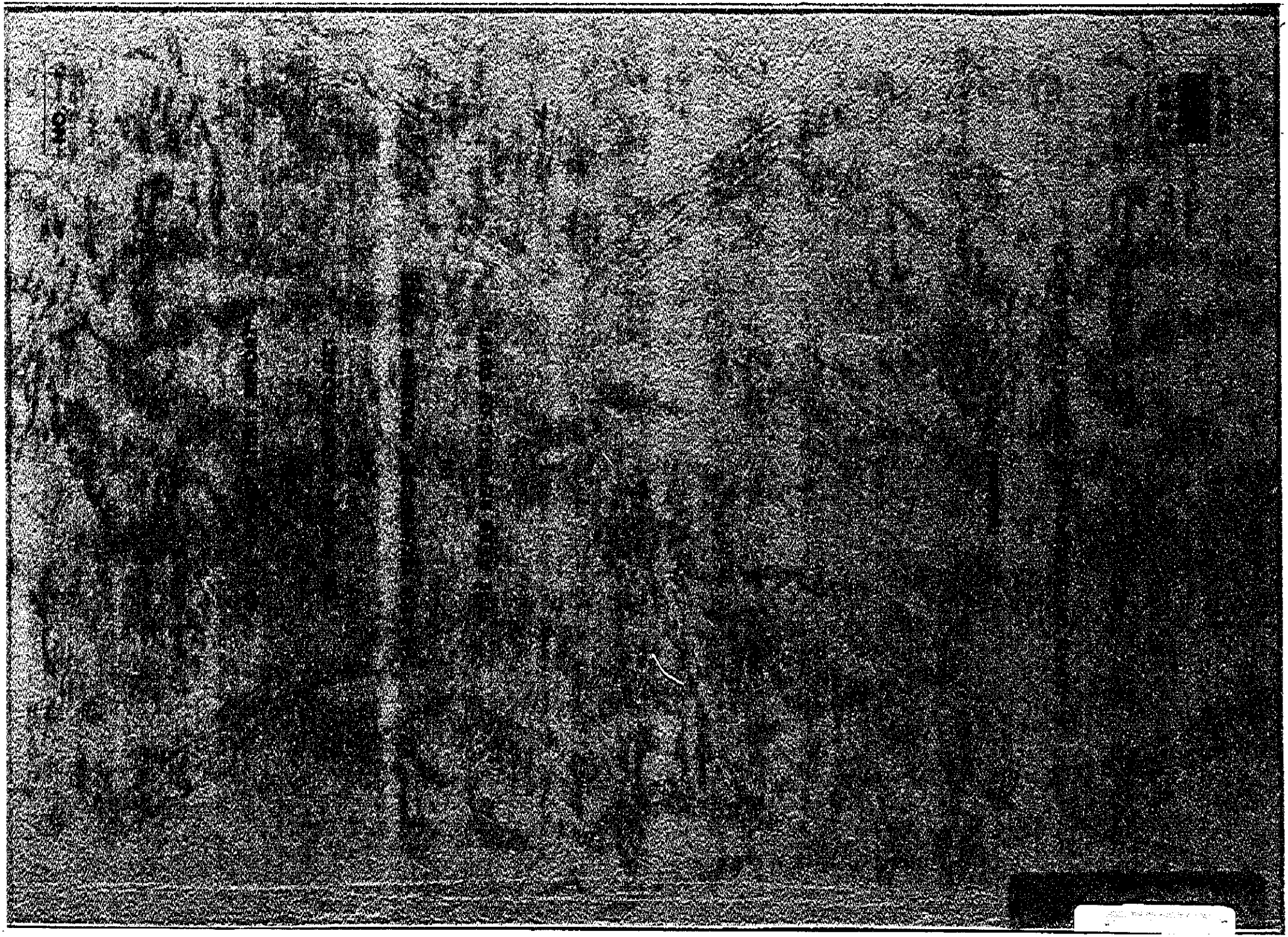


PREFACE

In response to the request of the Government of the Arab Republic of Egypt, the Government of Japan decided to conduct a basic design study on the improvement project of the rice technology training centre and entrusted the survey to the Japan International Cooperation Agency (J.I.C.A.). The J.I.C.A. sent to Egypt a survey team headed by Mr. Shigehisa NISHIKORI, Deputy Head, Inspection Div., Executive Dept., Food Agency, MAFF from August 21st to September 10th, 1982.

The team had discussions with the officials concerned of the Government of Egypt and conducted a field survey in Alexandria City.

After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the project and contribute to the promotion of friendly relations between our two countries.

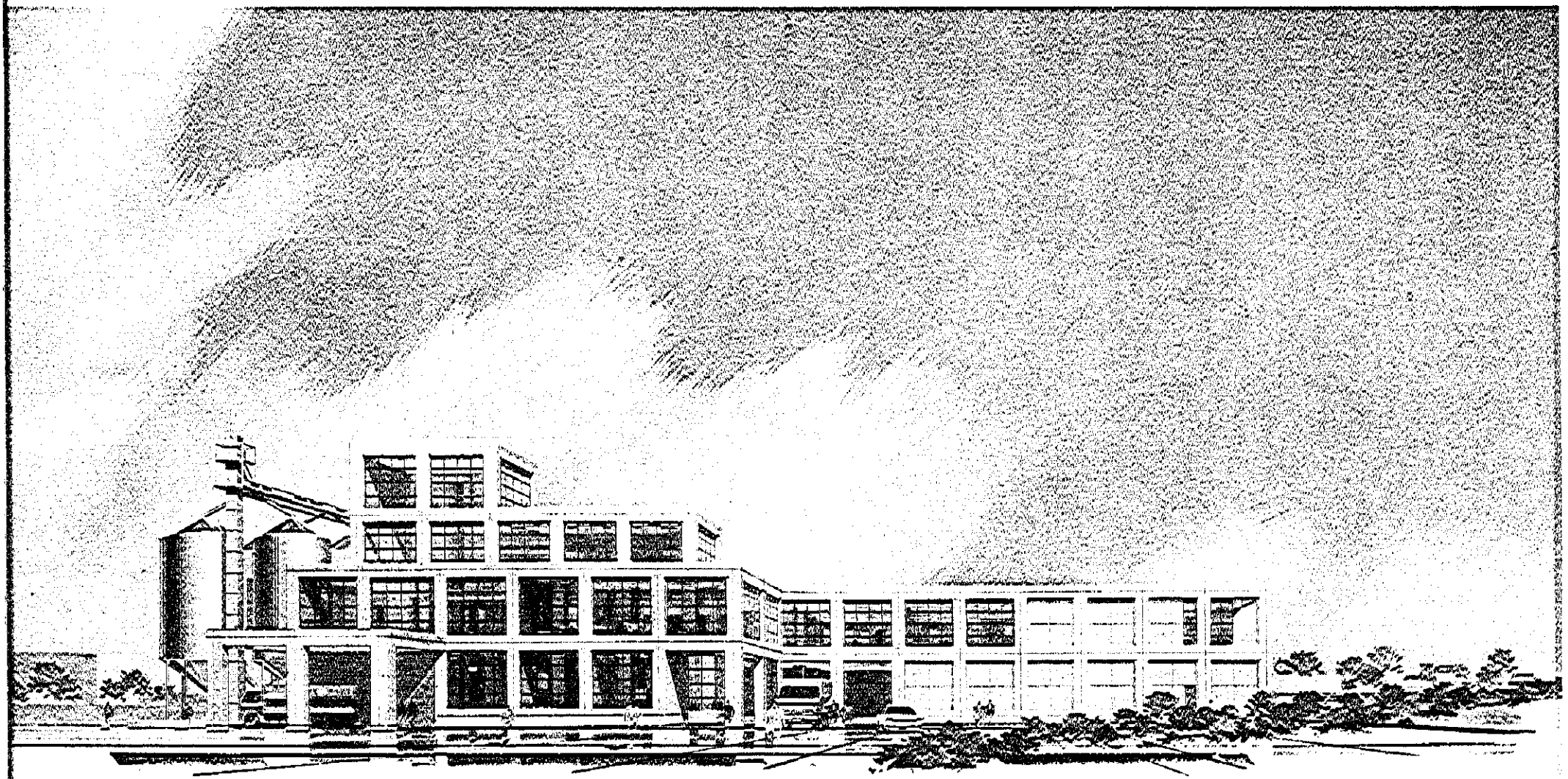
I wish to express my deep appreciation to the officials concerned of the Government of the Arab Republic of Egypt for their close co-operation extended to the team.

December, 1982

Keisuke Arita

President

Japan International Cooperation Agency



LOCATION MAPS

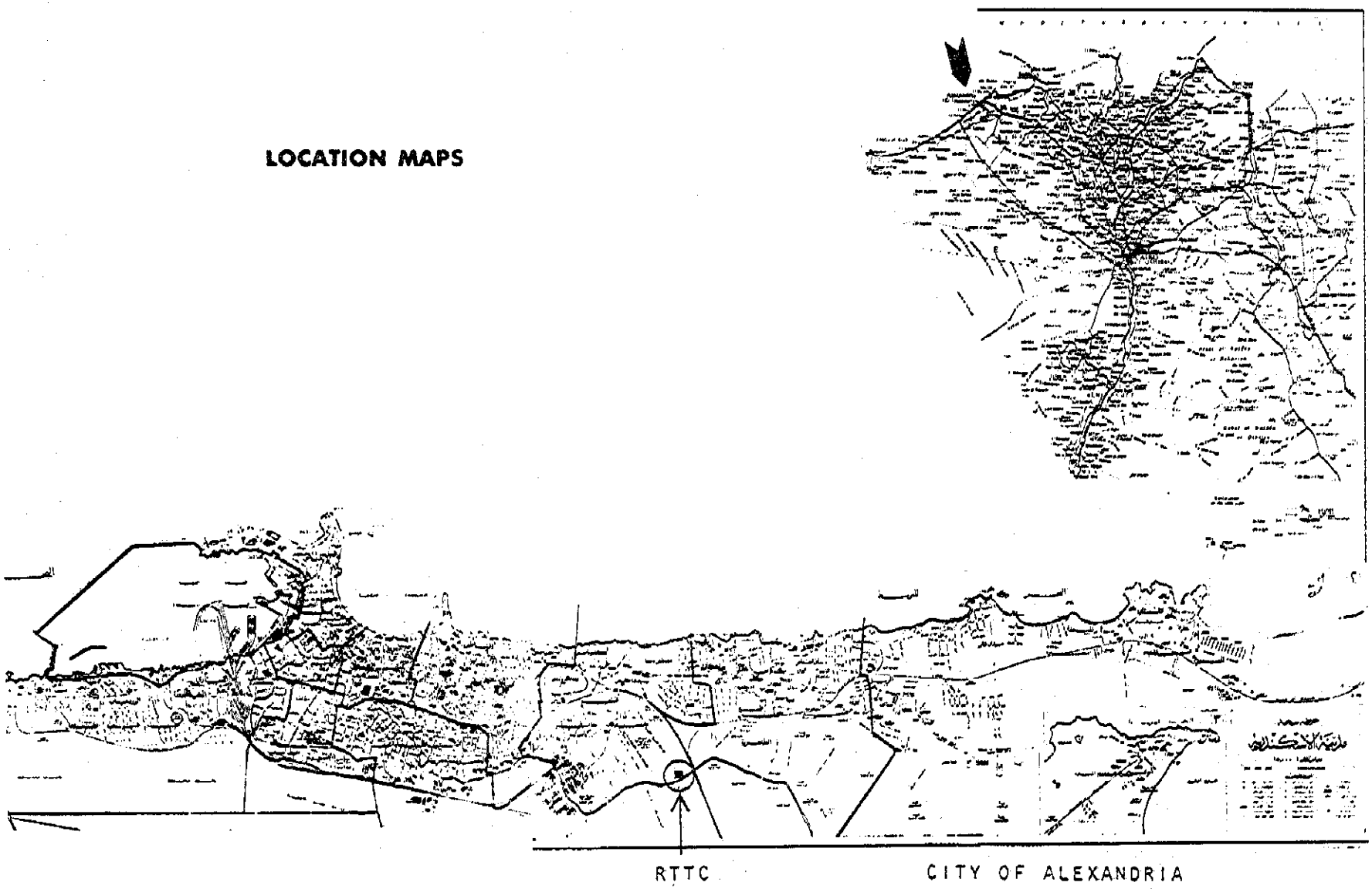


TABLE OF CONTENTS

SUMMARY

A. BACKGROUND OF THE PROJECT

1. Egyptian agriculture brought up in the cradle of civilization has achieved high productivity by through-the-year irrigation in recent years in spite of severe limitations of arable land areas. The food self-support ratio has declined to 40% due to difficulty in expansion of cultivated land areas, conversion of cultivated land to urban uses, and the rapid increase of population at the rate of 2.9% annually. Future prospects in this respect are not favourable. The indirect food self-supporting pattern of importing wheat by exporting cotton is becoming difficult due to salt damage caused by the effects of consecutive cropping of cotton.

   Rice plays an important role in the improvement of food self-support ratio.

2. Political measures are about to be implemented to improve the food self-support ratio by adopting double annual cropping. Changing to double cropping of rice involves such problems as changing rice varieties from Japonica to Indica and labour shortages due to the absence of labourers who are abroad.

3. Remodelling of rice mills and mechanization of agricultural processes are being planned as countermeasures to these problems. Establishment of technical and economic measures for the improvement of post harvest processes in line with the new rice cropping policy is very urgent.

4. Rice mills under governmental control are placed under 8 Rice Milling Companies. Their equipment is mostly old European Types in poor condition due to their age. Remodelling of these rice mills has also become an urgent issue for the country.

RIMCO (Rice Marketing Company) and RTTC (Rice Technology Training Centre) have concluded after a worldwide study that improvement of the rice mills with up-to-date Japanese technology is the best direction towards the solution of their problems.

5. The improvement project of RTTC is an indispensable primary step towards improvement of their rice mills as it will enable the implementation of the improvements through technological training, research and developments to be carried out at RTTC. The request to the Japanese Government for this technical cooperation is in line with these circumstances.

B. BUILDING SITE

1. Site for a new rice milling facility has been provided by the Egyptian Government within the compounds of the Rice Technology Training Centre in the city of Alexandria. RTTC is located near the Agricultural Road as it enters Alexandria. On its present site of about 12,000 m^2, three major facilities are existing, and an open space of about 4,300 m^2 is made available for the addition of the new training plant as its fourth major component.

2. The RTTC compound is flat and is on the same level as surrounding land which is about two (2) meters lower than the front road which runs on the crown of an embankment for a canal. The site is quite safe from floods.

3. Soil bearing for structures can be attained at a depth of about 15m from the surface. Piles are required for the foundation of substantial buildings.

4. All public utilities available in Alexandria are already existing on the site, and no problem is foreseen as to the receiving of electric power, water and telephone service.

C. BASIC DESIGN

1. New functions to be added to RTTC under this improvement project are as follows:

   a. Provision of a new rice mill training and research building equipped with Japanese type high performance machines for practical training on such processes as rice milling, storage and drying.

   b. Provision of research and testing facilities for research and development of new technology (production of parboiled rice, utilization of by-products, improvement of quantity and quality of milled rice)

2. Basic principles in planning of new facilities is to relate them organically with existing facilities, while at the same time making the new facilities independently functionable in line with the objectives and functions of RTTC. Improvement of practical technology based on the existing level of technology and facility operation is also to be considered. In the selection of equipment, rice milling processes are to be the primary consideration. Consideration of safety and ease of training with easy-to-understand equipment are to be made. Sizing of equipment is to be such as to enable practical training for milling operations and to be such as to perform experimental operations which lead to practical applications for by-product treatment.

3. Facilities to be provided under this Project are as follows:

   a. Receiving-drying facility, complete, treatment capacity of 25 ton/day

   b. Paddy storage facility, silo type, storage capacity of 1,000 tons

   c. Rice milling equipment, complete, capacity of 2 ton/hour

d. Teaching material, complete

e. Parboiled rice production equipment, complete, practical test capacity of 1 ton/hour

f. By-product utilization equipment, complete, for practical testing

g. Testing tools and equipment, complete

h. Machine maintenance tools, complete

i. Unit component machines, for comparison tests and maintenance training

j. Generator, one set, for emergency use

k. Data processor, one set, for data storage and retrieval

l. Low-temperature storages, for testing

4. Building to house training and other facilities is to be designed to harmonize with existing buildings and to take into consideration local climate, customs, habits and practices, especially regarding building construction. Building is to be designed to be easy to operate, administer and maintain.

5. Due to the nature of facilities and activities to be accomodated in the Building, it is to be of reinforced concrete, a high-ceiling single storey structure with a partial mezzanine. Total floor area is to be about 2,550 m^2.

6. Utilities normally required for a facility of this nature will be provided, such as electric illumination and service outlets, water supply and drainage. Air conditioning for laboratories, meeting rooms, office, control room and low-temperature storages is to be provided. Interior hydrants are to be provided for fire protection.

D. ADMINISTRATION AND MAINTENANCE

1. Expenses required for operation and maintenance is to be financed by collections from governmental rice mills receiving conveniences from the Centre. Governmental subsidies through RIMCO are also being received.

2. A new section is to be provided for the administration and control of the new facilities. The sincere enthusiasm for the realization of this Project on part of organizations and staff concerned is most evident. The capability and experience attained by the existing staff in the administration and maintenance of existing facilities is to be expanded for the new facilities.

E. EVALUATION OF THE PROJECT

1. Direct effects to be achieved by realization of this Improvement Project are listed below. They are judged to be justifiably in line with the objectives of a cooperation project of this nature.

   a. Upgrading of training level, especially on modern high-efficiency equipment

   b. Increase of training activities

   c. Expedite research and development of new applied technology

   d. Promotion of instructive and promotional activities on technology in general for the rice industry

2. Indirect effects as listed below will also be attained:

   a. Improvement of food supply situation by reducing grain loss, in increasing yield in drying, storage and milling processes

b. Increase worth value of production by improving quality of milled rice, which will also be advantageous in the exporting of rice

c. Utilization of by-products by processing of edible rice bran, resulting in the decrease of imports of edible oil

d. Improve rice mill operation by increasing production, conserving labour and energy

e. Provide a model for modernization of facilities for related industries (agricultural processing, food treatment, etc.)

f. Improvement of the nutrition level of the people

F. CONCLUSIONS

1. It has been confirmed by this Study that the RTTC Improvement Project is to contribute to the increase of food production in consistency with objectives of higher level national policies. This Project is to become a pilot plant for the Egyptian rice industry toward contribution to the improvement of food situation of the people and national economy. By appropriate implementation and execution of this Project, it will be justifiable as a grant aid cooperation by the Japanese Government.

2. In relation to technical cooperation, RTTC is performing activities well by its present staff. Post project technical cooperation, limited to technical guidance of machine operation, will be appropriate and sufficient as the existing ability to use facilities provided under this Project is sufficient.

OUTLINE OF THE PROJECT

CHAPTER ONE OUTLINE OF THE PROJECT

A. INTRODUCTION

In response to a request from the Government of the Arab Republic of Egypt to improve the facilities of the Rice Technology Training Centre in Alexandria, Egypt, the Government of Japan has sent, through the Japan International Cooperation Agency which is an official agency implementing the technical cooperation program of Japan, a Preliminary Study Team in June 1982. Based upon the results of this preliminary study, the Government of Japan has sent a Basic Design Study Team in August/September 1982. This team was followed by a Second Study Team in October of the same year.

The findings and conclusions outlined in this Report are based on the results of the above mentioned studies, and were made possible by virtue of the enthusiastic and sincere assistance and cooperation of the Egyptian Government to realize this project.

B. STUDIES

1. Basic Design Study

a. General

As it was observed during studies in Egypt by the foregoing Preliminary Study Team that staff members of the Rice Technology Training Centre, led by its General Manager, as well as those of the Rice Marketing Company, represented by its Chairman and National Director, were most enthusiastic about the realization of this Project. All studies and investigations were carried out smoothly by vitue of their thoughtful and careful arrangements and assistance. Positive and sincere reaction was always obtained in reply to questionnaires and requests of the study team. The sincere and positive cooperation of the

local staff at the Rice Technology Training Centre in Alexandria was most noteworthy, and deeply appreciated by the Team. A list of personnel concerned is included in the Attachment to this Report.

b. Basic Design Study Team

A Team* headed by Mr. Shigehisa Nishikori, Deputy Head, Inspection Division, Executive Department, Food Agency of the Japanese Ministry of Agriculture, Forestry and Fishery was dispatched during the period of August 21st to September 10th, 1982 to carry out a basic design study on this Improvement Project.

Through a series of discussions and exchange of views between the Team and officials of the Ministry of Supply, the Rice Marketing Company and the Rice Technology Training Centre, both sides agreed to recommend to their respective Governments and authorities concerned to examine the results of the survey toward the realization of the Project.

As result of these discussions, Minutes of Discussions were exchanged. A copy of these Minutes is contained in the Appendix of this Report.

2. Second Study

A Team* headed by Mr. Yoshifusa Shikama, Basic Design Division, Grant Aid Department, Japan International Cooperation Agency was dispatched from October 21st to 30th, 1982 to confirm the contents of this Report.

As a result, the Basic Design and contents of this Report were confirmed and Minutes of the Second Discussion were exchanged. A copy of these Minutes is contained in the Appendix of this Report.

*The firm of Matsuda, Hirata & Sakamoto, Architects, Planners & Engineers, Inc. participated in the teams, and prepared the basic designs of this Report.

