargaining agreement attached hereto as Exhibit "D" with all such recognized unions or (b) otherwise approved in writing by the CONSTRUCTION MANAGER.

In the event the CONTRACTOR breaches the provisions of this paragraph, such breach shall be considered a substantial violation of the provisions of this Agreement and of the Conditions of the Contract and CONSTRUCTION MANAGER shall have the rights and remedies provided for in paragraph 19.2.1 of the General Conditions.

ARTICLE 7 - PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND:

The CONTRACTOR, upon written request from the CONSTRUCTION MANAGER, shall furnish and pay for bonds, in favor of the CONSTRUCTION MANAGER, covering the faithful performance of all or such part of the Work as may be requested by the CONSTRUCTION MANAGER and the CONTRACTOR'S and Subcontractors' and Sub-subcontractors' obligations under this Agreement and the Contract Documents and all obligations arising thereunder or otherwise relating thereto, for such amount as the CONSTRUCTION MANAGER in good faith estimates it will cost the CONSTRUCTION MANAGER to complete and pay for the portion of the Work with respect to which such bond or bonds are to be provided, and with such sureties as may be agreeable to the CONSTRUCTION MANAGER. The CONTRACTOR shall, upon request from the CONSTRUCTION MANAGER, promptly submit satisfactory evidence to the CONSTRUCTION MANAGER that such bonds have been issued. Subject to the limitations contained in Article 3 of this Agreement, the reasonable actual cost of such bonds required by the CONSTRUCTION MANAGER shall be included as part of the Contract Price.

ARTICLE 8 - MISCELLANEOUS PROVISIONS

(a) In the event of any conflict between the provisions of this Agreement and the provisions of any other Contract Document(s), the terms and provisions of this Agreement shall control and be fully applicable.

(b) Except to the extent inconsistent with this Agreement, the definitions contained in the General Conditions shall be applicable in interpreting this Agreement.

(c) This Agreement shall be governed by the law of the Commonwealth of Kentucky.

(d) The titles and headings contained in this Agreement are for convenience only and should not be used in construction of this Agreement.

(e) The CONTRACTOR shall not be entitled to assign, transfer or convey any of its rights or obligations pursuant to this Agreement without the prior written consent of the CONSTRUCTION MANAGER.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement this the day and year first above written.

CONTRACTOR:

NATIONAL INDUSTRIAL CONSTRUCTORS

BY:______________________________

ITS:______________________________

CONSTRUCTION MANAGER:

OHBAYASHI CORPORATION

BY:______________________________

ITS:______________________________

000:020

APPENDIX 2

OPERATION CHART OF THE TOYOTA KY PROJECT

LEGEND
DO: DO
AS: ASSIST/INFORM
CH: CHECK/REVIEW
IN: BE INFORMED
AP: APPROVE

1) CONCEPTUAL PLANNING STAGE	OWNER TMC	CONSULTAN	STATE GOV'T	OHB
A. PRELIMINARY FEASIBILITY STUDY				
* MARKETING/POLITICAL ANALYSIS	DO	(AS)		
* DEFINE NEEDS	DO			
* PRELIMINARY FINANCIAL ANALYSIS	DO	(AS)		AS
* EXAMINING JOINT VENTURE	DO	(AS)		
* EXAMING CONTSACT METHOD	DO			
* DEFINE OPERATING REQUIREMENTS	DO			
* PROVIDE BASIC INFORMATION OF SITE	IN	IN	DO	IN

