CHAPTER 8 CONSTRUCTION PLAN

CHAPTER 8 CONSTRUCTION PLAN

8-1 Construction Situations in LAO PDR

This section is a summary of construction situations in LAO PDR, the details of which are shown in Appendix 11.

(1) General Situation Related to Construction Work

- Working hours in LAO PDR:
  7 hours a day (Monday through Saturday)
- Holidays: Six days a year
- Actual annual working days:
  Less than 200 days due to the non-workable days during the rainy season.
- There are no set standards and specifications for civil engineering designs and construction works in LAO PDR. Each project uses its own standards and specifications decided upon by the engineers concerned and by the involved aiding country and accepted by the concerned engineers of LAO PDR.

(2) Construction Companies

In LAO PDR, project constructions are undertaken by the State Companies that are under the jurisdiction of related ministries. Although privately owned companies do exist, they are small-scale and are only capable of building private homes.

(3) Construction Equipment

Construction equipment owned by State Companies was brought into the country for the construction of large projects and was subsequently subsidized after the foreign contractors completed their projects. This equipment has not been properly maintained, spare parts are lacking, and are of

different types and makes. As this equipment is not reliable and cannot operate efficiently, it is desirable to import major equipment for use in the construction of the Project from foreign countries.

(4) Wages

According to a State Company's estimation, wages for various types of workers are about US$2.5 to $4.0 a day.

(5) Construction Materials

The only construction materials available in LAO PDR are stone, sand, and lumber; all other materials must be imported.

(6) Transportation

The shipping route for construction materials and equipment to be used in the Project will be by land from Bangkok to Nong Khai, by ferryboat from Nong Khai to Thanaleng, and by land from Thanaleng to the Port of Laksi.

8.2 Construction Work Boundary

The construction work boundary for the Project is within the port area which is under the jurisdiction of MOTP and SRTC. The boundaries are as follows:

Northern boundary:	Irrigation channel
Eastern boundary :	Asian Highway
Southern boundary:	Existing administration office building, but excluding the upper work yard of the existing ramp.

The Project work includes the following:

(1) Civil works (ramp, wharf, yard pavement, etc.)

(2) Buildings

(3) Auxiliary Facilities
(water supply, fuelling, electric supply, etc.)

(4) Providing cargo handling equipment

Measures to be taken by the Government of LAO PDR are as follows:

(1) Demolishing all existing buildings inside the Project Site, and cleanup of Site.

(2) Piping installation for water supply to the storage tank and management office.

(3) Electric wire installation up to the Project Site's terminal board.

(4) Telephone wire installation up to the terminal board in the Project Site.

(5) Providing a spoil disposal area within 10 km of Vientiane City.