C. BACKGROUND OF THE PROJECT

1. General Conditions of Rice Production in Egypt

a. Outline of Agriculture in Egypt

The history of agricultural cultivation in Egypt is as long as its history which is the cradle of human civilization. Agriculture in Egypt today is still one of its basic industries. Expansion and improvement of cultivated land has been promoted in the past as the basis of agricultural development. Year round irrigation and provision of drainage facilities is symbolized by completion of the Aswan High Dam in 1971. Furthermore, the Food Security Plan was declared in 1981 as a basic governmental policy to cope with the rapid increase of population. Agricultural labour population in 1979 was 39.4% of the total labour population (Supplement 1). Agricultural production was 26.2% of the Gross Domestic Production (Supplement 2), and was 13.5% of the total export. However, cultivated land areas are limited to the Nile Delta, Nile Valley areas and scattered oases, accounting to only 3.2% of the total one million square kilometer land area of Egypt. This means that high-productivity agriculture is being carried out, but it also means a limitation to the agricultural development in this country. Self supply ratio of total foodstuff is as low as 40% caused in part by the 2.9% annual increase of population. Large quantities of wheat and other foodstuff are being imported. It is becoming difficult to expand the pattern of importing cereals by exporting cotton due to the limitation of consecutive cropping of cotton. Consequently, food production index per capita has fallen as the increase of agricultural production has not been able to catch up with that of population.

b. Production of Main Crops

Egyptian agriculture with its principal production area in the Nile Delta has been assured of high yield per unit area being blessed with fertile soil and water brought by the Nile River as well as abundant solar energy which is 1.7 times the maximum value of Japan. The warm climate enables two-crop annual production. Cotton, rice and maize are the summer crops which are rotated with the winter crops of wheat and berseem (Egyptian clover) thus constituting the main crops of Egypt. The cultivation of sugar cane, fruit trees and vegetables has increased rapidly in recent years. On the other hand, the population increase is bringing about the decrease of arable land due to urbanization (Supplement 4). Import of food is also increasing and has amounted to 22% of total imports.

c. Rice Production and Distribution

(1) Administrative Organizations of Rice Production and Post Harvest Processing

The Ministry of Agriculture and the Ministry of Supply and Internal Trade and two other ministries deal with agricultural administration. Of these ministries, the Ministry of Agriculture and the Ministry of Supply and Internal Trade are most related to rice production and post harvest processing. The former administers pre-harvest activity and the latter post harvest activities. Thus these two ministries jointly designate planting area of rice, determine the procuring price of paddy, and oversee procurement from farmers, storage, processing and distribution of rice. The Ministry of Supply and Internal Trade has as implementing agencies the Rice Marketing Company (RIMCO) and eight (8) Rice Milling Companies. The Ministry of Economy also conducts inspection of export rice by its extra-ministerial agency, the Foreign Trade Company.

(2) Production Increase Policies

Expansion of cultivated land area is extremely difficult in Egypt due to its natural conditions. The Government is planning to achieve an epoch making improvement of its food supply situation by changing the rice production pattern to double annual cropping. With the same object, the promotion of mechanization in rice cropping processes is being attempted to decrease losses through improvement of post harvest processing as well as to supplement agricultural labour shortages caused partly by drainage of labourers abroad and to increase yields by enabling operations within optimum periods.
The present boom of rice cropping supported by both the Government and the people is also brought about due to the fundamental fact that cotton cropping is detrimental to soil fertility and that its continuous cropping is resulting in salt damage while paddy production results in washing away the injurious salt exposed on the ground surface.

(3) Planted Area and Production

Planted area of rice increased rapidly by completion of the Aswan High Dam in 1971. Planted area in recent 5 years is 1 to 1.2 million feddans which is a little more than twice the area in the 1950s. The yield per unit area of 1.4 tons per feddan in 1952 increased to 2.3 tons per feddan in 1973. Production increased four times in the past 25 years because of increases in planted area and yield, however, the rate of production increase has retarded in recent years. The Government has estimated on annual basis an increase of 3.7% in planted area and an increase of 9.0% in production of rice under its New 5 Year Plan (1978 - 1982), however, the balance between supply and demand is expected to change unfavourably.

(4) Varieties

Rice is said to have been introduced to Egypt during the 7th Century. Egyptian rice today is of Japonica type. Varieties being cultivated are the new variety Giza 171 (45% in planted area ratio) and Giza 172 (45% in planted area ratio) which were introduced after the variety of Nahda. Giza is seeded during late April to May and is the so-called ear-heavy type ripening in 150 to 160 days to heights of 120cm. Transplanting cultivation is being adopted for weed control and saving of irrigation water. Ratio of transplanting is reported to be approximately 70%. Planted area of Indica type is estimated to be approximately 5,000 feddans which is a very small 0.5% ratio of the total area. However, the Egyptian Government is declaring that the planting area of two-crop system of paddy rice will be increased by 100 thousand feddans every year starting 1983/84 in order to increase rice production. Thus the early maturing varieties of Indica type will be cultivated and a drastic change in variety is expected to be achieved. Good result was observed in double cropping of paddy rice of IR-28 during a visit of this team to a test farm attached to the Agricultural Department of the Alexandria University. Change of variety from Japonica to Indica involves the problem of the taste of the people, but the following explanations have been voiced:

(a) Rice cooking method is the so-called froth-discarding method, and seasoning is always added, thus the taste of rice itself does not necessarily pose a problem.

(b) Actual quantity of milled rice supply is insufficient compared to rice consumption. The present problem is quantity rather than quality. Milled rice consumption per capita in Egypt was 39kg in 1973, but it is estimated to be less than 30kg in recent years. This has been caused by the decrease in the increase rate

of production as well as the chronic shortage of supply under the pressure of the increase in population.

(c) Historically, change of variety from Japonica to Indica has been achieved in modern times at Thailand and Burma.

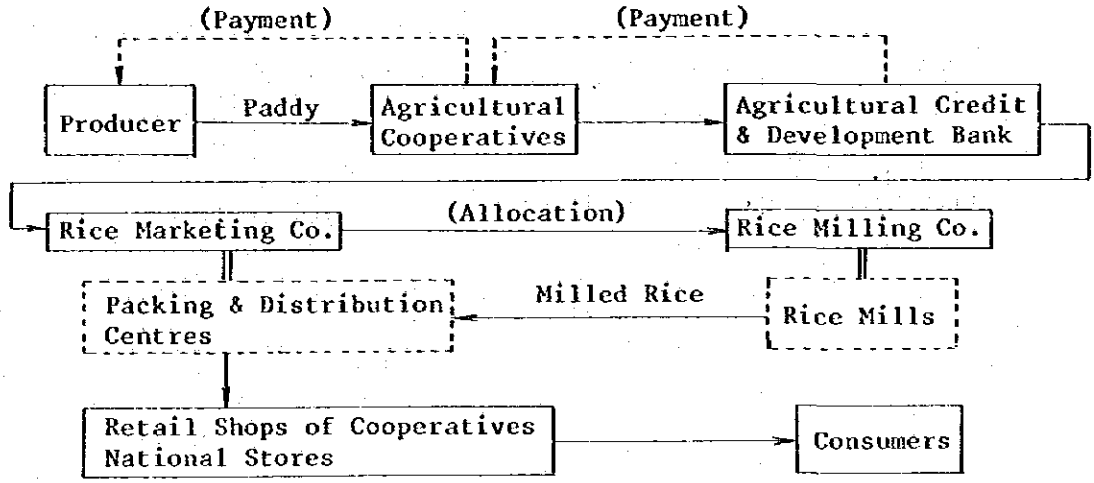
(5) Ratio of Rice under Governmental Control

Cropping and marketing of main agricultural crops are under the control of the Government, and in principle, the entire rice crop is to be controlled by the Government under the low-price policy for foodstuff. Government rice is procured from the producers at a low price after deducting share allotments for government installed irrigation and drainage facilities as well as costs of government furnished water, fertilizers, insecticides, seeds and other government supplied items. Approximately one half of the total crop is compulsorily bought up under this system. The standard allotment per feddan of 1.5 tons is adjusted to 1.1 - 1.2 tons according to the fertility and growth of the crop. (The percentage of procurement by the Government of the total crop during 1965 - 1970 is estimated at 66% according to the calculations of Abdel-Fadil.) As the average yield per feddan is 2.2 - 2.4 tons, the remaining 1.1 - 1.2 tons after deduction of government allotment is for self-consumption or sale to the free market. The Government is taking the policy to reduce the quantity of free market rice by strengthening the control system.

(6) Distribution Routes

Distribution routes of rice under government control are shown and explained in Fig. 1-1.

FIG. 1-1 DISTRIBUTION ROUTES OF RICE UNDER GOVERNMENT CONTROL



(a) Producers deliver paddy to collecting centres of Agricultural Cooperatives.

(b) Agricultural Cooperatives deliver the paddy to RIMCO *through Agricultural Credit & Development Bank*. Payment for the paddy is made to the producers by the Agricultural Credit & Development Bank through Agricultural Cooperatives.

(c) RIMCO allocates paddy to the 8 Rice Milling Companies throughout the nation for processing and the paddy is collected by the milling companies.

(d) The 8 Rice Milling Companies have 54 Rice Mills in total, and after the paddy is milled, the rice is delivered to Packing and Distribution Centres at 45 locations throughout the nation under the jurisdiction of RIMCO.

(e) Milled rice is packed into small bags at Packing and Distribution Centres, and supplied to consumers through government retail outlets.

(7) Price of Rice

(a) Price of Paddy

As rice cropping is under governmental control, the standard price for procurement of paddy is set by the government each year. As the setting of price is announced just before harvesting, the price has no influence on cropping of that year. However, it will naturally influence the incentive of farmers for cultivation of the next crop. Government and free market prices for paddy are shown in Table 1-2.

TABLE 1-2 PRODUCERS' PRICE OF PADDY

(LE/ton)

Year	1967-68	1979	1980	1981	1982(Forecast)
Governmental purchase	20	50	80	85	100-120
Free Market	40	100	140	150-160	200

As shown in the Table 1-2, prices of governmental and free market differ almost twofold. This can be said to support the incentive of farmers to go for rice production. Standard price of paddy for governmental purchase is based on the purity degree of 96%.
In 1981, the price was differentiated by one (1) Egyptian Pound per ton per 1% purity degree difference within the purity degree range of 94% to 98%.
The relationship between inspection methods and price differences have not been clarified by this investigation.

(b) Price of Milled Rice

Rice is being distributed at a very low price to consumers by the Government under the low price policy program for foodstuffs. For example, the standard price of government distributed milled rice in 1981 was LE 50 per ton while the actual cost to the government therefor was LE 154 (LE 85 for paddy plus processing distribution costs and expense). The difference of LE 104 per ton for example is resulting in an annual buildup of a huge financial burden. The accumulated deficit of the Egyptian Government, which corresponds to the Japanese deficit caused by a similar food control system, is estimated to have been about $3 billion in 1981, which is approximately the same amount of the Japanese deficit. When considering that the Egyptian population (43 million) is less than half of the Japanese population, the great efforts of the Egyptian Government to subsidize the diet of the people can be readily appreciated. Price of milled rice distributed in free market in 1981 was LE 200 - 300 per ton. This is reasonable when the paddy price of LE 150 - 160 is considered, however, it is 4 to 6 times the price of LE 50 for milled rice under the governmental system.

Three types of rice are distributed by the Government at different prices as listed in Table 1-4.

TABLE 1-4 PRICE LIST (1981) OF MILLED RICE DISTRIBUTED BY THE GOVERNMENT

Type of Milled Rice	Unit Price	Remarks
Ordinary rice (rationed)	5 PT/Kg	Bulk
High grade rice (rationed)	14 PT/Kg	Packed in 2.5Kg bags, one bag/family/month
Camulino rice	40 PT/Kg	Coated rice for hotels, restaurants, hospitals & private schools

Note: 1 LE = 100 PT

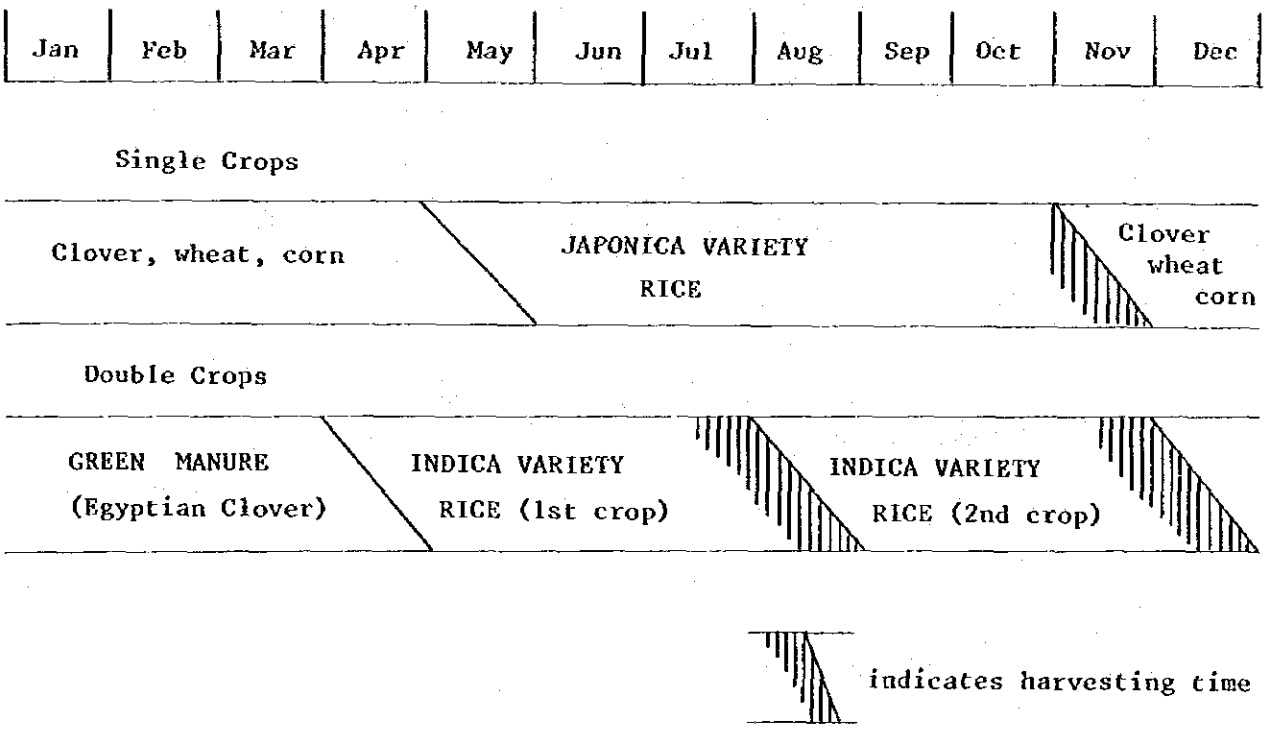
Source: Country Report of JICA Post-Harvest Rice Processing Course

2. Present Conditions of Post Harvest Processing

a. Processing by Farmers

rice is cultivated as a summer crop. Seeding is in May and harvesting in October/November. Double cropping of paddy rice is planned, and in this case, harvesting will be performed twice in July/August and November/December as shown in Fig. 1-2.

FIG. 1-2 CROPPING PATTERN OF RICE



(1) Reaping

Shashara reaping hook with saw-toothed blade is used for root cutting in the traditional manner of reaping. As plant heights of Giza 171 and 172 varieties now mainly cultivated are tall (120cm), they are susceptible to lodging, and much rice is reaped in that condition. Binding in small bundles is not practiced, and rice is dried at the field for about one week prior to threshing. At the time of reaping, field work is easy as fields are in a dry condition. Also as rice is of the Japonica variety, its non-shattering characters keep reaping losses small. Rice is transported in big bundles to neighbourhood threshing yards by tractors, horse-carts, donkeys, and sometimes by camels.

(2) Threshing

Inclusion of mud balls is one of the problems concerning quality in Egypt. Mud balls are usually mixed in during threshing operations due to threshing methods. Reaped rice is spread over hard, flat bare ground, and trampled on by tractors or oxen. The large amount of gravel, sand, mud and other impurities once mixed in, are very difficult technically to be removed completely.

Use of threshers is gradually being introduced. They are however the feeder type of IRRI prototypes and not suited to Japonica varieties reaped near the roots. It is quite important to improve threshers with due consideration given to rice varieties and reaping methods. The improvement of the quality of Egyptian rice is more a problem of avoiding the inclusion of mud balls than its removal. This problem must be taken up as an overall post harvest problem rather than just a problem of rice milling processes.

(3) Selection

The precision of selection is quite low in general, and is a hindrance to subsequent processes. The following are the main reasons why this condition prevails.

(a) Primitive equipment is still being used. In many cases only large impurities are removed by hands after threshing. Manual winnowers are used in some cases, but even they are crude machines with wide (60 - 70cm) fan drums.

(b) Appropriate grading of paddy is not being enforced. It has been proven in some parts of Southeast Asia that upgrading of paddy can be achieved by primitive methods. However, this can be achieved only when farmers are motivated in this direction.

(4) Drying of Paddy

Egyptian climate is known in general to be dry with little rainfall and high temperatures. However, during harvest season (October/November) in the Nile Delta area where more than 98% of the rice is produced, it is chilly at night with much night dew and dense fog early in the morning. Humidity exceeds 80% in some cases. Rice is left at the field for almost one week after reaping partly because of labour shortages. During this period the rice is dried rapidly by solar heat during the daytime, but it absorbs moisture again at night to be rapidly dried again the follow day. This repetitive drying and moisture absorption is the cause of cracked rice which entails much broken rice and lower yield rate at milling stage. In some cases, paddy rice with high water content is delivered in order to avoid such conditions and excessive drying. This again has an unfavourable influence on preservation of the quality of paddy during subsequent processing stages.

b. Collection and Distribution Processes

(1) Procurement Inspection

Inspectors from Ministry of Agriculture and from Ministry of Supply and Internal Trade are dispatched to Collecting Centres of paddy. Inspectors from the Ministry of Agriculture take the side of farmers against inspections by the Ministry of Supply and Internal Trade. However, due to deficiency in inspection technique and equipment, grading inspections gaining the concurrence of farmers is not been performed. Motivative factors to obtain delivery of high quality paddy is also missing. Consequently, government regulated rice is always inferior in quality when compared to self-consumed rice and rice sold at the free market.

Actual inspection method is only on purity degree, by which detection of impurities is performed only by using 2.4 - 2.5mm square woven mesh screens. Stones of the same size as rice cannot be detected and the water content is not checked. For proper inspection, training of inspectors as well as provision of appropriate and sufficient inspection instruments are required. An overall investigation and study is required first on such fundamental matters as pricing of paddy, grading of quality, items of inspection to be executed, inspection system and methods of collection.

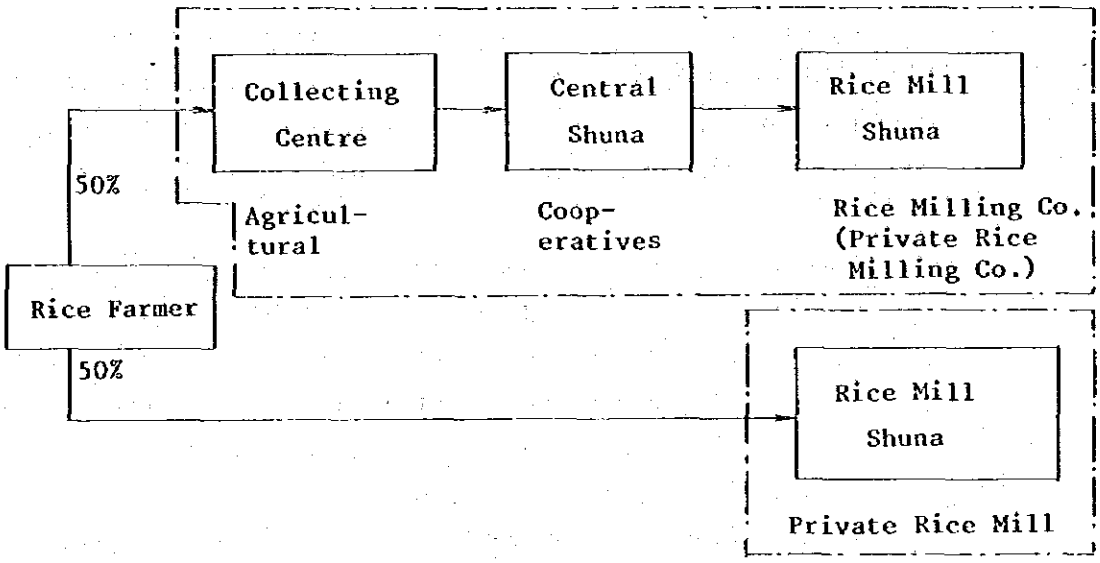
(2) Transportation of Paddy

Horse-carts, donkeys and in some cases camels are used by farmers for transportation of paddy to Collecting Centres of agricultural cooperatives.

Prevailing form of packing for transportation is mostly just bags as it is for other cereals. Rice Milling Companies furnish the jute bags. Size of jute bag is normally 110cm x 60cm which carries about 70 to 80 kg of paddy.

This jute bag is used for all truck transportation to collecting centres, rice mills as well as for storage. The cost of jute bags has risen rapidly (0.56 LE/bag in 1981 and 1.00 LE/bag in 1982), all of which are being imported, and the Rice Marketing Company (RIMCO) is looking into the handling of rice in bulk as an urgent matter.