2) PREDESIGN/PLANNING STAGE	OWNER TMC	CONSULTAN	STATE GOV'T	OHB	A/E GIF
A. SELECTION OF CONSTRUCTION MANAGER	DO			AS	
B. SELECTION OF A/E	AP			DO	AS
* PERSONNEL SELECTION OF CM	CH			DO	
* PERSONNEL SELECTION OF A/E	CH			DO	DO
C. SITE SELECTION	DO	AS	AS	AS	
* INVESTIGATION OF ZONING REGULATION, ETC.	IN	DO	AS	DO	
* INVESTIGATION OF CLIMATE, GEOTECHNICAL CONDITION, INFRASTRUCTURE, ETC.	IN	DO	AS	DO	
* INVESTIGATION OF ACQUISISION TERMS	IN	DO	AS	DO	
D. NEGOTIATION ABOUT INCENTIVES FOR SITE SELECTION	DO		DO	AS	
E. PRELIMINARY ARCHITECTURAL PLAN	DO			AS	AS
* ARCHITECTURAL DESIGN	DO			AS	AS
* STRUCTURAL DESIGN	AP			DO	AS
* BUILDING EQUIPMENTS	AP			DO	AS
* PRODUSTION ENGINEERING	DO			AS	AS
F. COST ANALYSIS	CH			AS	DO
G. DEVELOPMENT PROCESS AND SCHEDULING	CH			DO	AS

OPERATION CHART OF THE TOYOTA KY PROJECT

LEGEND
DO: DO
AS: ASSIST/INFORM
CH: CHECK/REVIEW
IN: BE INFORMED
AP: APPROVE

3) ENGINEERING & DESIGN STAGE	OWNER TMC	STATE GOV'T	OHB	A/E GIF
A. MAKIN & ARRANIGING DESIGN DOCUMENTS	AP		CH	DO
* DRAWINGS AND SPECS FOR PERMISSION	IN	AP	CH	DO
* DRAWINGS AND SPECS FOR ESTIMATION	AP		CH	DO
* SPECS FOR CONSTRUCTION	AP		CH	DO
B. APPLICATION FOR PERMISSIONS	IN	AP	AS	DO
* BUILDING PERMITS	IN	AP	IN	DO
* FOUNDATION PERMITS	IN	AP	IN	DO
* OTHER PERMITS	IN	AP	IN	DO
C. COST CONTROL/VALUE ENGINEERING	CH		DO	AS
* REVIEW FINAL PLANS AND SPECS WITH COST ESTIMATES	AP		DO	AS

4) PROCUREMENT STAGE:	OWNER TMC	KY/LOCAL GOV'T	OHB	A/E GIF	G.C.s	SUBs	UNION
A. BIDDING & CONTRACT NEGOTIATION	AP	(CH)	DO	AS	DO	DO	CH
* NOTICE TO BIDDERS	AP		DO		IN		CH
* QUALIFYING & SELECTION OF SUBS	IN		CH		DO	IN	CH
* BID EVALUATION	AP	(CH)	DO	AS	AS		CH
B. LABOR RELATIONS							
* PROJECT AGREEMENT	AP	CH	DO	IN	IN	IN	DO
* NEGOTIATION ABOUT LABOR RELATIONS	AP	CH	DO	IN	IN	IN	DO

OPERATION CHART OF THE TOYOTA KY PROJECT

LEGEND
DO: DO
AS: ASSIST/INFORM
CH: CHECK/REVIEW
IN: BE INFORMED
AP: APPROVE

5) CONSTRUCTION STAGE:	OWNER TMC	LOCAL GOV'T	OHB	A/E GIF	G.C.s	SUBs	UNION	TEST LAB
A. CONSTRUCTION								
* SCHEDULING	CH		DO		AS	AS		
* QUALITY CONTROL	CH		DO	AS	AS	AS		AS
* COST CONTROL	CH		DO		AS	AS		
* SAFETY CONTROL	CH		DO		AS	AS		
* DOCUMENT CONTROL	CH		DO	IN	IN	IN		
* REVIEW PLANS & SPECS			AS	AS	DO	DO		
* PERSONNEL SELECTION			CH		DO	DO	AS	
* CONSTRUCTION METHODS			CH		DO	DO		
* INSPECTION			AP		AS	AS		DO
* CHANGE ORDERS	DO		AS	AS	IN	IN		
* CONSTRUCTION			CH		AS	DO		
B. COORDINATION CONSTRUCTION WITH PUBLIC AGENCIES	CH	IN	DO	AS	IN	IN		
C. PURCHASING (MATERIALS)			CH, DO		DO	DO		
D. FINAL INSPECTION	AP		DO	AS	AS			AS

6) OPERATION AND MAINTENANCE STAGE	OWNER TMC	OHB	A/E GIF	G.C.s	SUBs
A. MAINTENANCE DURING GUARANTEED PERIOD	AP	CH	AS	AS	DO
B. INSPECTION AFTER ONE YEAR	AP	DO	AS	AS	AS
C. MAINTENECE AFTER THE GUARANTEED PERIOD	DO	AS			IN,DO

Appendix 3

Roles of some managers in OHB's site office in the Toyota KY

Project Director (Ohba):

1) Responsible for all field and design activities.