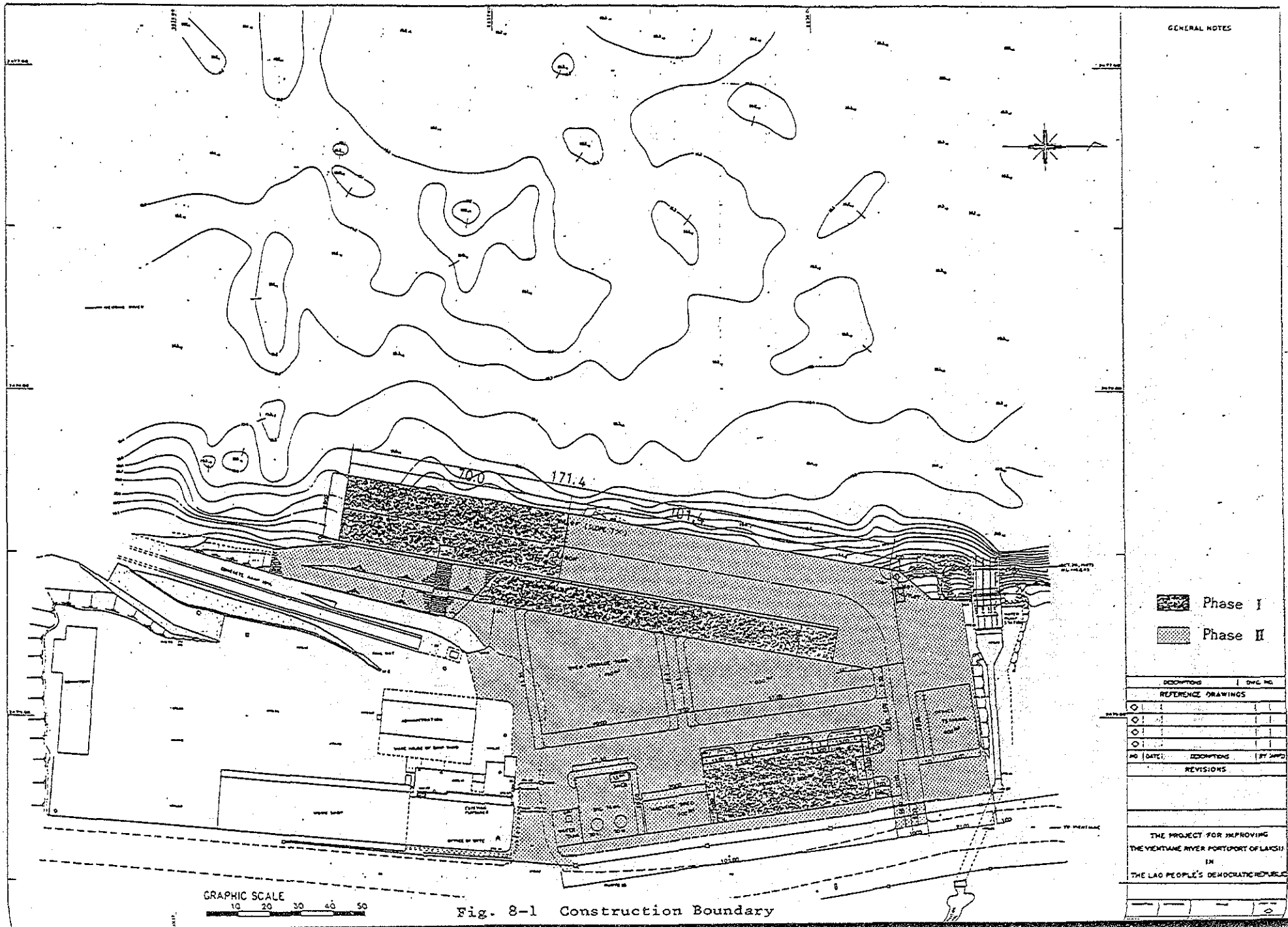


Fig. 8-1 Construction Boundary

8.3 Construction Plan

(1) Construction Methods and Procedures

The most important factors to consider for port construction are: first, that the rainy season lasts for six months (the high water stage period); secondly, there are procurement limitations imposed on steel materials used in temporary works and the availability of construction equipment. For efficient and economical construction work, therefore, major construction equipment will be shipped from Japan, and the construction work shall be carried out from the shore.

The ramp and wharf may be constructed using the following methods and procedures:

1) To build an earth-retaining structure on the inland side of the wharf by driving sheet piles with a pile driver in order to facilitate the ramp's earthwork.

2) To carry out earthwork along the ramp using a backhoe or bulldozer for creating working space.

3) Using a crawler crane, to place precast concrete blocks at the ramp wharf, and then, by using a pile driver, build a sheet-pile wharf.

As it will be necessary to drive sheet piles into a hard clay layer, the pile driver must be equipped with water-jet system.

(2) Temporary Yard

After demolishing existing Project Site buildings, the cleared area will be utilized as a temporary yard for construction work. No dedicated temporary yard outside the Project Site will be required.