FIG. 1-3 TRANSPORTATION OF PADDY (FROM FARMER TO RICE MILL)



(3) Storage of Paddy

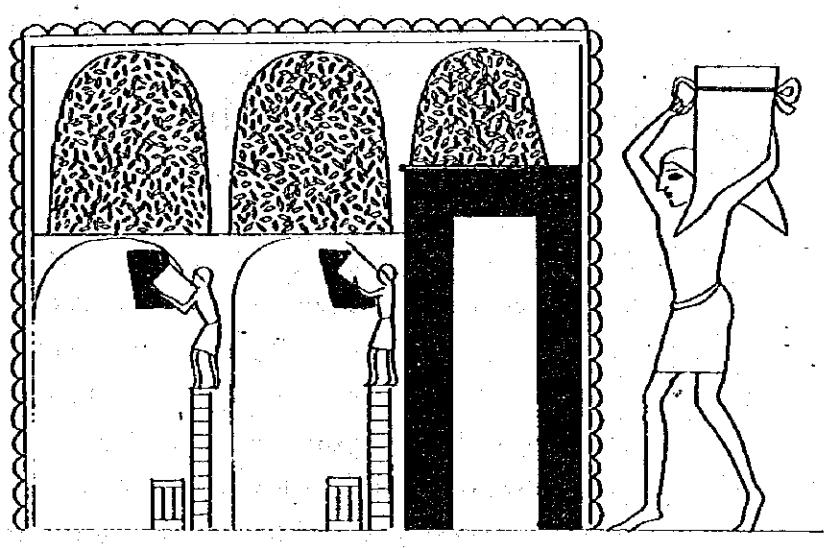
Rice is transported in jute bags as mentioned before, and storage is usually in the form of jute bags. Storage of rice under governmental control is in warehouses or Shuna of rice milling companies.

Most paddy storages of rice mills are of brick structures without such provisions as protection against birds and rodents. Thermometers, hygrometers, grain thermometers and other storage tools and equipment are not provided. Average loss during storage amounts to 5 - 8% according to reports by RIMCA, and a change to silo storage is

desired earnestly by them to reduce the loss. Cereals in ancient Egypt were bulk-stored within brick buildings by red pottery, which seems to be proof that the method of storaging in silos is most suited to the natural conditions. (Bulletin of Council on Imported Food, October 1981).

Shuna is similar to field heaping in principle and functions as a temporary storage. One type is an outdoor pile-up of bags of paddy simply covered with canvas and surrounded by fence. Another type is one with a simple corrugated galvanized iron roof without side walls. Though data is not available, the ratio of outdoor Shuna to overall storage facilities is presumably large. Thus the deterioration losses of paddy such as cracked and discoloured rice are brought about by exposure to rain and dew. Existence of quantity losses caused by insects, rodents and birds is also apparent.

FIG. 1-4 GRAIN SILOS IN ANCIENT EGYPT



Granary, showing how the grain was put in, and that the doors a. b. were intended for taking it out.
Source: Cairo Agricultural Museum

c. Processing at Rice Mills

(1) Existing Rice Mills

There are two categories of rice mills in Egypt. The first category is those belonging to the eight (8) rice milling companies under the Ministry of Supply and Internal Trade numbering 54 rice mills (60 units) in total, and the second category of about 1,700 small rice mills of private ownership. See Supplement for their locations and descriptions. Of the private rice mills, 42 units participate in the processing of government controlled rice by milling annually 75,000 tons of rice. The 54 public rice mills can be classified according to the time of their establishment as follows:

(a) Old plants established before 1962 when private rice mills were nationalized. They are equipped with obsolete machines of British, Italian and West German origin.

(b) The 8 rice mills (see Supplement) established with East German machines for export of rice to Eastern Europe and USSR after nationalization. Though large in size, their daily milling capacity of 155 tons is relatively small. Existing rice mill unit for training at the RTTC is also of East German origin.

(c) Plants classified under (a) above where machines have been replaced partly with new Japanese machines.

More than 80% of the rice mills are equipped with deteriorated obsolete machinery and their capabilities and efficiencies have decreased. Thus being unable to process the entire quantity of rice under governmental control (about 1.1 million tons), 70 to 80 thousand tons have been sent to private rice mills for processing.

There are some milling plants temporarily not operating for some time because of procurement difficulties of parts and repair technique. This is placing additional burdens on other mills, some of which are being compelled to operate 24 hours a day.

Small private rice mills are scattered in village districts and operate mainly at a charge as ordered. Many of them are equipped with small Engelberg hullers of Egyptian make.

(2) Equipment of Public Rice Mills

Though there are differences between individual rice mills, the following is a general description of rice mill equipment:

(a) They are generally situated at convenient places facing main roads which are convenient for the transportation of raw material and finished products.

(b) Older rice mills are usually located in urban areas due to urbanization after their establishment.

(c) Mill buildings have 4-stories and warehouses single storey. Both are of reinforced brick structure.

(d) Mill buildings are large in comparison with their processing capacity (4 - 5 tons of paddy per hour). This is noticeable especially where equipment is old East German machines.

(e) Machines are installed in 4 tiers and rice is lifted to the top tier and gravity fed for processing. This process is repeated until processes are completed.

(f) Prime movers are internal combustion engines or electric motors. Power transmission is by flat belts with intermediate axes. Steam engines fuelled with husk, as used in the past, have not long become obsolete.

(g) Paddy rough sorter, stone eliminator, disc sheller (husker), compartment separator (paddy sorter), corn-type milling machine, broken rice separator and metering devices are the primary machines. In many cases, rubber roll type rice shellers, friction type milling machines and small bag packing machines have been added later.

(h) Machine to remove mud balls (stone eliminating machine) is considered an important component.

(i) Plants where small bag packing machines are not provided, milled rice is delivered in jute bags to RIMCO Packing and Distribution Centres (45 Centres in the country) for packing into 2.5 or 5.0kg bags.

(3) Yield

Average overall yield of existing Egyptian rice mills is reported as 63.8% as shown in Table 1-3. There is definitely a margin for improvement in this respect.

Table 1-3 Yield

	1979/80		1980/81	
Head rice	55.6%	63.8%	53.8%	63.8%
Broken rice	8.2		10.0	
Chips	5.3		5.8	
Bran	7.5		7.4	
Embryo	2.1		1.9	
Husk, foreign matter	21.3		21.1	

N.B. Purity degree 96 %

Variety Japonica

Source: Country Report of JICA Rice Processing Course, 1982

(4) Milling Problems

Problems observed in husking and milling process of Egyptian rice are as follows:

(a) Mud Balls

Mud ball impurities in paddy delivered from farmers due to reasons stated before remain in the finished product of milled rice. This means that the quality of Egyptian rice is regarded unfavourably in the international rice market. Upgrading of Egyptian rice cannot be achieved without elimination of mud balls. Though many people concerned have made efforts in the past to solve this problem, the problem still persist.

(b) Quality of Compulsorily Procured Paddy

As explained hereinbefore the paddy grading system, inspection methods and pricing problems are hindering the motivation of farmers to supply better quality products. These factors are bigger problems than the lack of technology.

The Government acquires about one half of rice production by compulsory allocation under the low price policy for foodstuff, and distributes the rice for domestic consumption and export. Self consumption and surplus rice is traded under marketing principles of prices reflecting quality. The price of compulsory rice being less than 1/2 the free market price at farmyard provides a motive for farmers to supply paddy of inferior quality to the public sector and retain the better quality rice for sale to the free market.

(c) Ratio of Broken Rice

It is quite important to reduce broken rice and upgrade milled rice quality and yield by improving drying methods as well as husking and milling facilities in view of breakage during paddy drying and breakage during husking and milling operations.

(d) Milling Technology

The lack of milling technology must be reduced by intensive research and training.

(5) Production of Parboiled Rice

Egyptian rice is of Japonica variety not requiring parboiled rice and it has been understood in the past that parboiled rice does not meet the taste of the people.

However, in order to reduce processing losses and to increase the yield of milled rice, parboiled rice is being reconsidered. Tests have been conducted by RTTC with parboiling test equipment of Shule Co., West Germany. Test results, as indicated in the Supplement to this Report, show that remarkable effects can be achieved in reducing broken rice during milling processes. Panel taste tests have also been favourable.

On the other hand, past records shown that about 15,000 tons of parboiled rice had been produced annually by a public rice mill from 1958 to 1978 until operation became difficult due to deterioration of facilities. This parboiling equipment was a product of the British Luis Grant Company, and the dryer (rotary dryer) a product of the Italian Olimia Company. The facilities were a batch system with 4 tons per hour average production capacity. Further reports on production methods of parboiled rice were presented at a seminar promoted by the RTTC on "New Aspects in Rice Milling Technology."

(6) Utilization of By-products

It is of utmost importance in present Egyptian agriculture, where the rapid expansion of arable land area cannot be achieved, to relieve the shortage of foodstuff by utilization or adding value to by-products of rice mills.

(a) Bran

Rice bran is sent to plants for extraction of crude oil to be used for soap manufacturing. This crude bran oil contains a high percentage of free fatty acid (FAA), and therefore cannot be utilized for edible oil. As a content of 14% or less of FAA is required of bran for extraction of edible oil, extraction must be made from bran obtained immediately after milling or by providing bran stabilizer

facilities to prevent increase of FAA. Bran stabilizer "Excluder," manufactured in the USA, is said to have been introduced to Egypt as a test. Defatted bran is also a useful fodder.

The Alexandria Soap Industry, a rice oil extraction company, has 4 factories and treats a total of 60 to 70 tons of bran a day, which is estimated as a little more than 10% of the average bran production per day of Egypt. The factories are equipped with extraction plants of East German make. Consumption of vegetative oil in Egypt is about 390 thousand tons (1980), and its greater part of 290 thousand tons is imported. Of the total import, 2/3 is from the USA and is mostly cotton seed oil. Of the domestic production, 90% is also cotton seed oil. Whether edible oil can be obtained from rice bran or not can therefore be very important to the national economy of the country.

(b) Broken Rice

After pulverizing, broken rice is used for baby food, starch for beer brewing and for fodder.

(c) Germ

Rice germ is used for extraction of oil for manufacturing of paint. Residue is used for fodder. Manufacturing of edible germ oil is a problem of the future, and extraction of nutrition (vitamins) should also become possible.

(d) Husk

Brick has been the most important building material since ancient Egypt. Husk is presently being used for mixing into clay and as fuel in the baking of brick.

However, as a Government policy, the use of the unlimited supply of desert sand and rock is to replace the traditional brick which consumes precious fertile soil.

Crushed husk is mixed, after ammonium treatment, into fodder by about 20% as an extending agent in modern fodder factories. This usage of husk is presumed to increase in the future.

3. Production of Agricultural Machines

a. Post-Harvest Processing Machines

Threshers, winnowers and rice milling machines are manufactured by two or three manufacturers, however, statistical data was not available to the Team. Most machine manufacturers in Egypt are public except the small town shops. Diversified manufacturing in small quantity prevails, and concepts of productivity and cost control are not prevalent.

(1) Threshers

Development and manufacturing of machinery such as various types of threshers (for rice, wheat and pulse), small four-wheel tractors and boom sprayers are being carried on at part of the large Marera Company in Alexandria.
Three-point links of the tractors are manual operated simple mechanism not using Hydraulic power.

Threshers of the inclined feeder type being manufactured can be considered to be improvements of the prototype IRRI TH8 to suit local conditions.

Capacity	300 Kg/hr/paddy (Japonica variety)
Required Horse Power	12hp
Handling Drum	
width	120cm
revolution	450rpm
Price	LE 2,500 (with engine)
Annual Production	50 approx. (1981)

As rice of Japonica variety reaped near their roots is threshed, the efficiency is low because of the relatively high quantity of straw which moreover is of the strong stack Japonica variety.

(2) Winnowers

Large wooden type winnowers are being manufactured. There is much margin for improvement, such as to reduce width of fan drums to attain better performance and to make transportation easier by making them smaller.

(3) Milling Machines

Engelbery type hullers are being manufactured for small private rice mills. More than 20% of the total 1,700 mills are said to be using these hullers, however, accurate statistics are not available. The same manufacturer produces bucket elevators, screw conveyors and planshifters for use at rice mills.

D. NECESSITY OF THIS PROJECT

As described hereinbefore, in spite of the efforts to develop new cultivable areas, conversion of rice fields to industrial and urban housing developments is also taking place, and the net increase of rice growing areas in recent years has been retarded to an alarmingly slow pace. It has therefore become an important national policy to increase the productivity of rice per feddan by introducing new high-yield varieties, promoting the mechanization of harvesting and other agricultural operations, and by utilization of more efficient and more modern post harvesting methods and techniques. In the field of post harvesting, milling of rice is a major process, and the establishment of the Rice Technology Training Centre in Alexandria in 1975 is an important effort to improve rice milling and relevant techniques and technology.

Training of rice processing personnel at the Centre is performed mainly with its existing rice mill. This facility contains, for the most part, machinery of European origin in order to conduct training on European type rice mill machinery by which the majority of existing rice mill plants are equipped. However, the equipment being used in these rice mill plants have become obsolete and inefficient, and their replacement is an urgent necessity to decrease losses suffered during milling operations and to increase productivity. In view of this urgency, the Government of Egypt has made a world-wide survey of milling operations, and they have come to the conclusion that Japanese milling equipment is most suitable for modernization of their plants.

It has been confirmed by the Basic Design Study Team that the improvement of the Rice Technology Training Centre to enable training and research on modern rice milling techniques and technology with modern Japanese equipment is a most urgent and appropriate undertaking. The Improvement Project of the Rice Technology Training Centre is to establish within the existing compounds of the Rice Technology Training Centre in Alexandria, Egypt, a new rice milling facility for the training of rice mill operators on modern Japanese machinery and equipment as follows:

(1) Building

(2) Machinery and Equipment

Rough paddy receiving facilities
Drying equipment
Paddy storage facilities
Parboiling equipment
Rice milling unit
By-product processing machines
Training aids
Component machines
Laboratory equipment
Workshop machines and tools
Emergency generator
Low temperature storage rooms
Data processor

Described hereinafter is the Rice Technology Training Centre (Chapter Two) and its infrastructure (Chapter Three). The Basic Design described thereafter in Chapter Four for the establishment of the new rice milling facility in the RTTC is based on the foregoing conditions.

RICE TECHNOLOGY TRAINING CENTRE

CHAPTER TWO RICE TECHNOLOGY TRAINING CENTRE

A. ESTABLISHMENT AND STATUS

1. Establishment

Based on recommendations of the First Rice Conference held in Cairo under the auspices of the Egyptian General Rice Milling Organization in 1970, the Rice Technology Training Centre (RTTC) was established in Alexandria under the jurisdiction of the Ministry of Supply and Internal Trade under the Rice Marketing Company (RIMCO) in 1975. Construction was performed with the cooperation and assistance of FAO and UNDP for technology and equipment. However, a long period was required until actual activities were commenced. Rice technology training, the main aim of RTTC was started in 1981.

Main objectives of the establishment of RTTC are as follows:

Training of rice milling industry personnel on technical and social-economic matters.

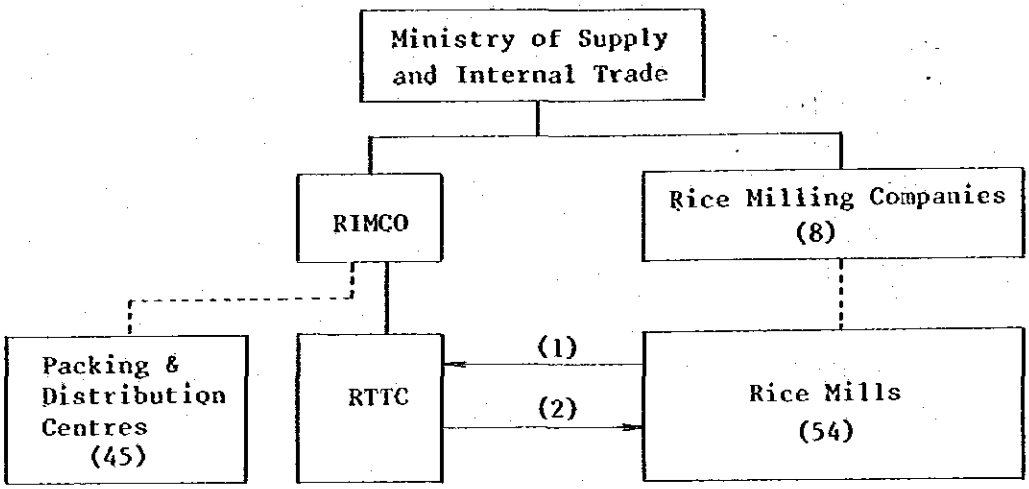
Promotional activities for improvement of rice milling technology.

Research and development of applied technology on rice milling and post harvest processes.

Actual objectives of activities are diversified and are listed in the Supplement to this Report. In short the Centre is aiming at general researches in the processing of rice. Leaders of the RTTC are envisioning the grough of RTTC in the future to become an international organization in this field for Arabic countries whereby trainees from neighbouring countries will participate.

2. Status

Status of the RTTC is under Rimco which is under the Ministry of Supply and Internal Trade as shown below:



(1) Payment of operation expenses
Request for sample analyses
Dispatching of trainees

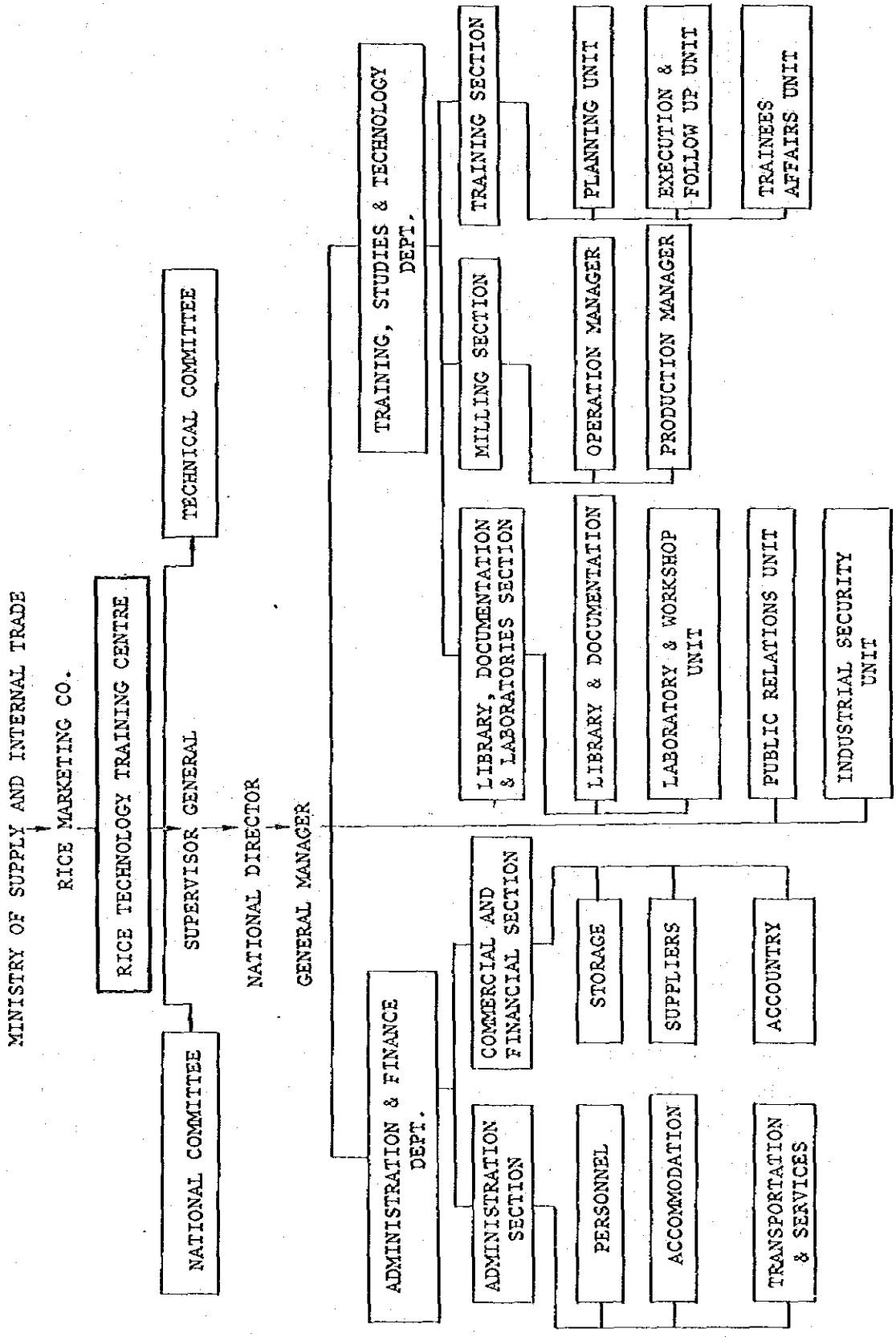
(2) Technical guidance

B. OUTLINE OF THE CENTRE

1. Organization

Organization of the RTTC as a subordinate structure of RIMCO is as shown in Figure 2-1. Number of full-time staff as of September 1982 was 67. Certain managing staff members are personnel of RIMCO serving concurrently.

FIG. 2-1 ORGANIZATION CHART OF RTTC



2. Operation

RTTC is operated primarily by representatives of RIMCO and Rice Milling Companies which are organizations under the Ministry of Supply and Internal Trade. Operation is governed by the National Board its highest legislative organ. Its National Committee implements the operation and administration of the Centre and the Technical Committee handles its technical affairs.

The General Supervisor totally supervises the activities of the Centre by governing the National Committee. The National Committee is made up of representatives of the 8 Rice Milling Companies and RIMCO, the National Director of RTTC and team leaders of FAO/UNDP. Discussions on important affairs and policies are taken up at Committee meetings.

The National Director coordinates activity plans of its technical staff and oversees the Technical Coordinating Committee. Members of this Committee are four persons from the National Committee, and representatives from rice producers, private rice mills, manufacturers of rice processing equipment, seed breeders, national research institutes and educational institutions. This Committee forms subcommittees for such fields as production, post harvest processing, drying and storage, husking and milling, by-product utilization and management and marketing. A list of members as of September 1982 is included in the Supplement to this Report.