2) Companies on and off site representative of the project.

3) Organizing Ohbayashi's Toyota KY on and off site office.

Deputy Project Manager (Mizoguchi):

1) Responsible for all job site activities.

2) Companies on site representative with owner, labor, vendors, and public.

3) In the absence of the Project Director, assumes the responsibilities of the Project Director.

Project Manager (Jordan):

1) Promotes and maintains good relations with the client, A/E, and local community.

2) Provides the focal point for the coordination of the construction staff and achieves the required schedule, cost, and quality.

3) Is an integral part of the development of the overall project plan.

4) Integrates the engineering, procurement, administration, and construction groups to a common goal.

5) Monitors the projects safety, security, and medical aid programs.

6) Monitors the overall project schedule and budget performance.

7) Promotes labor harmony.

Engineering Manager (Japanese):

Engineering Manager (Japanese):

1) Is responsible for procurement, and coordinates information flow with engineering expertise among client (TMC), construction manager (OHB), A/E (GIF and OHB's design team), and area general contractors.

2) Provides bid package and recommendation (analyzing contents of bid package, method of bid classification, listing of bidders, bid itself, etc.)

3) Provides for the orderly flow of design documents to support the construction effort, along with the timely flow of construction documents to the design firm for reviews and approvals.

4) Coordinates the economic utilization of similar materials, equipment, and construction principals with the design effort to obtain optimum results.

5) Provides for technical correspondence with the A/E, vendors, professional societies, etc.

6) Provides, monitors, and recommends changes to the project master schedule plan.

7) Provides the management level cost, capitalization and budget reporting.

8) Controls the quality of soil, steel, and concrete quality.

9) Edits construction reports (in Japanese).

Area Manager (American):

1) Manages and administers the contract with the Construction Manger/General Contractor with his assigned area.

2) Ensures construction meets or exceeds the project objectives with regard to cost, quality, and schedule in accordance with the Construction Documents.

3) Coordinates and cooperates with the other Area Managers and Area Engineers to promote and insure the overall Project goals are met and that good working relationships are maintained.

4) Promotes and enforces the Construction Manager's/General Contractor's safety and security programs by insuring a maintained awareness among construction supervision on the overall project safety and security.

5) Advises and receives advise from Engineering Manager as regards planning for both the project and his individual area requirements.

6) Monitors and directs General Contractor's subcontractors' planning efforts to achieve project requirements.

Area Engineer/Area Contract Coordinator (Japanese):

1) Is responsible for engineering in his assigned area.

2) Needs direct contact with TMC, A/E, and the Area General Contractor to deal with the following works.

3) Needs close cooperation with Engineering Manager.

4) Evaluates bids and recommends award contractors.

5) Reviews and negotiates estimates for change orders.

6) Monitors and approves area budgets, and adjustments to these budgets.

7) With the General Contractor establishes short range schedules and provides for monitoring and recommendations for corrective

action.

8) Provides construction planning in his assigned area.

9) Monitors the construction work for compliance to Project Quality Standards.

10) Through field tours provides for efficient utilization of labor, materials, equipment, and services.