3. Facilities

The Rice Technology Training Centre is located in the outskirts of Alexandria which is within the rice producing area. The following three major facilities are existing on its compound which has an area of about 12,000 m^2.

Administration Building

A three storey (1,800 m^2 x 3) building accommodates offices, conference rooms (1 large hall, 2 ordinary lecture rooms), laboratories (chemical, milling, paddy, moisture content), library, etc.

Rice Milling Building

A three storey (600 m^2 x 3) rice milling plant with paddy storage, milled rice storage, paddy drying equipment, etc.

Hostel

A four storey (1,000 m^2 x 4) living accommodation for 48 trainees with cooking facilities and caretaker's quarter.

At time of the Center's establishment in 1975, an East German rice milling unit was provided in return for exports of rice to East Europe. Later, under technical cooperation programs of FAO/UNDP, various individual machines, testing and experimental equipment, literature, teaching aids and vehicles were obtained. In 1982, a Denmark "Cimbria" paddy drying facility of the value of LE 120,000 is being erected under a grant from FAO.

Present facilities of the Centre are primarily those related to husking and milling processes. Facilities usually found in rice milling plants are provided in the Centre, but few post harvesting equipment and implements used at farm and cooperative stages are provided. This is due mainly to the recent commencement of its activities and the policy to limit its scope of activities to that of existing rice mills.

The utilization of the facilities of the Centre can be said to be generally good. Especially the rice milling plant is being utilized extensively for training purposes during milling seasons in similar operation to that of practical milling plants. Maintenance of facilities is relatively excellent and no problems are

foreseen as far as parts are to be available. There are some testing and experimental instruments which are out of order, and as the repair of precision instruments cannot be done locally, care must be exercised in their use.

Main training facilities presently existing at the Centre are as follows (see Supplement for details):

Rice milling plant (capacity of one (1) ton of paddy hour)	1 set
Testing and experiment instruments	
Audio-visual training aids (slide and overhead projectors, etc.)	
Vehicles (microbus, etc.)	3 ea.
Paddy Dryer (capacity of 4 tons/30 min./pass)	1 set

Literature, data and text books are insufficient and should be supplemented as there are only about 100 volumes of Arabic and English literature. As it seems to be difficult to obtain Arabic literature in this field, gathering of literature may have to be started by literature in foreign languages. Appropriation of adequate funds to substantialize the collection of information is desirable.

Periodicals being subscribed to include the following:

Post-harvest Quarterly (SEARCA), IRRI

International Agricultural Development, FAO

Agricultural Business

AMJ (Agricultural Machinery Journal)

Cereals

Food Outlook

Rice Market News

A partial list of textbooks compiled and being used at the Centre is included in the Supplement to this Report.

4. Budget

Cost for administration, operation and maintenance of the facilities are covered by payments from rice milling companies and subsidies from the Government. Annual income in 1981 was as follows:

Payments from rice milling companies (0.1 LE per ton of rice processed)	100,000 LE
Government subsidies	70,000
Others	30,000
Total	200,000 LE

It has been explained that budgetary measures have been taken for the amount of 70,000 LE for expenses in 1982 to cover Egyptian responsibilities for this Improvement Project.

C. ACTIVITIES

Objectives of RTTC activities are widely diversified as mentioned herein before. As the Centre is still young, the increase of knowledge and experience of its staff and reinforcement of its facilities is imperative for its development in the future. Present activities of the Centre are training, research, development and technical guidance and promotion.

1. Training

Training was commenced in 1981. Number of trainees in that year was 311. In 1982, 270 trainees are expected to attend training programs. In addition to the RTTC staff, outside lecturers such as foreign specialists, authorities of the industry, researchers

of governmental research institutes and professors of universities are invited. Total number of lecturers in 1981 was 61.

Training is divided into technical courses, primarily regarding husking and rice milling, and management courses on plant administration. Division according to levels, such as novice and retrainees are made. Considerations are given to perform specialty training in detail according to the type of work and aptitude of the trainees. Training periods are presently 2 weeks (short term) and 4 weeks (long term). Longer term of about 6 weeks is planned for the future. Training courses and their terms are listed in the Supplement.

Trainees are selected from RIMCO, rice milling companies and private ricemmills. Number of trainees per course are about 20. Trainees range from field personnel to managers, and most are staff engaged in actual field work. Achievement record of years 1981 and 1982 (until June) are listed in the Supplement.

2. Research and Development

a. Investigation of production loss during post harvest processes (reaping and threshing) by cooperation of the Agricultural Faculty of Alexandria University and FAO experts (being continued at present)

b. Paddy drying tests

c. Test production of parboiled rice and its marketing research

d. Storage simulation tests of paddy and milled rice (being continued at present)

e. Overall investigation of governmental and private rice mill facilities (under execution at present) —— search of problems being encountered in the rice mill industry, and countermeasures

f. Investigation of quality and grade of rice according to year and district of production

g. Investigation of rice quality in domestic and foreign markets

h. Economical and technical research of imported brown rice for domestic consumption

3. Technical Guidance and Promotion

Sample analysis requested to the Centre by governmental rice mills is the main line of service. Test equipment in the Centre is being used effectively for this purpose. Results of analyses are reported to requesting organizations with appropriate advice. Data sheet on analyses is shown in the Supplement.

4. Other Activities

a. Seminars and Conferences

Sponsoring of seminars and conferences concerning rice and rice milling industry. Listed below are some examples of those sponsored in the past.

1970 The 1st Rice Conference, Cairo

1974 The 2nd International Rice Conference

1980 Post Harvest Technology Seminar

1981 New Aspects in Rice Milling Technology

Similar seminars and conferences are being planned to be sponsored every year together with several local seminars also every year.

b. Foreign Cooperation

A husking and rice milling plant (1 ton/hr) of East German make was donated by East Germany at the time of establishment of this Centre in 1975. Individual machines, test and experimental equipment, books, teaching material, vehicles and others were donated later under technical cooperation programs by FAO (PFL/EGY/001 Project) and UNDP (EGY/78/017 A/01/12 Project).

Specialist teams from FAO were dispatched for long terms, but at present only Mr. Bibs M. Ramos (Agricultural Engineer, FAO) is engaged in investigation and research on harvesting processes. His cooperation term is about to end in May 1983.

A paddy drying plant is now under installation to be ready for use by harvesting time this year. This is also a cooperation from FAO. FAO projects mentioned above are aimed at improvement of rice milling and storage, and UNDP/FAO projects, directed at both government and private sectors, are aimed at reducing production loss during post harvest processes at farmer level (reaping, threshing, cleaning and drying).

A new project, USAID Project (263 - 0027) regarding harvesting and storage is being planned, though this is not a cooperation project directly to RTTC. Exchange of information regarding this project with RTTC will be desirable.

c. Training Abroad

Trainees from Egypt, nine (9) in total so far, have attended Rice Post-harvest Processing Courses conducted by JICA every year. Names of trainees are listed in the Supplement. With the exception of one, they are all working now at the Centre after returning to Egypt. The results of their training is believed to be effective in their actual work. Four persons, in addition to the above, are being trained abroad on milling, storage, drying and quality control after having completed their training at the Centre.

d. Future Research and Development Plans

In addition to training, the Centre has plans for positive activities in the fields of research and development as follows:

(1) Production of improved type parboiled rice

An up-to-date plant (1 ton/hr capacity) for high quality parboiled rice production, the first of its kind in Egypt, is to be introduced as a pilot plant for the Egyptian rice industry. Production of parboiled rice of quality acceptable in international markets, is the objective of this undertaking.

(2) Utilization of by-products

Many utilization methods have been introduced, however, utilization methods which have proved economical have not yet been established in Egypt. Promotion of research and development mentioned below is desirable.

(a) Husk

Further promotion of utilization of husk as fodder. This program is presently being performed through cooperation with the Rashid Rice Milling Company.

(b) Rice bran

Establishment of a test plant for manufacturing of edible rice bran oil (1/4 ton/day capacity) in the Centre. Edible bran oil has not been manufactured so far in Egypt. On the other hand, despite soaring international prices of edible oil, imports to Egypt have been increasing. It is therefore very important to realize in Egypt the production of edible bran oil as early as possible.

(3) Execution of market investigation and research

(a) Investigation of problems and planning of counter-measures regarding the increase in demand per capita as well as in the total domestic demand. Such matters as storage facilities, supply, transportation and price policies should be taken up.

(b) International marketability of Egyptian rice.

BUILDING SITE

CHAPTER THREE BUILDING SITE

A. SITE CONDITIONS

Existing conditions at the proposed construction site and its infrastructure where investigated and confirmed as outlined below:

1. Proposed Site

This improvement project is to improve and reinforce the existing Rice Technology Training Centre (RTTC) in Alexandria situated at latitude 31°12'N and longitude 29°54'E. The present compound of RTTC is approximately 12,000m^2 in area, and there are three major existing buildings on the site. The land is trapezoidal in shape and the bottom line of the trapezoid (south side) faces the Al Mahmudiya Canal Street along the Al Mahmudiya Canal. The site adjoins rice mills on its north and east sides, and a horserace track and its facilities (Marine Racing Club) is on its westside.

Space for the Proposed Building to be built in the RTTC compound is an open area between the existing facilities, Rice Milling House and Hostel, and the north and east boundary lines of the compound. The terrain is almost level or flat and the height of the ground is approximately 2 meters lower than the front road, Al Mahmudiya Canal Street.

2. City Planning

Proposed RTTC site is defined properly from neighbouring establishments and the front road by fencing. There is no city planning projects which requires a change in the shape of site, such as by expansion of the front road width. Sewage main is planned to be installed underground under the front road but the time of its installment is unknown.

3. Existing Facilities

Three buildings are existing as shown in Fig. 3-1. Their features are as follows:

a. Administration Building

Reinforced concrete construction, 3-storeys above grade, total floor area about 1,950m^2.

b. Rice Milling House

Reinforced concrete construction, 3-storeys above grade with partial basement floor, total floor area about 1,370m^2.

c. Hostel

Reinforced concrete construction, 4-storeys above grade, total floor area about 2,100m^2.

d. Others

At the southwestern corner of the site facing the front road is a transformer shed. At the north side of the Rice Milling House is an outdoor husk storage.

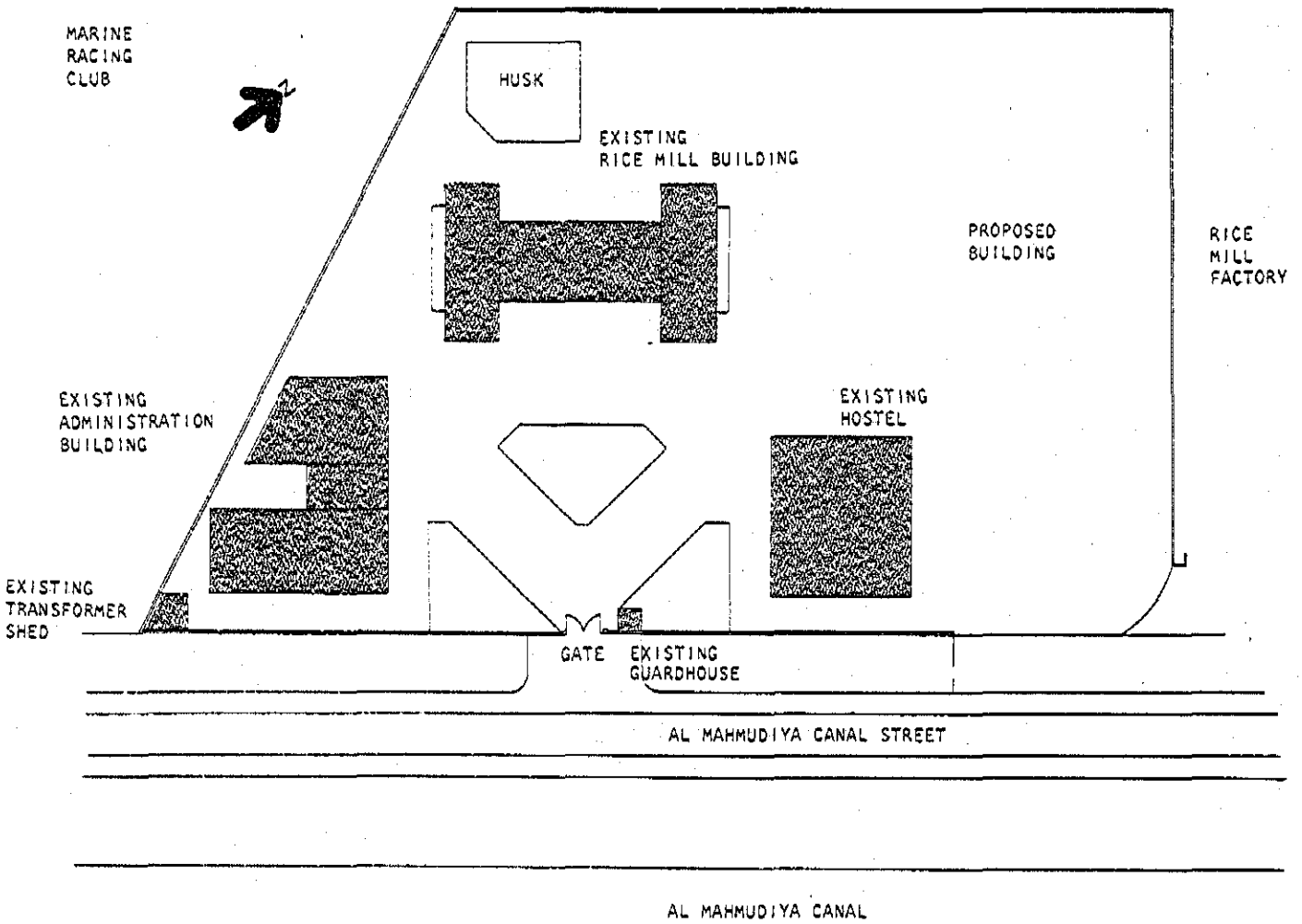


FIG. 3-1 EXISTING FACILITIES

B. CLIMATIC CONDITIONS

Climatic conditions in Alexandria as outlined below pose no special problems in building and equipment design.

1. Temperature

a. Monthly Average Temperature, 1951 - 1960

Maximum	26.8°C	August
Minimum	13.7°C	January

b. Seasonal Average Temperature

Maximum	29.1°C	Summer, May - October
Minimum	21.4°C	Summer, May - October
Maximum	18.2°C	Winter, November - April
Minimum	9.1°C	Winter, November - April

2. Humidity

a. Monthly Average Humidity, 1951 - 1960

Maximum	73%	July
Minimum	66%	March, April

b. Seasonal Average Humidity

66%	May - October
62%	November - April

3. Rainfall

a. Monthly Average Rainfall

Maximum	59mm	December
Minimum	0mm	June - September

b. Seasonal Rainfall

124.4mm	May - October
0mm	November - April

4. Daylight Hours

Summertime	6 am - 7 pm	approx.
Wintertime	8 am - 4 pm	approx.

More detailed data on climatic conditions are contained in the Supplement.

C. SOIL CONDITIONS

Soil boring tests were executed at three locations where the Building is proposed to be located. Standard penetration tests, soil characteristics tests and soil grading analyses were also conducted. Test results are as follows:

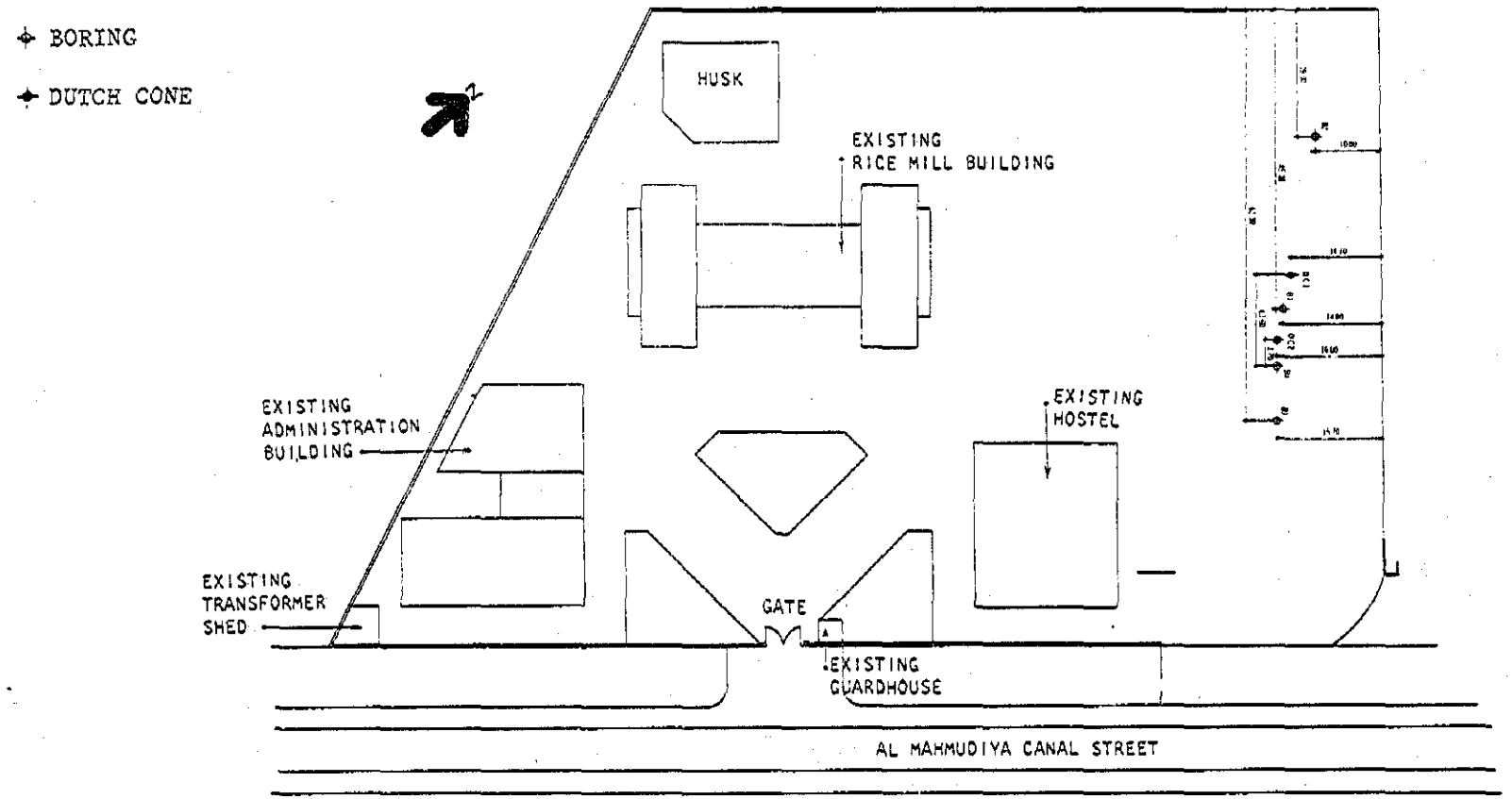


FIG. 3-2 TEST BORING LOCATION PLAN

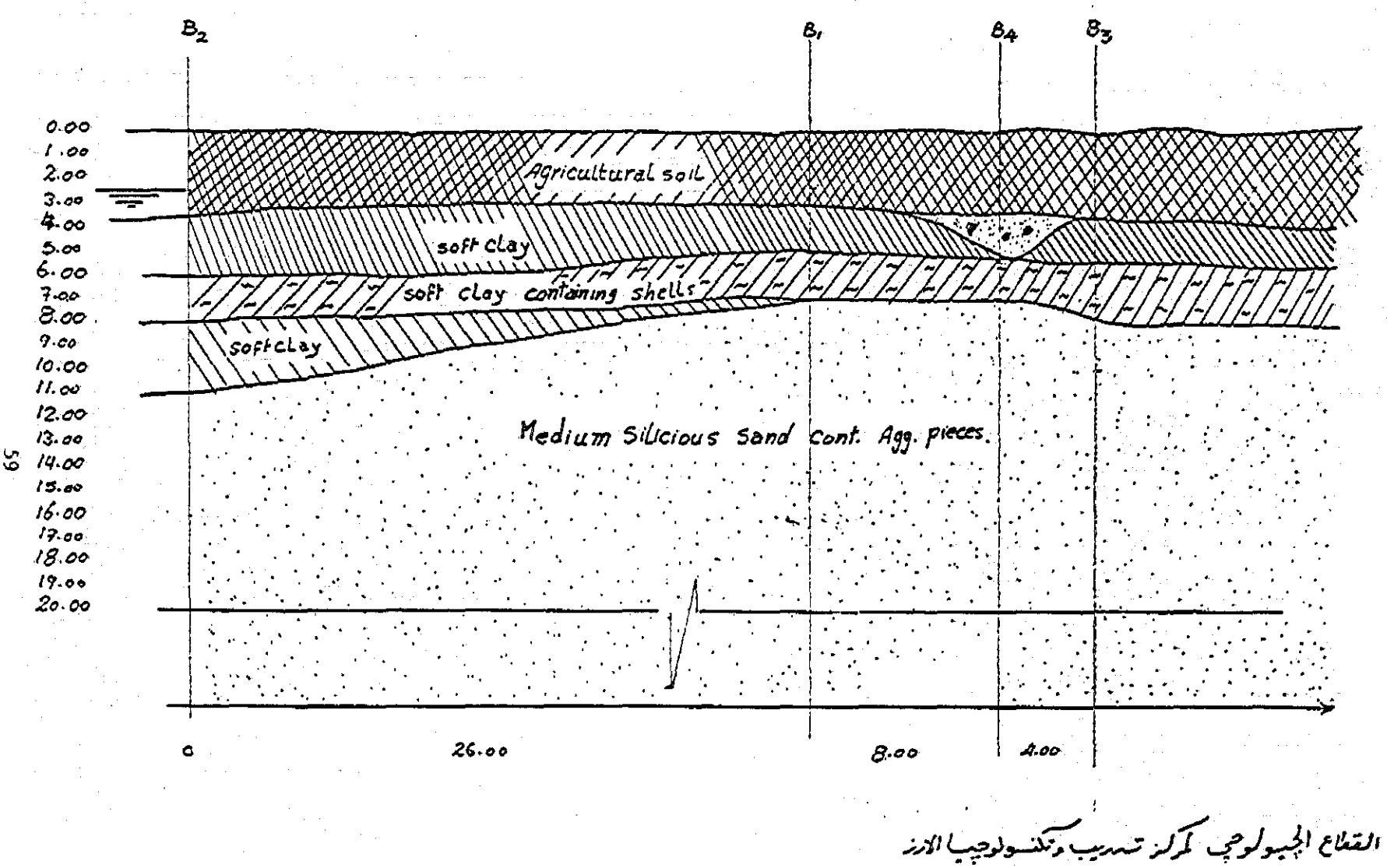


FIG. 3-3 SUBSURFACE SOIL PROFILE

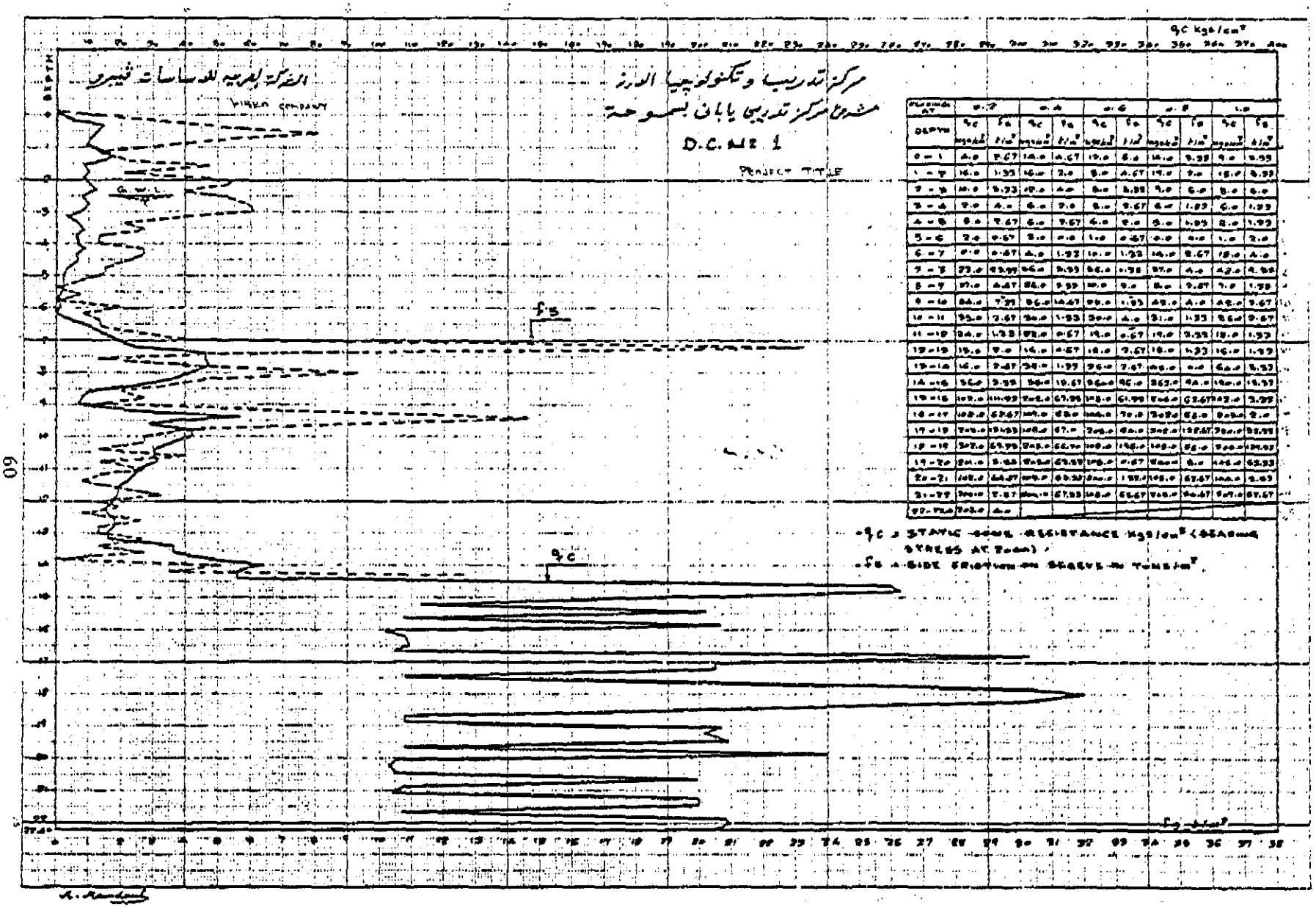
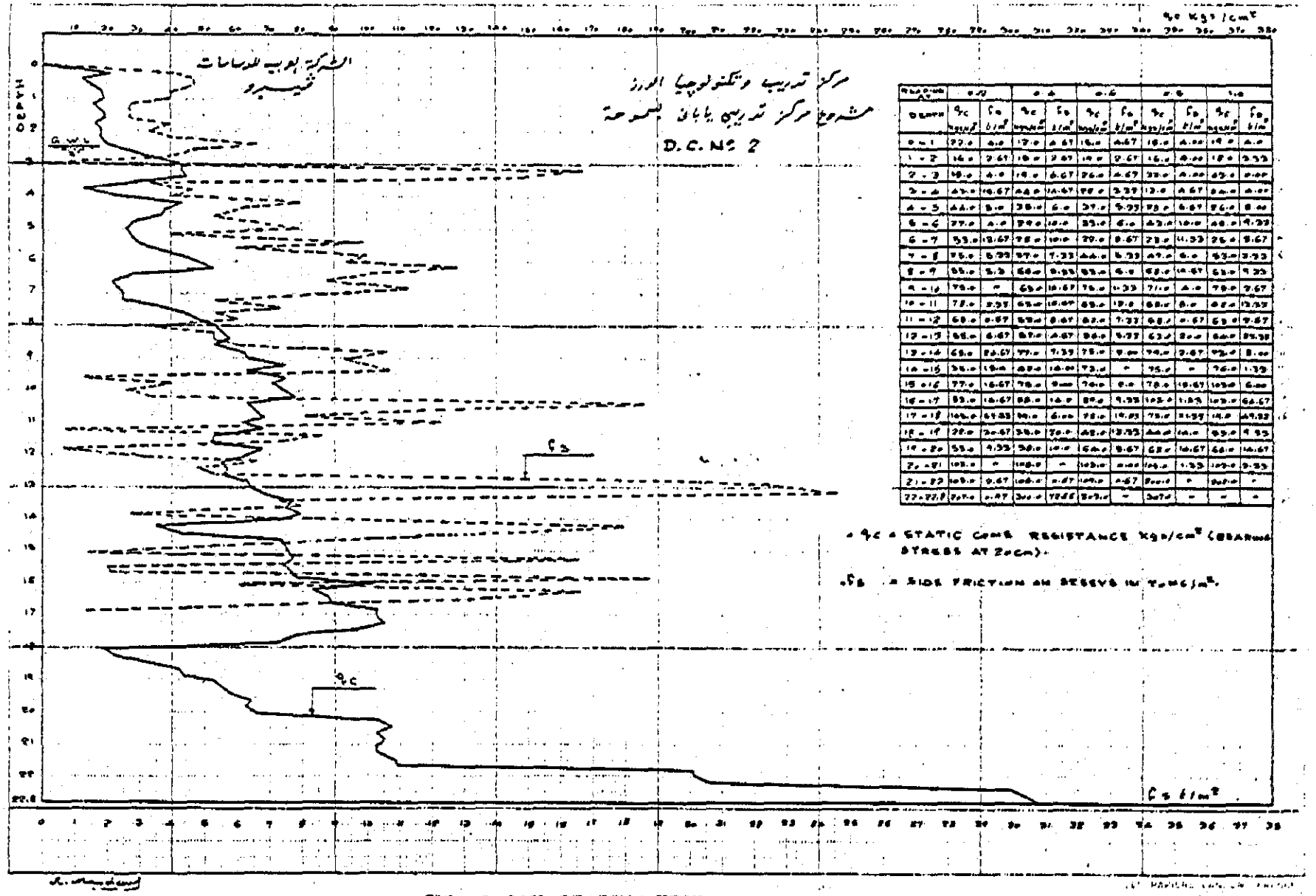


FIG. 3-4 SOIL BEARING TEST RESULTS



Depth M	0.2		0.4		0.6		0.8		1.0	
Depth	qc Kg/cm²	fs T/m²	qc Kg/cm²	fs T/m²	qc Kg/cm²	fs T/m²	qc Kg/cm²	fs T/m²	qc Kg/cm²	fs T/m²
0 - 1	22.0	4.0	17.0	4.67	16.0	4.67	18.0	4.00	19.0	4.0
1 - 2	16.0	2.67	18.0	2.67	19.0	2.67	16.0	8.00	18.0	2.33
2 - 3	18.0	4.0	19.0	6.67	26.0	4.67	22.0	4.00	43.0	9.00
3 - 4	43.0	16.67	44.0	14.67	28.0	2.33	12.0	4.67	24.0	4.00
4 - 5	44.0	8.0	28.0	6.0	27.0	5.33	28.0	6.67	26.0	8.00
5 - 6	27.0	4.0	29.0	10.0	35.0	6.0	43.0	10.00	48.0	9.33
6 - 7	53.0	13.67	28.0	10.0	29.0	8.67	28.0	11.33	25.0	8.67
7 - 8	25.0	5.33	27.0	7.33	44.0	5.33	49.0	6.0	53.0	3.33
8 - 9	55.0	5.3	60.0	9.33	53.0	6.0	48.0	10.67	63.0	9.33
9 - 10	79.0	"	69.0	10.67	75.0	11.33	71.0	8.0	79.0	7.67
10 - 11	78.0	9.33	63.0	10.67	69.0	12.0	68.0	8.0	84.0	12.33
11 - 12	69.0	8.67	59.0	8.67	82.0	7.33	98.0	8.67	63.0	9.67
12 - 13	98.0	6.67	87.0	6.67	96.0	9.33	63.0	8.0	64.0	10.33
13 - 14	69.0	26.67	77.0	9.33	75.0	9.0	74.0	9.67	78.0	8.0
14 - 15	34.0	13.0	82.0	14.0	73.0	"	75.0	"	76.0	11.33
15 - 16	77.0	16.67	78.0	9.0	74.0	8.0	78.0	12.67	103.0	6.0
16 - 17	83.0	16.67	88.0	14.0	89.0	9.33	103.0	11.33	103.0	66.67
17 - 18	104.0	61.33	96.0	6.00	78.0	14.33	78.0	21.33	14.0	49.33
18 - 19	28.0	20.67	34.0	20.0	42.0	13.33	44.0	14.0	93.0	9.33
19 - 20	55.0	9.33	58.0	10.0	64.0	9.67	68.0	16.67	66.0	14.67
20 - 21	103.0	"	108.0	"	103.0	11.33	103.0	11.33	103.0	9.33
21 - 22	109.0	9.67	108.0	11.67	109.0	14.67	108.0	"	108.0	"
22 - 22.8	207.0	11.67	300.0	72.66	309.0	"	307.0	"	"	"

- qc = STATIC CONE RESISTANCE Kg/cm² (BEARING STRESS AT 20cm).
- fs = SIDE FRICTION ON SLEEVE IN T/m².

FIG. 3-5 SOIL BEARING TEST RESULTS

D. INFRASTRUCTURE

1. Electric Supply

Electric power is supplied to the existing facilities from the 6,000 volt, 50Hz high tension underground cable buried under Al Mahmudiya Canal Street. The power is stepped down at the existing transformer shed to 3-phase, 380 volts and single-phase, 220 volts. Supply capacity is 300 KVA at present. It is planned by the RTTC to increase this to 800 KVA in the near future.

Demand load of the Proposed Building is estimated at this stage to be 500 KVA. This is to be supplied by underground cable to the Building by the Egyptian Government.

2. Telephone

At present, 6 service lines are taken into the Administration Building from an underground telephone cable buried under the front street. A desk-type telephone switchboard with a capacity of 48 branch circuits is existing. The required number of branch circuits are to be connected to the Proposed Building by the Egyptian Government.

3. Water Supply

A 100mm underground branch pipe from the city water supply main buried under the front street is presently serving the existing buildings. Supply water pressure is 2.5 kg/cm^2 to 3.0 kg/cm^2.

4. Drainage

Public drainage piping system is not available in the area at present. However, an underground drainage main is planned to be installed in the future along Al Mahmudiya Canal Street. Disposal of existing facilities is by seepage sumps located within the compound. Sewage is initially treated by septic tank.

5. City Gas

City gas supply is not available at the site.

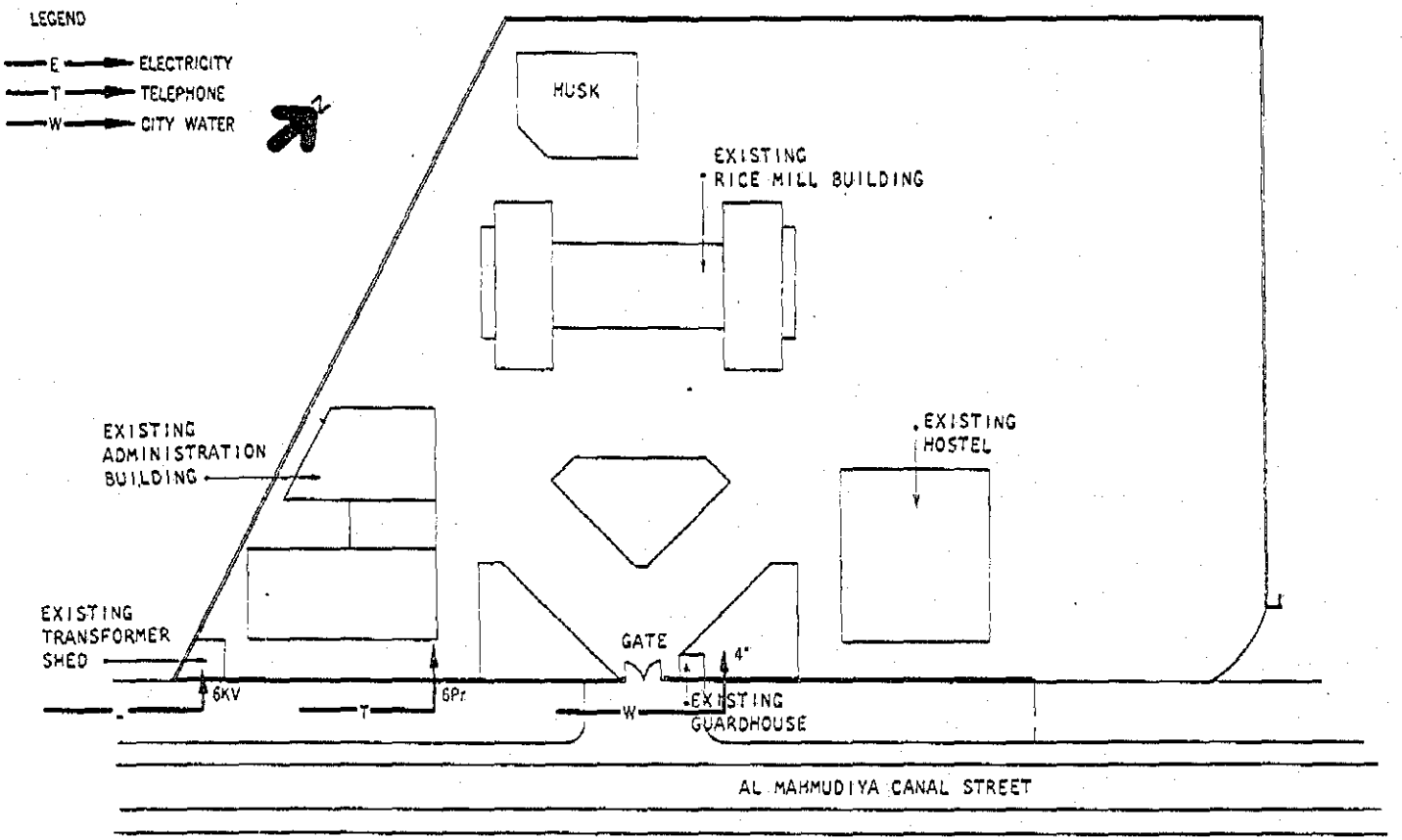


FIG. 3-4 UTILITY SERVICE LINES

BASIC DESIGN

CHAPTER FOUR BASIC DESIGN

A. DESIGN PRINCIPLES

The following principles are to be adhered to in the design of the facilities.

1. Architectural

a. The design is to harmonize with the environment and existing facilities within the compound.

b. Sufficient space is to be provided within the rice milling area around training equipment to enable training activities and to cope with future development and changes.

c. Facilities are to be designed with due considerations given to the natural environment, manners and customs of Egypt.

d. Ease of operation, maintenance and control is to be an important priority in the design.

e. Consideration is to be given to the construction technology and skill prevailing in Egypt.

f. Priority is to be given to locally produced building material in the selection of building materials and construction methods.

2. Training Equipment

a. Basic Conditions

(1) The basic intent of this Project is to improve the existing facilities at RTTC in Alexandria.

(2) Construction site is restricted and the building area is limited to approximately 4,200 m^2 due to the area and shape of the site.

(3) The facilities are for training, research and development activities.

(4) Local rice which is cropped and harvested in the Nile Delta is to be processed in the facilities.

(5) Paddy collected by the Government from farmers is to be the raw material. Inclusion of more impurities than free market paddy has to be expected.

(6) Varieties to be processed are those being cropped today as well as those being planned under future double cropping policies.

b. Fundamental Policies

New facilities to be provided by the Improvement Project are to be organically tied into existing facilities of the RTTC, such as its administration, training, research, development and hostel facilities. The new facilities are also to be planned as follows so they are independently capable of fulfilling the objectives and functions of the RTTC.

(1) Structure, size, types, quantity and layout of equipment are to be such that practical training, research and development regarding post harvest processing techniques can be performed.

(2) Appropriate transfer of technology is to be attempted to improve the existing level of technology.

(3) Easy maintenance and low running costs are to be attempted to facilitate the self supporting efforts of the RTTC.

(4) Design is to take into regard the natural conditions of the site.

B. SITE LAYOUT DESIGN

1. Building

Building site for the Proposed Building within the compounds of the Rice Technology Training Centre is at the east side of the existing Hostel. The site is 38 meters wide and 91.5 meters deep.

The space between the existing Rice Mill Building is to be used as a common trucking space for in-transportation of paddy and out-transportation of finished products. The utilization of the street side for direct trucking access was given up as the level of the compound is about 2 meters lower than the front road. An entrance for pedestrian traffic to be provided at the street side of the Proposed Building can be used for special occasions or as required.

The street side of the Proposed Building is to be aligned with the Hostel. The opposite north side of the Proposed Building is for storage facilities for paddy and husks as well as for passage of trucks to handle the disposal of husks.

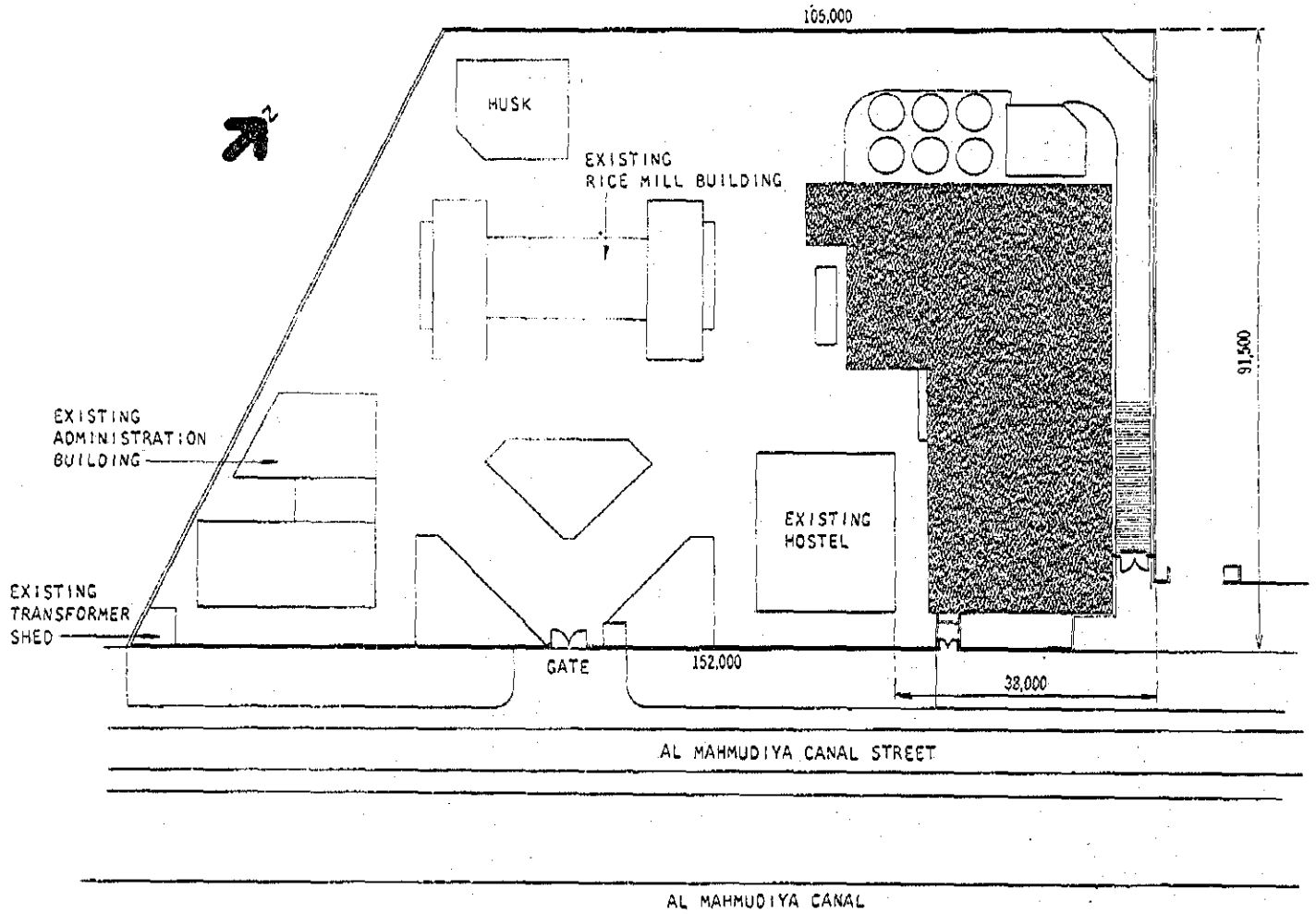


FIG. 4-1 BUILDING CAYOUT

2. Circulation

Traffic flow of vehicles and pedestrians are arranged as follows:

a. Vehicular Traffic

(1) Vehicular incoming and outgoing access to the site is to be through the existing gateway.