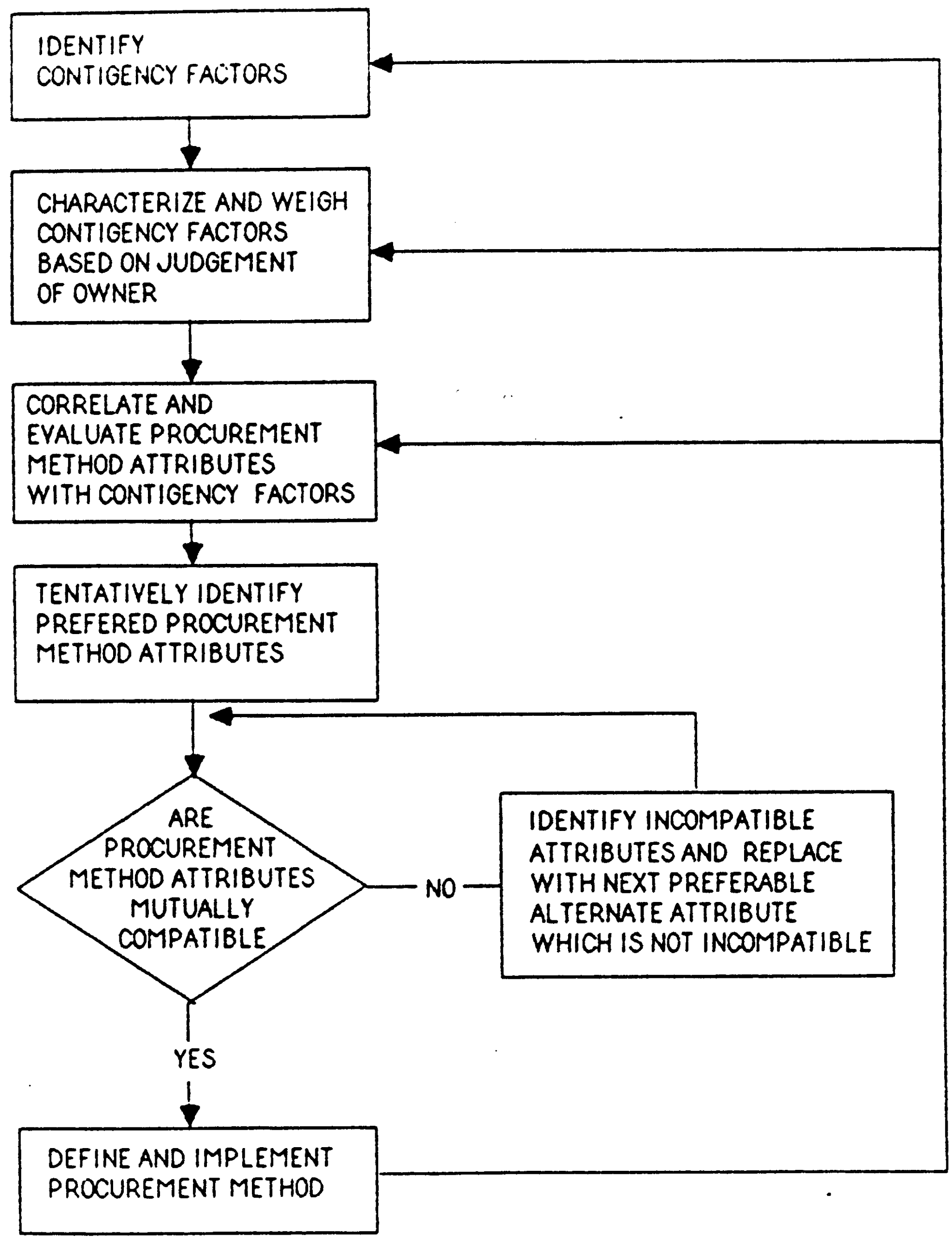
11) Coordinates construction process with the General Contractor and supplies of production machineries for the setting for them.

12) Provides construction report written in Japanese to TMC.

APPENDIX 4

MINDEN'S "PROCUREMENT METHOD DESIGN MATRIX" And Its Explanations

Figure A General Procurement Method Decision Algorithm



SOURCE: MINDEN'S THESIS AT MIT, 1986

Instructions

1 Select contingency factors which apply to project.

2 Weigh contingency factors in terms of relative importance.

3 Compare each contingency factor with procurement method attributes as indicated on the left matrix.

4 Score each attribute according to correlation with weighted contingency factors. Example: Score design-build given:

	weight	correlation	score
Early Delivery	5	0	5
Complex Project	2	x	-2
Tight Budget	3	0	3
Sophisticated, limited mgmt	2	0	2
Type II Owner	4	0	4
Total Score	→		12