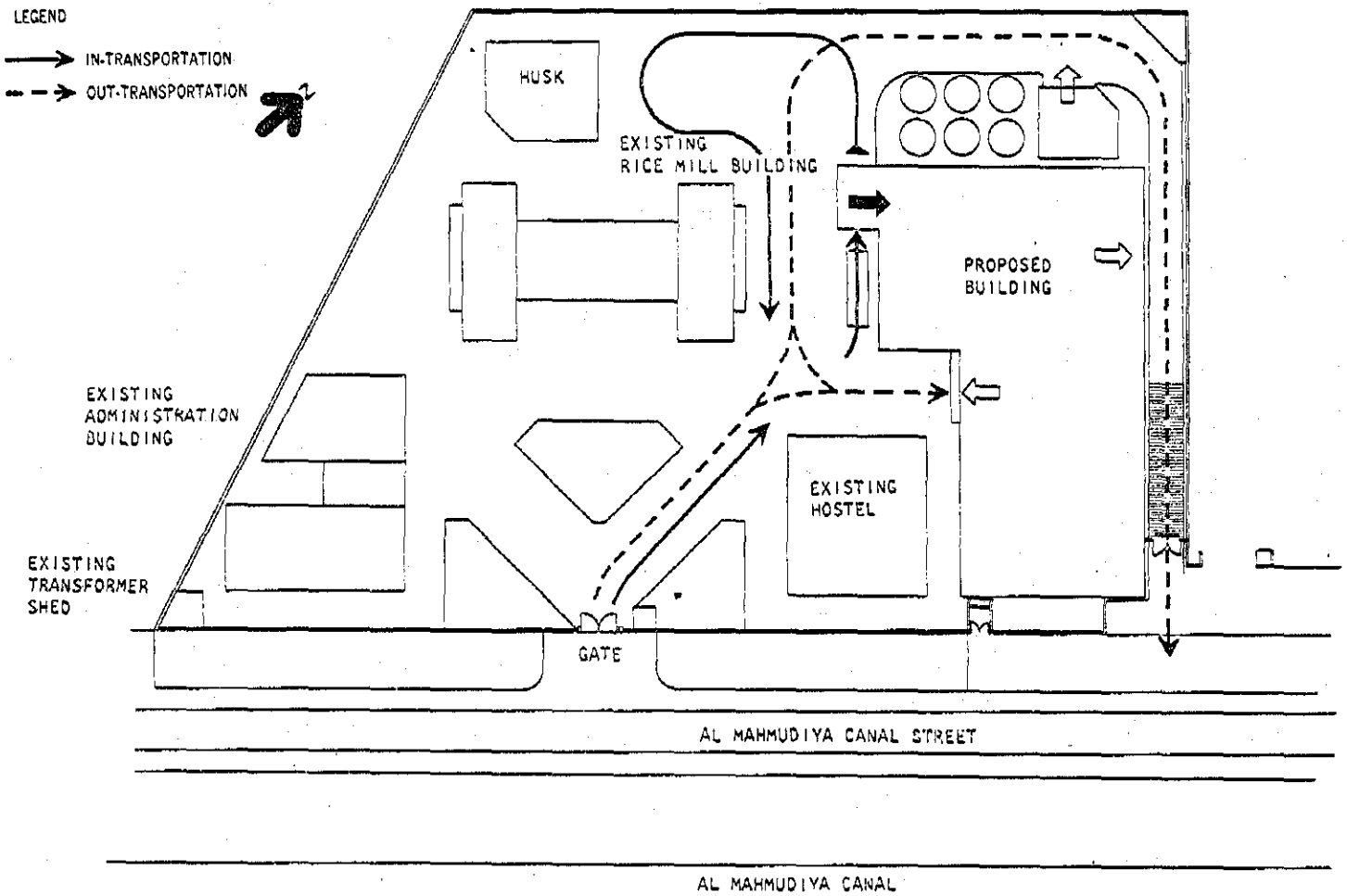
(2) A vehicular traffic road is to be provided all around the Proposed Building for the out-transportation of husks and rice bran.

(3) Open space at the north of the existing Rice Mill Building is to be utilized for turning of vehicles.

b. Pedestrian Traffic

(1) A front or official entrance is provided at the mezzanine level of the Proposed Building for direct entry from the front road. If required from security or other reasons, this entrance may be left closed, and access to the Building be through the existing gate and the side doorway.

(2) A side entrance to the Proposed Building is provided between the paddy receiving and milled rice shipping intakes and outlets. This side entrance can be the normal access to the Proposed Building for pedestrians between the existing Administration Building as well as those entering the compound from the outside.



VEHICULAR TRAFFIC FLOW DIAGRAM

FIG. 4-2 VEHICULAR TRAFFIC FLOW DIAGRAM

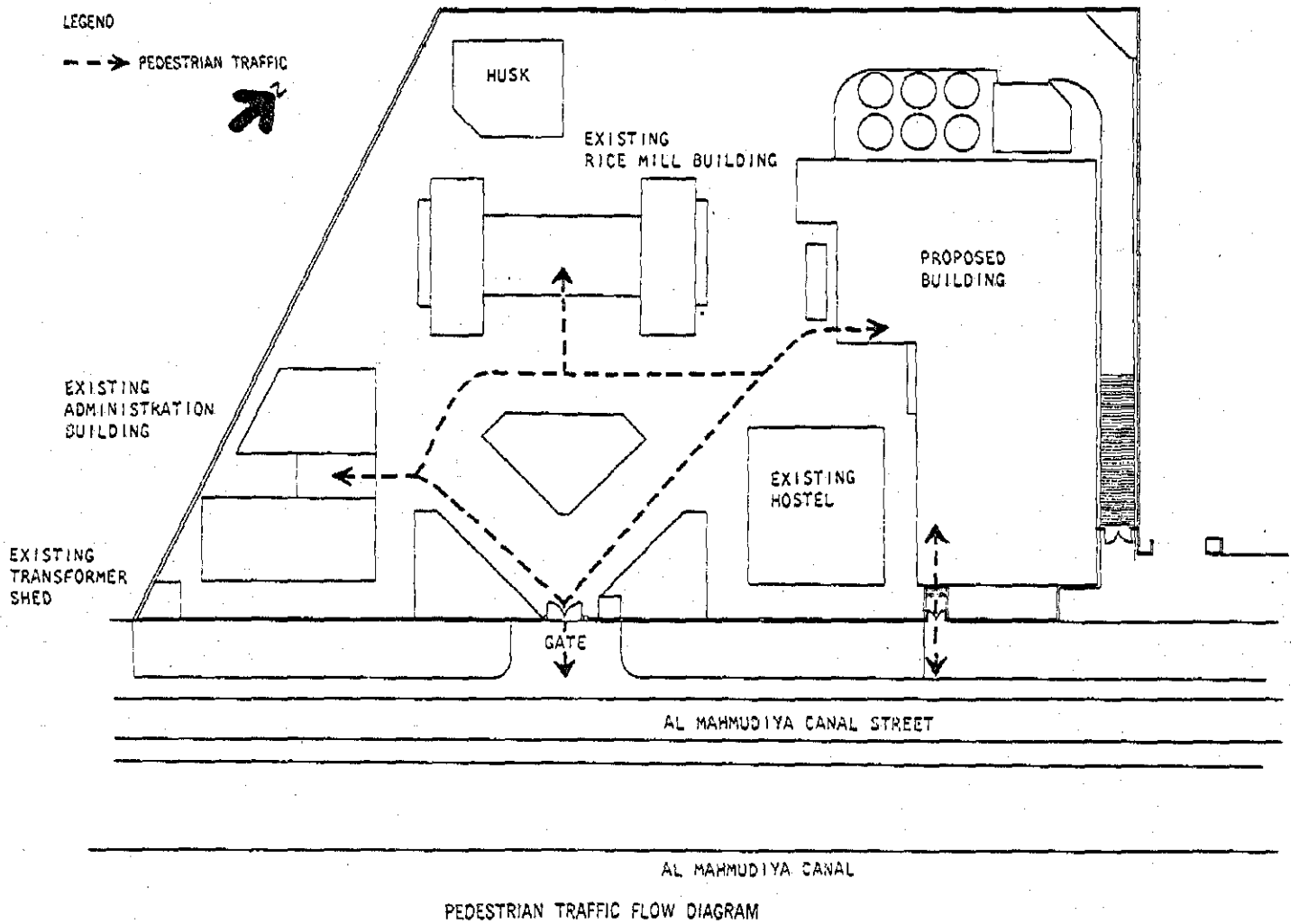


FIG. 4-3 PEDESTRIAN TRAFFIC FLOW DIAGRAM

C. EQUIPMENT DESIGN

1. Selection Principles

a. Scope of training equipment to be provided is to be primarily for rice milling processes however, appurtenant facilities to enable overall practical training in this field, such as storage facilities, are to be provided.

b. Scale of equipment to be provided is not to be the same but to simulate those installed in the actual rice mills. However, to enable trainees to acquire practical technology, the mechanism of the equipment is to be the same as those of actual mills.

c. Safety during training is to be guaranteed.

d. Equipment is to be of composition and layout which are easy to understand by the trainees.

e. Scope of equipment for research and development is to be limited to that assumed to be the object of rice mills operating in Egypt. Therefore, functions of subsidiary nature which are normally undertaken by separate establishments, such as the extraction of bran oil, are excluded from this Project.

f. Research and development equipment is to be of laboratory scale. However, equipment suited for practical application tests are to be provided for subjects on which the RTTC has finished laboratory stage tests.

g. Variety of paddy rice to be supplied as raw material to the facilities is assumed to be both the Japonica varieties presently cultivated in Egypt as well as the Indica variety which are planned to be cultivated in the near future.

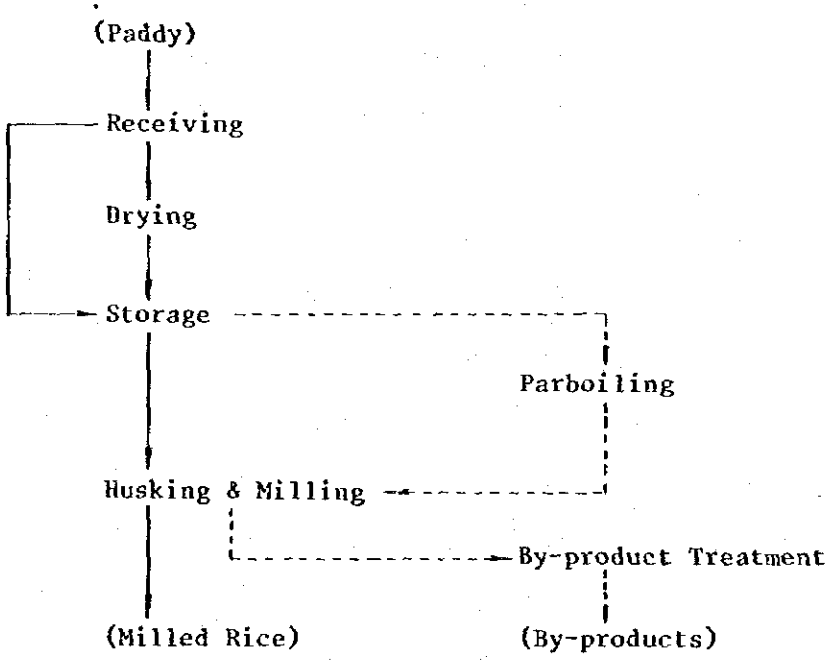
h. Japanese type rice processing machines (small high efficiency types) are to be provided.

2. Flow Design

In line with the fundamental policies established under the design principles for this Project, rice processing facilities to be provided under this improvement program are to be able to function independently.

Thus the processes and treatments conducted normally in rice mills such as receiving, drying, storage, husking and milling, as well as treatment of by-products are to be conducted in a continuous process. Practical test equipment for parboil treatment is also to be provided so that it can be inserted in the line of processing.

Flow diagram of the new facilities is as follows:



D. BUILDING DESIGN

1. Outline of the Building

a. Constituents

Proposed Building is consisted of the following facilities:

(1) Paddy Receiving

(2) Paddy Drying

(3) Parboiling

(4) Rice Husking & Milling

(5) Training

- (a) Component Training Machines
- (b) Workshop
- (c) Laboratories
- (d) Meeting Rooms
- (e) Low-temperature Storage

(6) Control Section

- (a) Control Room
- (b) Office

(7) Milled Rice Shipping

(8) Storage

- (a) Silos
- (b) Bran Storage
- (c) Bran Stabilizing
- (d) Husk Pulverizing

(9) Appurtenant Rooms

- (a) Boiler Room
- (b) Transformer/Generator Room
- (c) Fan Room

(d) Toilets

(e) Corridors

(f) Lounge

(g) Stairs

b. Building Structure

The building structure of the Proposed Building is designed as a single storey reinforced structure with a partial mezzanine floor. The mezzanine floor accommodates laboratories, low temperature storages at the road or south side of the Building, and a lounge and meeting room over the control room at the west side of the Building. These two groups of rooms on the mezzanine floor are connected by a bridge spanning the shipping section and overlooking the milling facilities.

Eave heights of this single storey building are as follows:

(1)	Main Portion (rice husking, milling, etc.)	9.450m
(2)	Parboiling	13.950m
(3)	Part of the Drying Facilities	18.450m

c. Areas

(1) Overall Floor Areas

Ground Floor	2,060m^2
Mezzanine Floor	492
Total	2,552m^2

(2) Facility Areas

(a) Ground Floor

1.	Paddy Receiving	135.0m^2
2.	Drying	135.0m^2

3.	Parboiling	337.5m^2
4.	Rice Husking & Milling	652.5m^2
5.	Educational	
	a. Component Training Machines	234.0m^2
	b. Workshop	90.0m^2
6.	Control	99.0m^2
7.	Milled Rice Shipping	162.0m^2
8.	Appurtenant Rooms	
	a. Boiler room	27.0m^2
	b. Transformer/Generator Room	36.0m^2
	c. Fan Room	27.0m^2
(b)	Mezzanine Floor	
1.	Laboratories (3 rooms)	84.0m^2
2.	Meeting rooms (2 rooms)	117.0m^2
3.	Low-temperature Storage (4 rooms)	42.0m^2

2. Planning Design

Facilities constituting this Proposed Building are as described in the preceding paragraph 1. Outline of the Building. Floor planning design was derived from functional requirements of the facilities as follows:

a. Receiving, Drying and Parboiling

As these functions deal with paddy and are accompany odour, noise and dust, they are to be separated by walls from husking and milling operations as well as laboratories and other functions.

b. Control Room

This is located at the center of various training activities and operation to enable centralized control.

c. Laboratories and Research

These functions are placed on a mezzanine located above ground floor facilities which do not require high ceiling heights. Laboratories and Low-temperature Storages are located in one group above the Generator/transformer Room and Workshop. Meeting Room and Lounge are grouped together over the Control Room and Office. These two groups are connected to each other with an overhead passage which is also to serve as an observation deck.

d. Column spacing is determined by equipment layout and training activities. In this case, as the functions are composed of groups of relatively small size equipment, 9m x 6m and 9m x 7.5m column spacings have been selected mainly from economical considerations of building construction.

3. Structural Design

a. General

(1) Construction method widely employed in Egypt is to be adopted for columns, beams and walls which consist the perimeter of the Building. Columns and beams are to be of reinforced concrete construction, and spaces between these framing members are to be filled with brick or concrete block masonry.

(2) As the single storey main portion of the Building is relatively tall, tie beams connecting the columns are to be provided at height of 9.0m above ground floor level in order to reduce column sectional area and shape.

(3) Floor structure of the Ground Floor is to be reinforced concrete slab on grade. Individual foundations or structural floor slabs are to be provided for heavy equipment or those creating severe vibration.

(4) As soil conditions at the site are not favourable, pile foundations are to be employed. In general, pedestal piles of 400mm to 500mm in diameter are used in Egypt.

b. Design Criteria

(1) Structural design shall be based on applicable Standards of the Architectural Institute of Japan in principle. For reinforced concrete construction, the Egyptian "Code of Practice for the Use of Reinforced Concrete in Buildings" will be used as reference standard.

(2) Main structural material shall conform to the requirements of Japanese Industrial Standards (JIS), and the following allowable stresses shall be applied:

(a) Reinforcing steel

Plain bar;	SR24	ft = 1,600 kg/cm^2
Deformed bar;	SD30	ft = 2,000 kg/cm^2
	SD35	ft = 2,200 kg/cm^2

(b) Concrete

Fc = 240 kg/cm^2, 28 day strength

(c) Cement

For underground use: Sulphate resisting Portland cement

For aboveground use: Ordinary Portland cement

(3) Foundation piles are to be placed-in-site concrete piles reaching bearing stratum. Pile heads are to be monolithic with foundation footings. Rigid footing beams are to link the footings.

c. Design Loads and External Forces

Design loads are to be established as follows:

(1) Dead loads

Weights of unit volume of main material are;

1. Reinforced concrete: 2.4 t/m^3
2. Red brick: 2.0 t/m^3

(2) Live loads

Live loads applicable to each building portion as listed below are as determined by Japanese standards and actual conditions in Egypt. For special heavy equipment and other special live loads, provisions such as independent footings are to be made accordingly for actual equipment load and layout.

1. Roof: 60 kg/cm^2
2. Floor

Laboratories, Meeting Rooms, Stairs, Corridor: 350 kg/cm^2

Passage spaces around training equipment, Mechanical and Electrical Rooms: 600 kg/cm^2

Storages 1,000 kg/cm^2

(3) Seismic Forces and Wind Loads

As the height of this reinforced concrete building is in the range of 10 to 17 meters, seismic forces and wind loads will not be considered in accordance with local Egyptian practice.

4. Material Design

In accordance with the basic policy of adopting construction methods and building materials employed generally in Egypt, the following material for the exterior and interior of the building are being planned:

a. Main Structural Material

Columns, beams and floor slabs are to be of reinforced concrete.

(1) Cement:

For underground use:	Sulphate resisting Portland Cement
For aboveground use:	Ordinary Portland Cement

(2) Reinforcing steel:

Deformed bars, SD30 and SD35

b. Main Exterior Finishes

Roof:	Reinforced concrete roof slab, asphalt membrane waterproofing, topping concrete, cement tile finish
Exterior walls:	Colour cement mortar mixed with marble powder over levelling and intermediate coats (Egyptian BAIAD Finish)
Doors & windows:	Aluminum and steel window sashes and doors

c. Main Interior Finish

(1) Training Rooms

Floor:	Terrazzo tile
Walls:	Portland cement plaster, paint finish
Ceiling:	Portland cement plaster, paint finish
Baseboard:	Cement mortar

(2) Control Room, Lounge and Laboratories

Floor:	Terrazzo tile
Walls:	Portland cement plaster, paint finish
Ceiling:	Acoustic mineral board
Baseboard:	Terrazzo tile

(3) Utility Rooms and Storages

Floor:	Cement mortar
Walls:	Portland cement plaster
Ceiling:	Structural concrete exposed

E. UTILITY DESIGN

1. General

Japanese standards and specifications are to be applied in the utility design for such items where Egyptian standards or specifications are not found. However, due considerations are to be given to local conditions such as climate, customs, manners and habits as well as local workmanship.

Basic principle in the utility design is to provide clear-cut, simple and economical utility systems which can be easily operated, controlled and maintained. Safety is to be a major consideration in the design.

2. Electrical

a. Transformer Equipment

Power supply to the Proposed Building is to be received by a service line provided up to the Building by the Egyptian Government. This service line is to be an underground cable, 3ϕ, 3W, 6.6KV connected to the existing transformer bank located in the south corner of the RTTC compound. Cubicle type transformer equipment is to be installed in the Proposed Building for voltage stepdown to 3ϕ, 380V and 1ϕ, 220V. Connected equipment load is roughly estimated at 750KW and two (2) sets of 300KVA transformers are to be installed.

b. Emergency Generator

One (1) 250KVA diesel engine generator is to be provided as an emergency power supply source during supply failure. Parboil equipment including dryers, cooling equipment for low temperature storages, laboratory equipment requiring uninterrupted power supply and emergency lighting as required are to be activated by this emergency power source.

c. Main Feeder Power Supply

Electric conduit piping and wiring shall be installed from transformer cubicles in the Building to local power control panelboards, lighting panelboards and equipment control panelboards. Feeders are to be 3ϕ, 380V and 1ϕ, 220V. Connection control panelboards to individual equipment are also to be provided.

d. Lighting Fixtures and Service Outlets

Fluorescent lights are to be used for general lighting in general. Mercury and incandescent lights are to be used as required to supplement fluorescent lighting. Standard lighting intensity at work level shall be 300 lux. Service outlets, 1ϕ - 220V shall be provided where required.

e. Telephone

A telephone terminal board shall be provided in the Proposed Building. The primary connection is to be provided by the Egyptian Government from the terminal board existing in the Administration Building. Conduit piping for future telephone wiring shall be provided to office and meeting rooms, laboratory, control room, workshop etc.

3. Air Conditioning and Ventilation

a. Air Conditioning

Control Room, offices, Laboratories, Meeting Room and other rooms which are to be normally occupied are to be provided with window-type air conditioners. Low temperature storage rooms shall also be provided with air-cooled package-type air conditioners.

b. Ventilation

Forced mechanical ventilation shall be provided on the roof for recirculation ventilation and room temperature control. Mechanical ventilation shall also be provided at required locations such as Boiler Room and Transformer/Generator Room.

4. Plumbing and Fire Protection

a. Water Supply

The existing 100mm dia. water supply pipe in the compound servicing the existing buildings is to be branched out to the Proposed Building by the Egyptian Government. Sterilization equipment will not be provided as the water supply is potable. As the supply water pressure available is 2.5 kg/cm^2 to 3.0 kg/cm^2 constantly, and as the required supply water pressure for the Proposed Building is about 1.5 kg/cm^2, the water supply is to be direct-coupled without a receiving reservoir or elevated water tank. Treatment equipment for the boiler feed water is to be provided.

b. Sewage Disposal

Sewage from toilets is to be disposed of by providing septic tanks. Treated sewage will be disposed of by seepage sumps. Septic tanks are to be of Egyptian standards for ease of maintenance. Drainage from training equipment shall be treated individually as required.

c. Plumbing Fixtures

Japanese made plumbing fixtures shall be selected as appropriate for this Project.

d. Fire Protection

Dry type fire lines shall be provided for interior fire hydrants. Fire water reservoir and fire pump will not be provided. Siamese couplings shall be Egyptian products in order to be compatible with local fire trucks. Fire hose cabinets, hose and nozzles shall be Japanese products, however, fire hydrant valves shall be interchangeable type to enable connection to local Egyptian hoses.

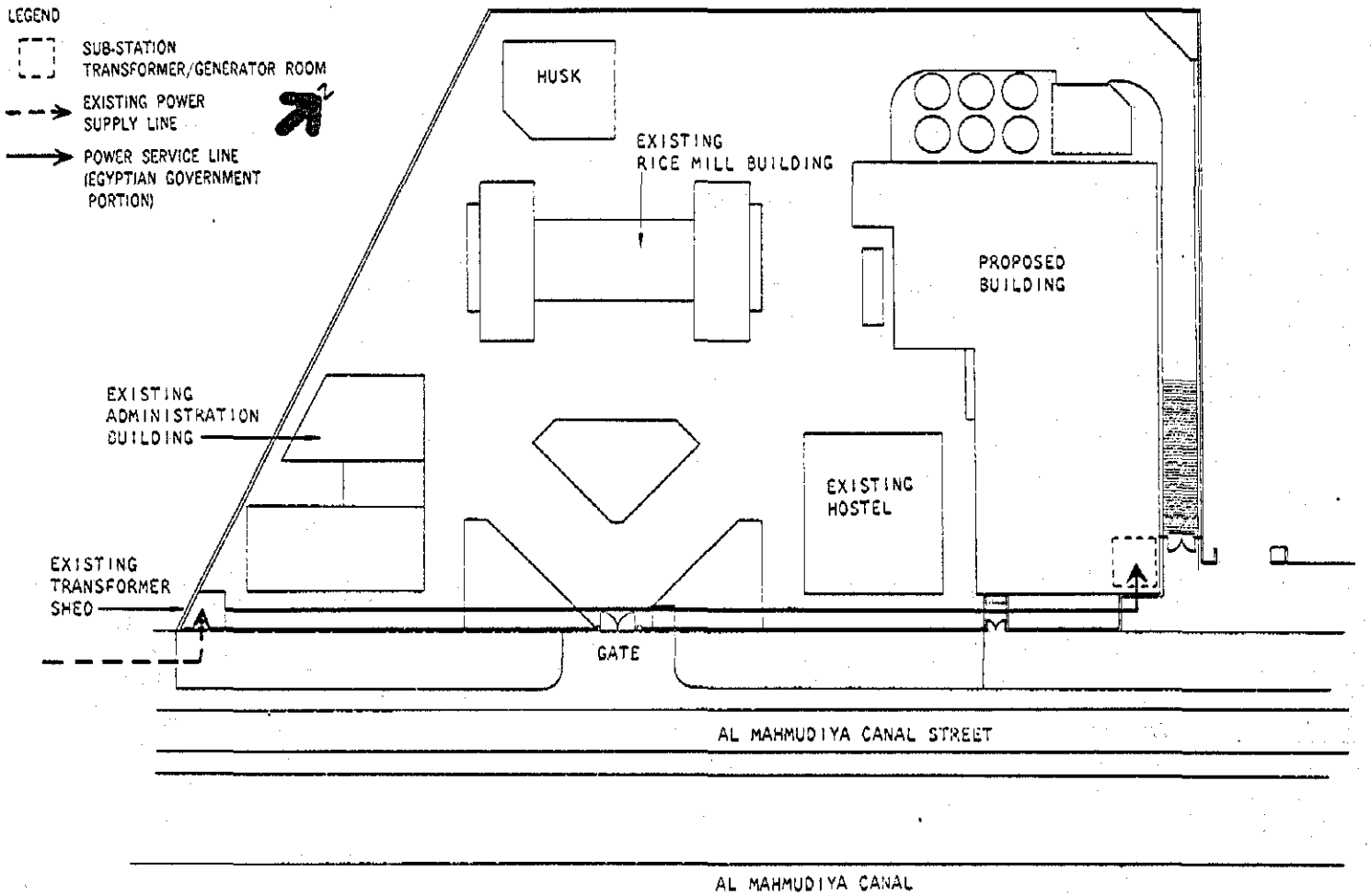


FIG. 4-4 ELECTRICAL SYSTEM

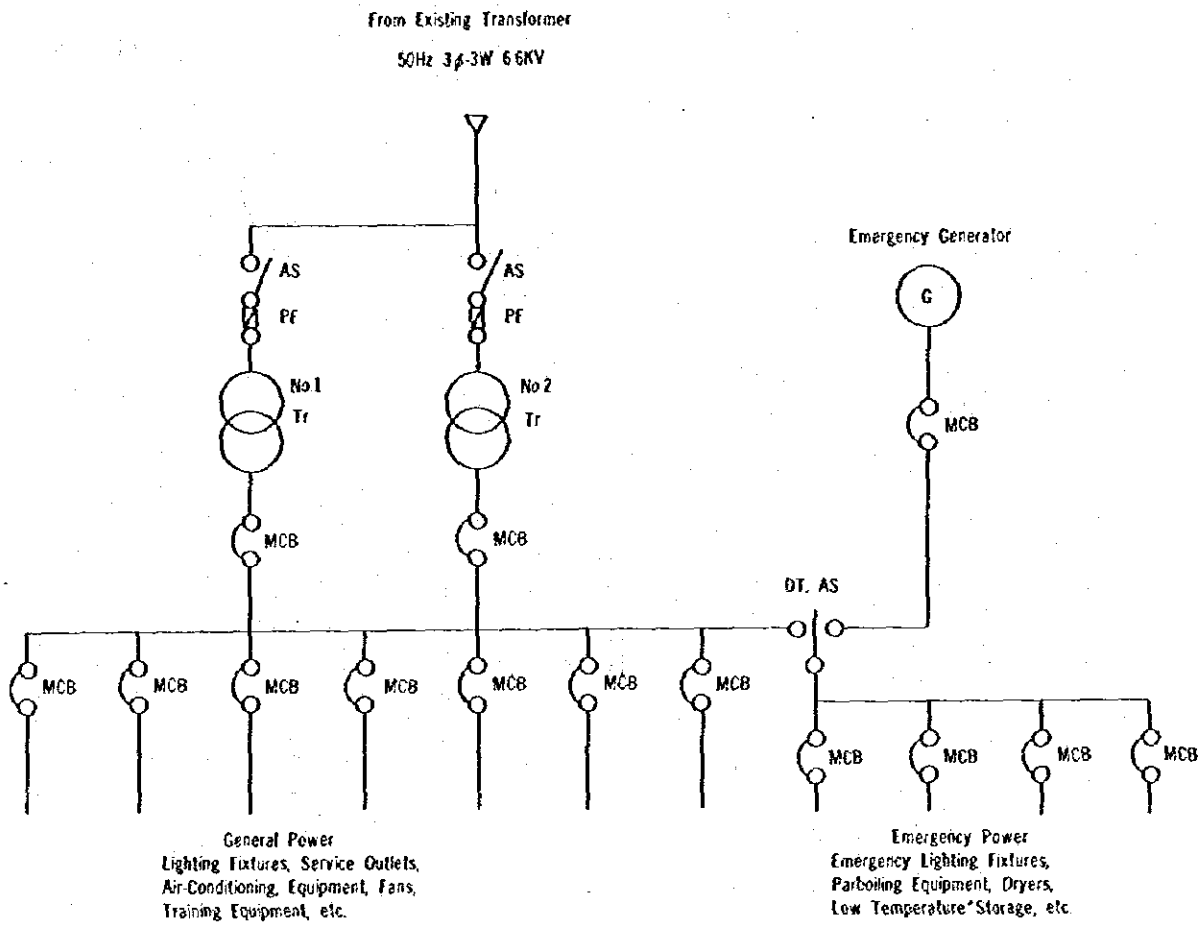


FIG. 4-5 SUBSTATION POWER SUPPLY DIAGRAM

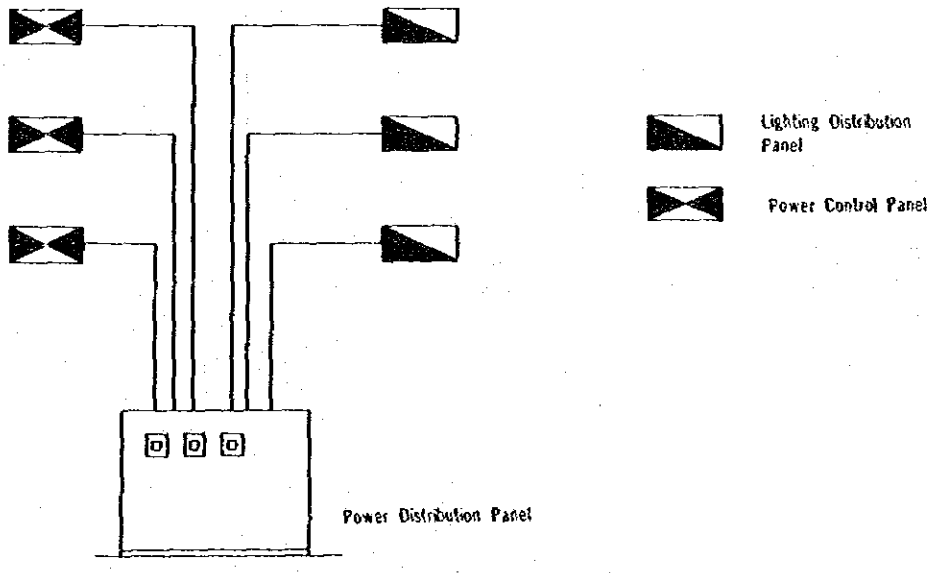


FIG. 4-6 POWER RIZER DIAGRAM

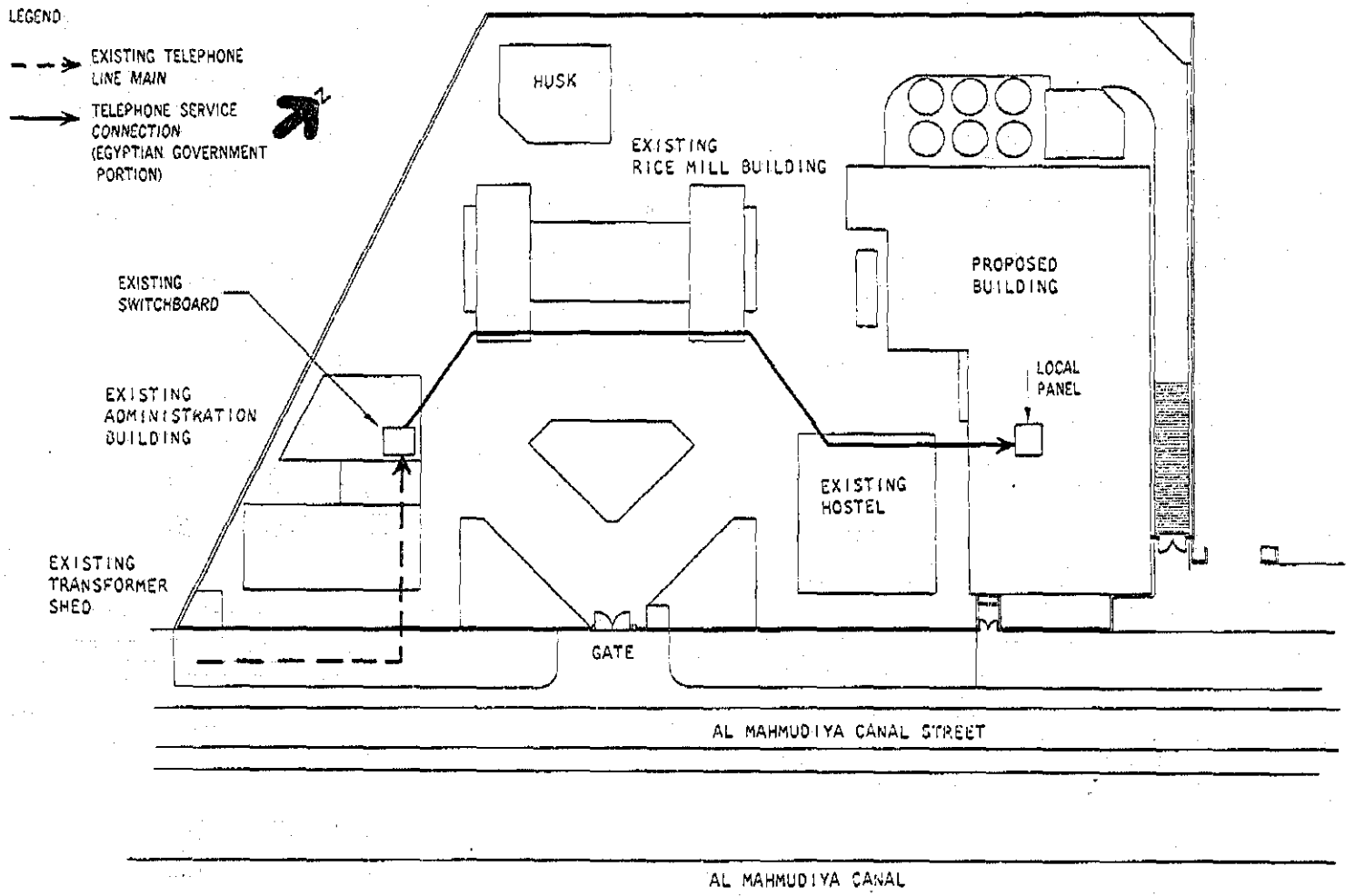


FIG. 4-7 TELEPHONE SYSTEM

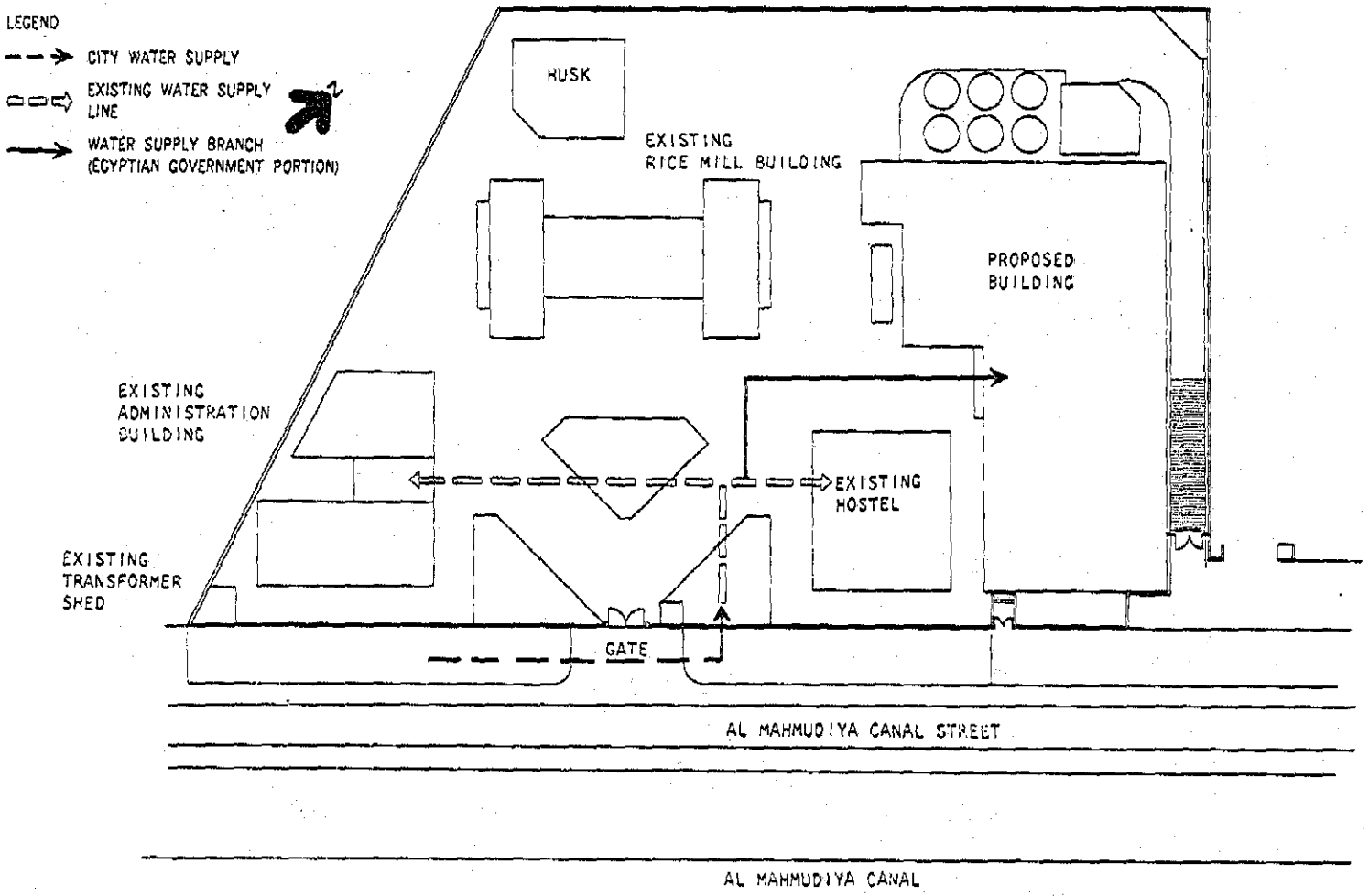


FIG. 4-8 WATER SUPPLY SYSTEM

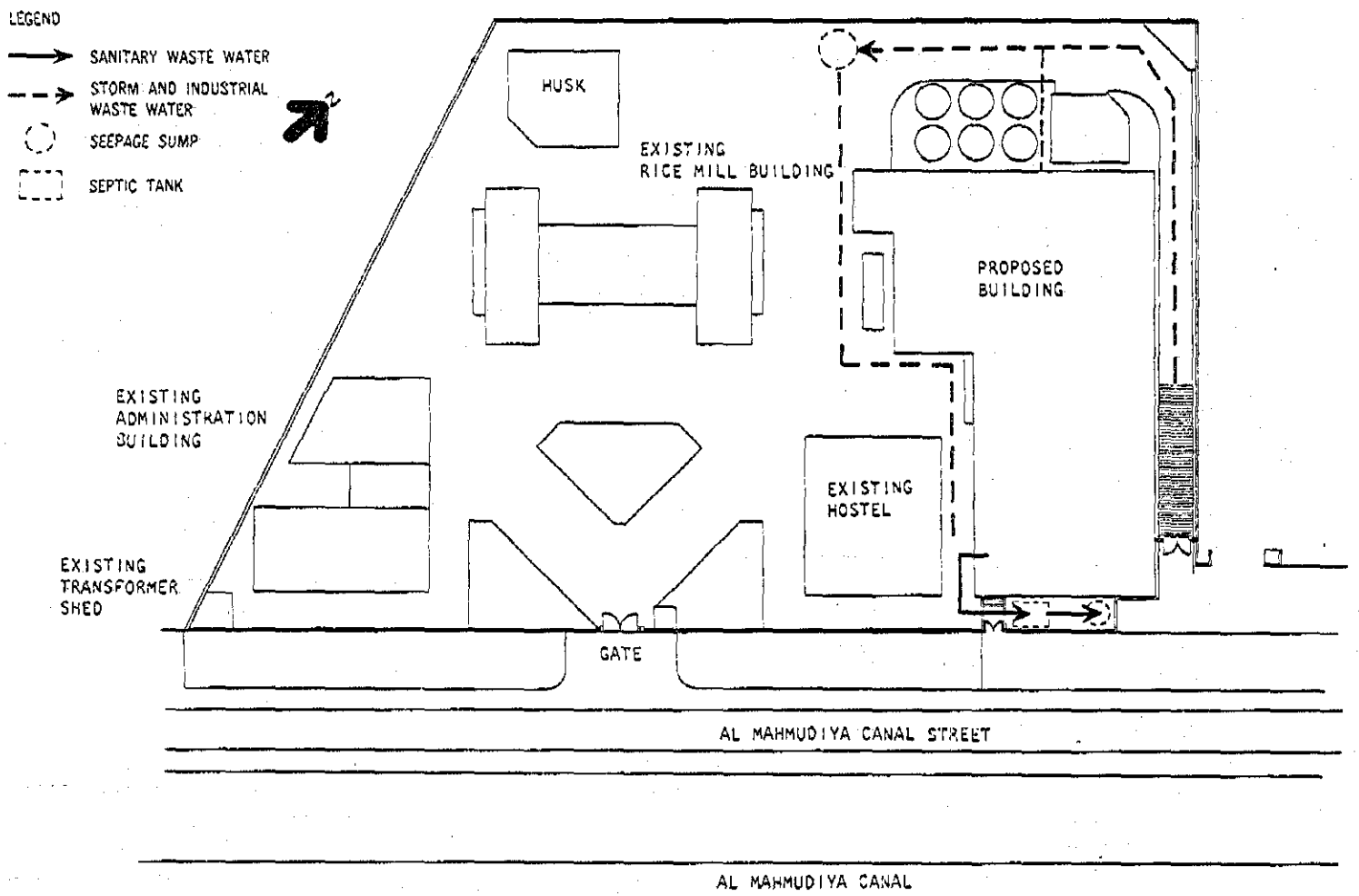


FIG. 4-9 DRAINAGE SYSTEM

F. EQUIPMENT LIST, FLOW DIAGRAMS AND DESIGN DRAWINGS

1. Equipment List

a. Rough Paddy Receiving Facilities — 1 unit

- Truck scale
- Portable stacker (belt conveyor)
- Feeding hopper
- Paddy cleaner
- Hopper scale