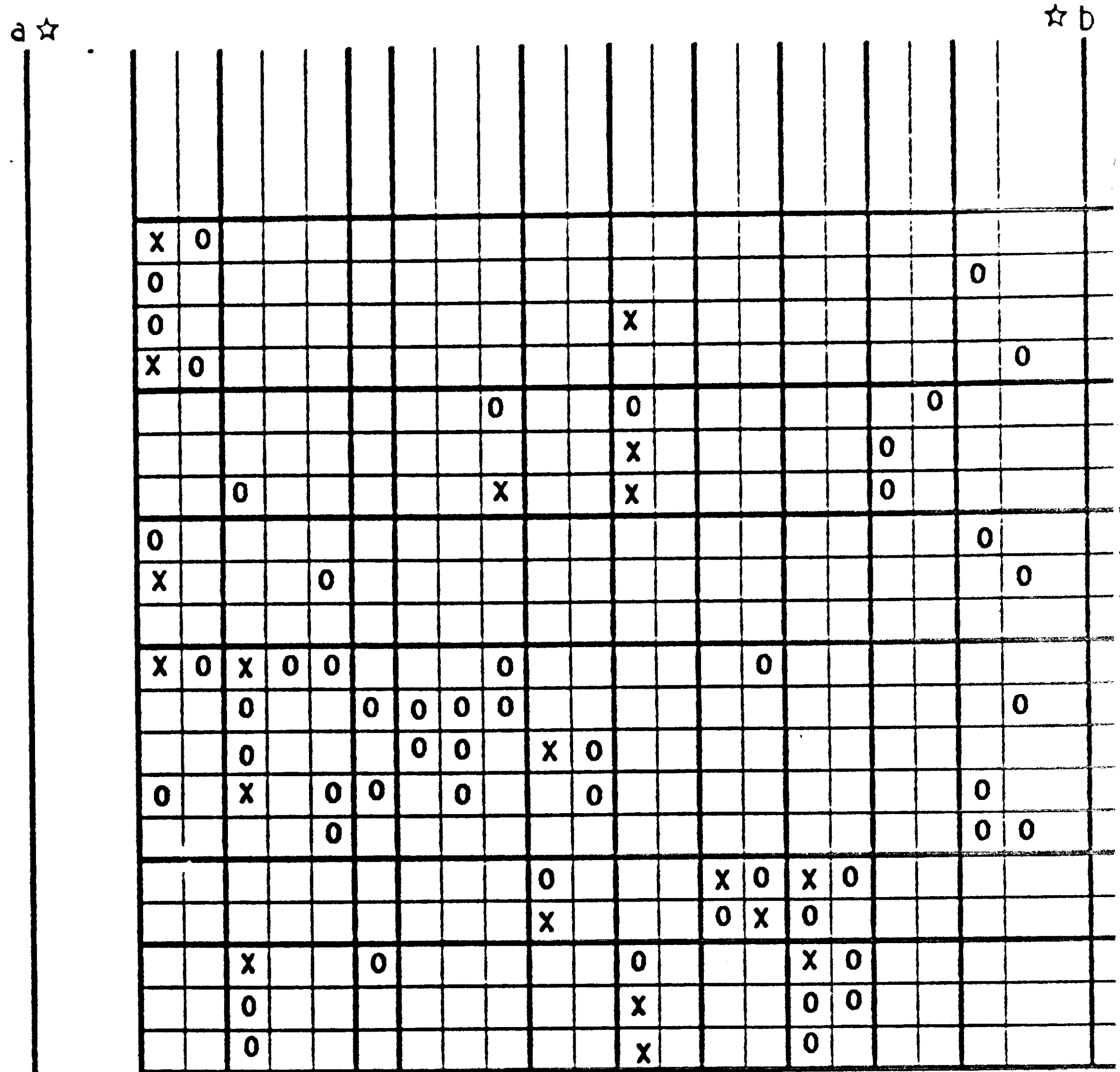
5 Tentatively select attribute in each category with highest score.

6 Compare attributes on right matrix for incompatibility, denoted " **X** " If incompatibility detected, select alternate attribute(s) to eliminate incompatibilities while optimizing total score of all attributes.