b. Drying Equipment — 1 unit

- Dryer
  - Furnace and burner
  - Oil tank
  - Tempering tank

c. Paddy Storage Facilities (approx. 1,000 ton) — 1 unit

- Corrugated steel silo
- Conveying equipment
- Aeration apparatus

d. Parboiling Equipment (1 ton/hr) — 1 unit

- Paddy cleaner
- Thickness grader
- Stoner
- Gravity separator
- Hopper scale
- Soaking tank
- Cooking machine
- Pre-dryer
- Dryer
- Furnace and burner
- Boiler
- Hot water tank
- Oil tank

e. Rice Milling Unit (2 ton/hr) — 1 unit

- Paddy cleaner
- Stoner
- Hopper scale
- Paddy husker with aspirator
- Paddy Separator
- Thickness grader
- Rice whitening machines
- Sifter
- Rice grader
- Rice polisher
- Colour sorter
- Weighing and packing machine
- Germ (embryo) separator
- Spare parts
- Small packed milled rice conveyor

f. By-products Processing Machines

Husk pulverizer	1 set
Broken rice pulverizer	1 set
Bran stabilizer	1 set

g. Training Aids

Slide projector	1 set
Screen	1 set
Overhead projecter set	1 set
Video tape recorder	1 set
Video camera	1 set
Television (Video)	1 set
Printing machine set	1 set
Paper binding machine	1 set
Blackboard	2 sets

h. Components Machines for Assembling and Disassembling, and Comparative Test

Paddy husker	1 set
Rice whitening machines	2 sets
abrasive type	
friction type	
Rice polisher	1 set
Weighing & packing machine (weight system)	1 set
Rice moisture conditioning machine	1 set
Embryo rice whitening machine	1 set

i. Laboratory Equipment

Test dryer	1 set
Rice inspection machine	1 set
Test rice grader	2 sets
Moisture meter (high accuracy)	2 sets
Moisture meter (handy type)	10 sets
Whiteness meter	1 set
Grain rigidity tester	2 sets
Grain crack inspector	1 set
(Electric automatic reading type)	
Grain indentification board	10 sets
(mirror plate)	
Sample pan	100 sets
Rice grain counter	10 sets
Grain shape tester	4 sets
Analytical balance	2 sets
Table balance	4 sets
Filling & litre (1 litre) cup	1 set
Grain volume - weight tester	1 set
(Brauer type, weight-to-volume balance)	
Weight per litre tester	1 set
Thermometer	20 sets

Grain sample divider	2 sets
Sample bottle	200 sets
V-type mixer	4 sets
Grain trier	10 sets
Seed sample pan with hopper	20 sets
Infra-red moisture meter	1 set
Dockage tester	1 set
Test thickness grader	1 set
Rice chemical analizer	
Kjeldahl distillation apparatus	1 set
Kjildahl digestors	1 set
Kjeldahl titration sets	1 set
Soxhlets extraction apparatus	1 set
Crude fiber detemination apparatus	1 set
Automatic muffule furnaces	1 set
Microscope with camera and rotary microtome	1 set

j. Workshop Machines and Tools

Engine lathe	1 set
Bench drill	1 set
Disk cutter	1 set
Hand cutter	2 sets
Hand bender	1 set
Electric welding machine	1 set
Gas welding set	1 set
Spot welding machine	1 set
Bench grinder	1 set
Electric hand grinder	1 set
Vise	2 sets
Electric drill	1 set
Gear puller set	1 set
Hand tool set	3 sets
Vernier	1 set
Hoist	2 sets
Compressor	1 set
Try square	1 set

Tapping screw and dies set	1 set
Grass cutter	2 sets
A.V.O. meter	1 set
Tacho-meter	2 sets

k. Diesel Generator 1 set

l. Low Temperature Room (approx. $9m^2$ x 4 rooms)

m. Data Processor (personal computer) 1 set

2. Flow Diagrams

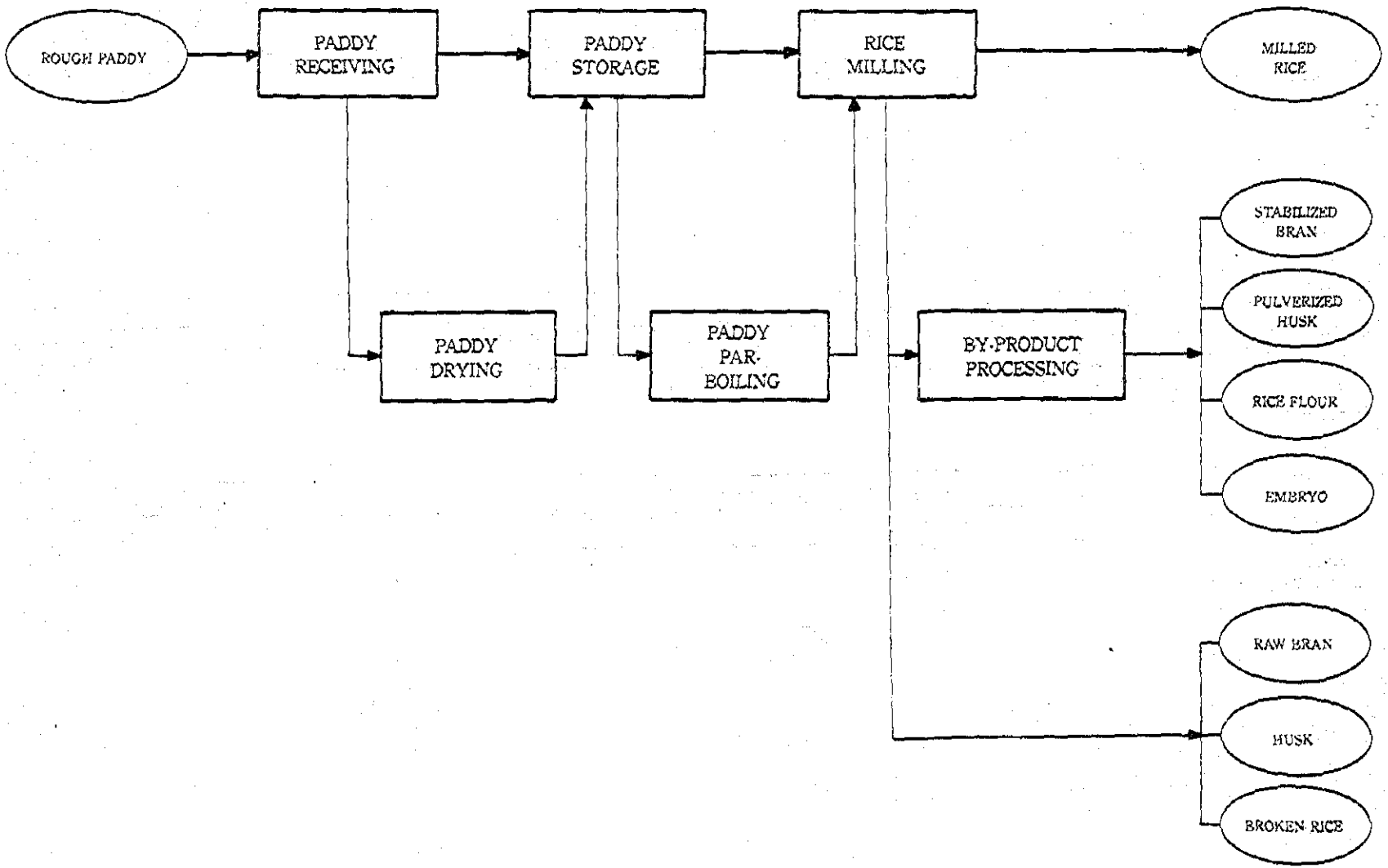


FIG. 4-10 GENERAL FLOWING OF RICE

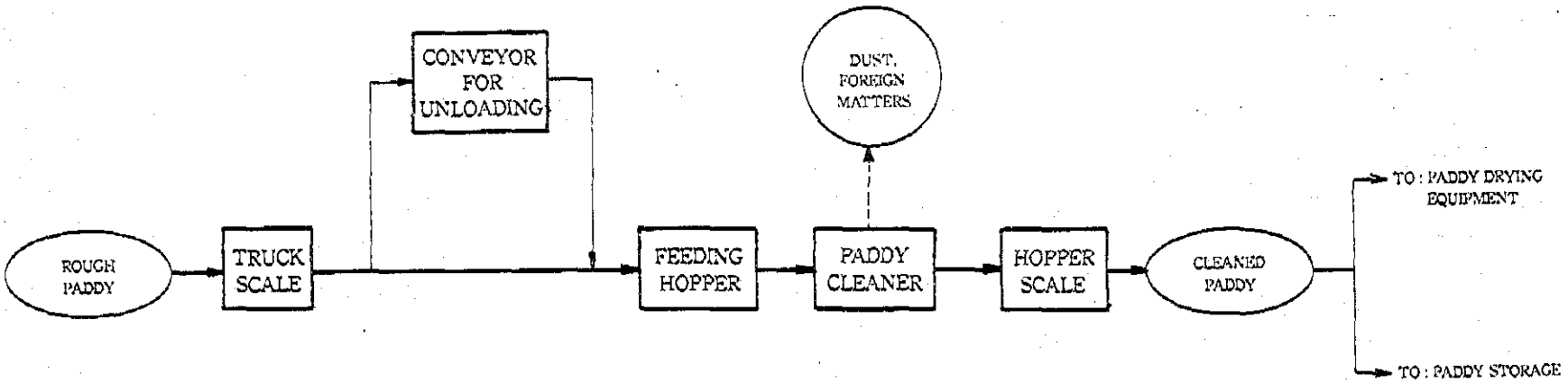


FIG. 4-11 ROUGH PADDY RECEIVING

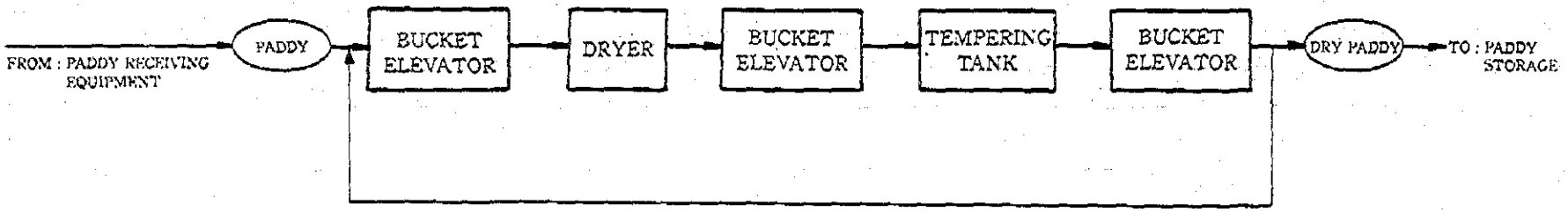


FIG. 4-12 DRYING EQUIPMENT

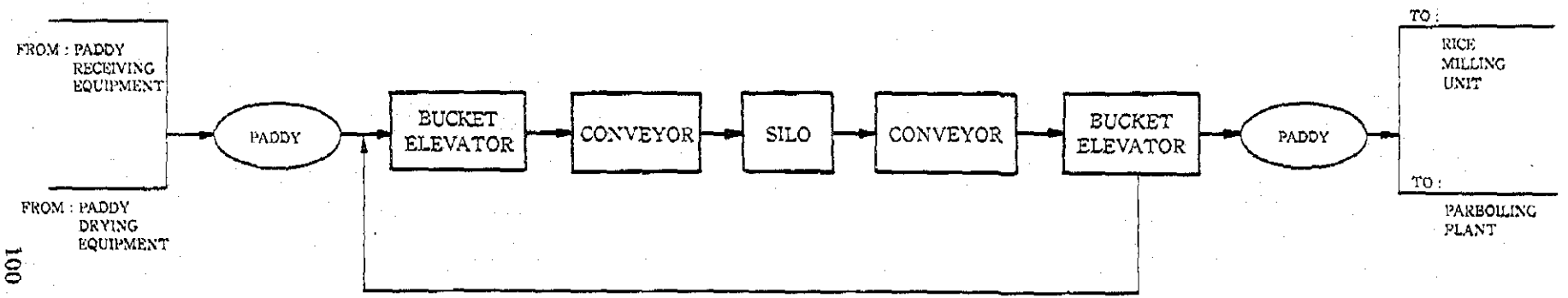


FIG. 4-13 PADDY STORAGE

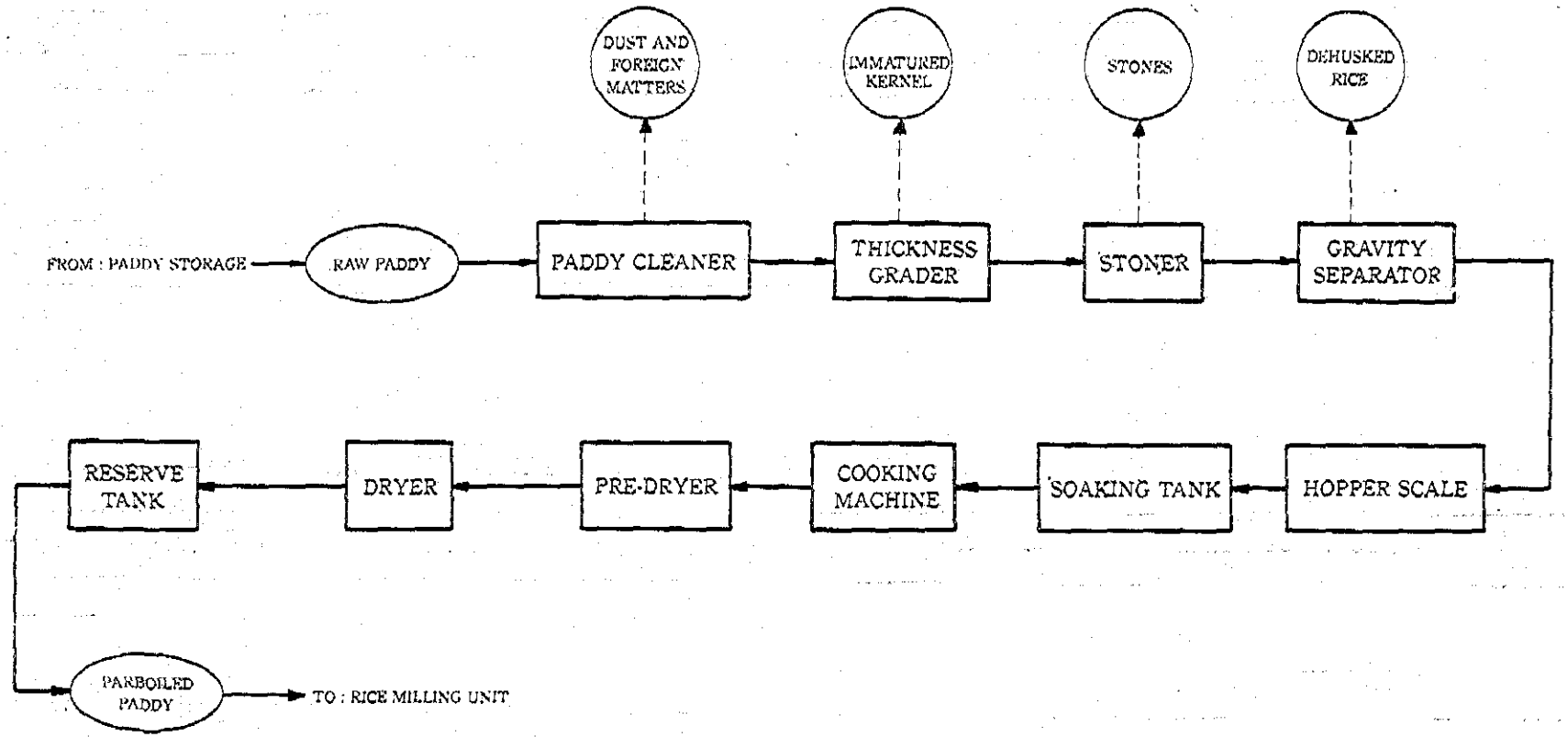


FIG. 4-14 PADDY PARBOILING EQUIPMENT

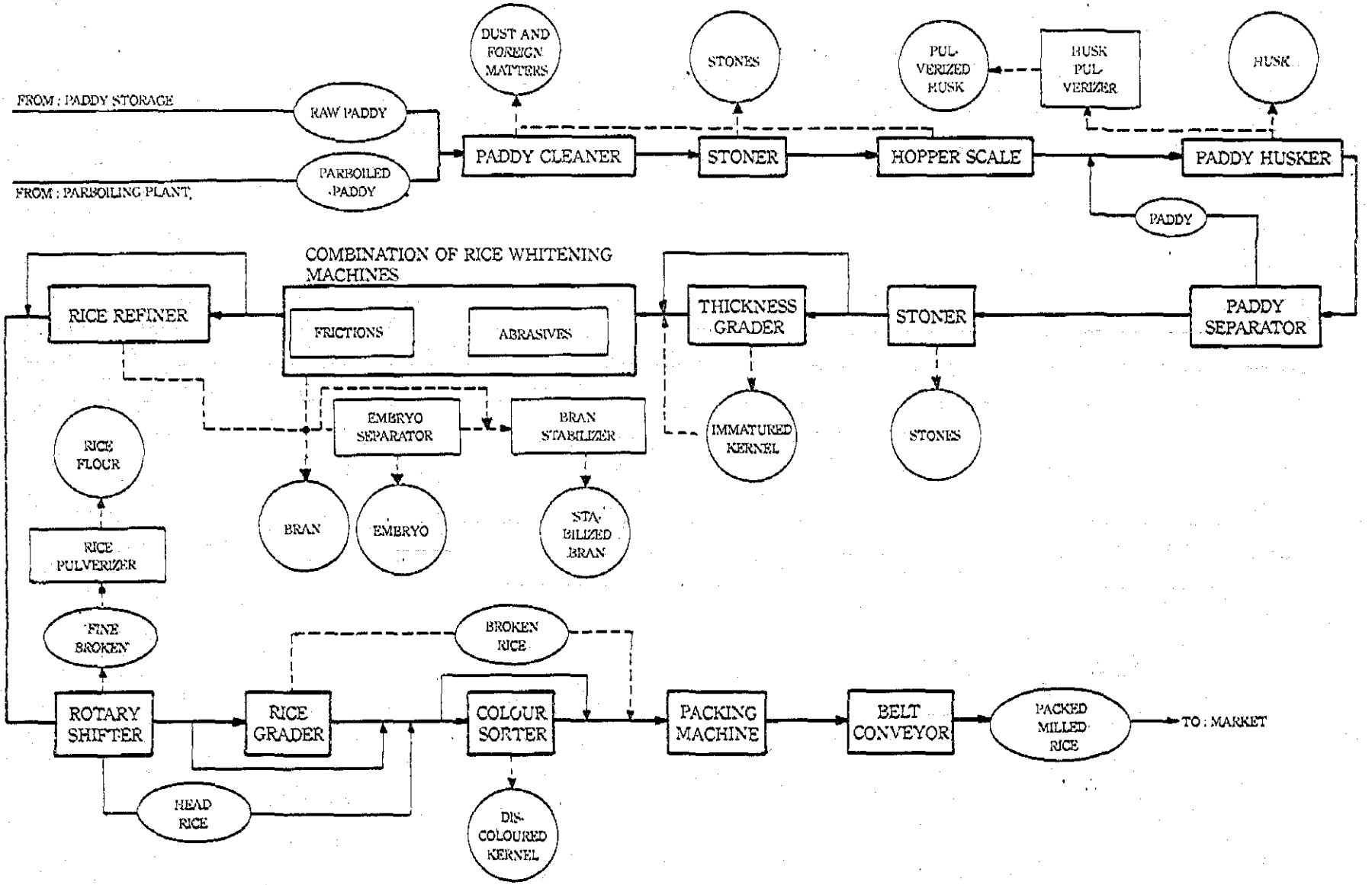


FIG. 4-15 RICE MILLING UNIT