SOURCE: MINDEN'S THESIS AT MIT, 1986

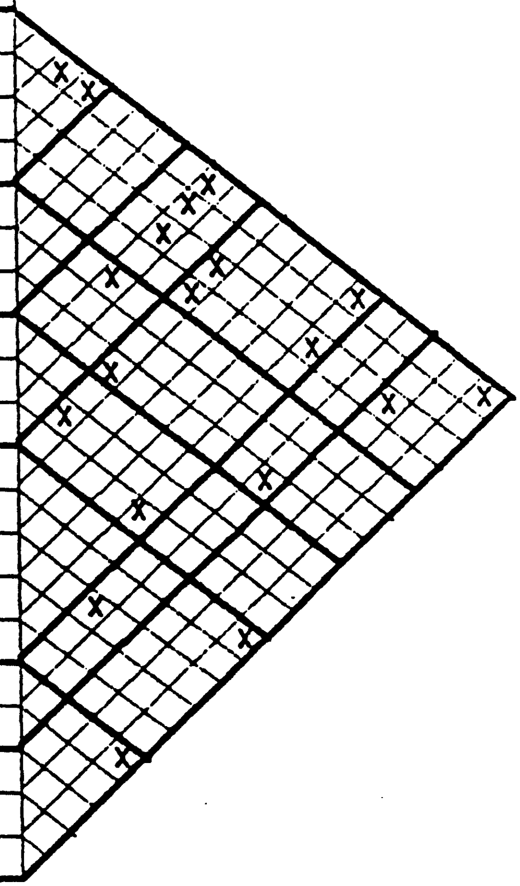
Figure Procurement Method Design Matrix

Weight	Procurement Method Contigency Factors		
	Early Accelerated Delivery Required	delivery time	Project Requirements
	Normal Sequencing Adequate, Delivery Time Not Critical		
	Project Large &/or Complex &/or High Risk &/or Poor Definition	size/complexity/risk	
	Project Moderate in Size &/or Complexity		
	Project Simple, Straightforward, Governed by Generic Standards		
	Based on Scope/Quality/Time, Budget Appears Tight	cost	
	Owner has Sophisticated,Capable & Extensive Management Resources	management resources	Owner Constraints
	Owner has Sophisticated but Limited Management Resources		
	Owner lacks Management Resources & Know-how		
	Type I Owner, Weak Negotiating Position, or Required to Bid	bibbing/negotiating constraints	
	Type II Owner, Strong Negotiating Position, No Bidding Restraints		
	Requires Fixed Price Before Commiting to Bid	risk aversion	
	Able to Bear Most Cost Risk		
	Weak Competition, Limited Qualified Contractors	bidding climate	Market Conditions
	Good Competition, Bidding Viable		
	Qualified Contractors Unable to Offer Fixed Price w/o High Premium	contractor risk aversion	
	Qualified Contractors Can Offer Fixed Price w/o Excessive Premium		
	Competition May Be Improved or Risk Managed by Disaggregating Project	advantages of disaggregation	
	No Significant Benefit by Disaggregating Project		
	Building Systems Meeting Project Requirements Available	building systems availability or market potential	
	Building Systems Not Available but Potential Market Aggregations May Justify		



SOURCE: MINDEN'S THESIS AT MIT, 1986

Procurement Method Attributes		Score	Rank	Compatable	Selection
Normal Sequential Design/ Bid/ Build Schedule	scheduling				
Accelerated Design &/or Construction					
Fast-Track					
Pre-Engineering					
Single Responsibility Contract	work packaging				
Early Work Packages w/ Transfer					
Multiple Work Packages					
Use Existing System	systems applica-tions				
Develop New Building System					
Use Open Systems or Conventional Technology					
Traditional Method	generic procure-ment method				
Design-CM					
Construction-CM (CM w/GMP)					
Design-Build					
Systems					
Bid Competitively*	con-tract award				
Negotiate*					
Fixed or Unit Price*	pricing/ risk allocation				
Shared Savings*					
Cost Plus*					



* *For overall project, not necessarily seperate work packages*