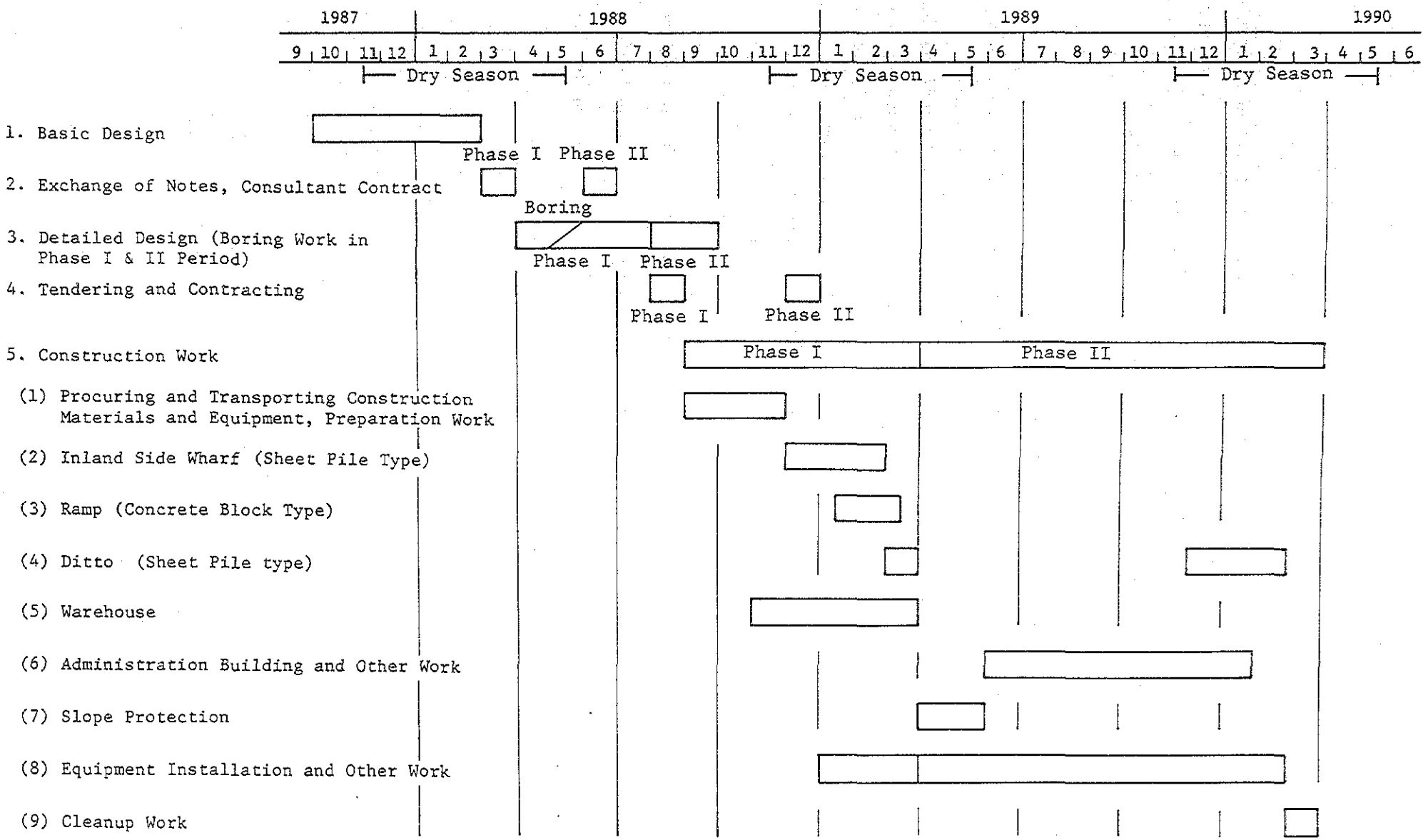
(3) Construction Work Schedule

The period of time necessary for Project construction is about nineteen months (see Table 8-1). The most important point to take into consideration for performing construction

work is to make effective use of the dry season. Project construction work can be divided into dry season work and all season work.

The dry season work (construction of ramp and wharf) will be the most critical. Judging from the construction's scale, two dry seasons will be required to perform dry season work. In order to secure one cargo handling berth during the high water and low water periods, 96.5 m on the inland side of the wharf and 70 m of the ramp wharf will be constructed during the dry season of the first construction year.

Table 8-1 Overall Project Implementation Schedule



8.4 Estimation of Project Cost

Costs to be borne by LAO PDR, such as clearing existing buildings, etc. on the Project site and installing water supply line, electrical wires, and telephone line to the Project site, were estimated to be about 35 thousand U.S. dollars.

8.5 Operation and Maintenance Cost Estimate

Presently there are from 10 to 15 SRTC staff members stationed at the Port of Laksi for operation and management purposes. After completing Project construction, the number of SRTC staff members for port operation and management work will be increased to about 20 members due to the improved port facilities and the increased cargo handling volume. Thus, it was estimated that the annual operation and maintenance costs would be about 66 thousand U.S. dollars. (see following):

1. Personnel Expenditures:	
20 persons x US $15/month/person x 12 months =	3,600 US$/year
2. Facilities' Operation and Maintenance Costs	62,000 US$/year
Total:	65,600 US$/year

CHAPTER 9 EXAMINATION OF OPERATION AND MANAGEMENT PLAN

CHAPTER 9 EXAMINATION OF OPERATION AND MANAGEMENT PLAN

9.1 Effective Port Management

SRTC's present services, except for its ship repair and building department, can roughly be categorized into the following three groups: (1) River Transportation; (2) Port Management; and (3) Land Transportation.

These three groups are interdependent and form one mass transportation system as a whole. Therefore, if one group's efficiency is lowered, it becomes a bottleneck in the system and causes a reduction in the transportation capacity.

Looking at the present situation of the Port of Laksi, the insufficient capacity of land transportation (the secondary transportation means) is the bottleneck for cargo unloading and, as the inefficient cargo handling results in keeping boats waiting at anchor.

From an economic viewpoint, inefficient cargo handling results in wasted man-hours and an excessive number of non-operational hours for cargo handling equipment. Also boats, because they must remain at anchorage longer, lose valuable operating time and their crew members, even though idle, must continue to receive wages. Inefficient cargo handling and the excessive periods of time boats must wait at anchorage prior to being unloaded are two main factors in port and boat management; corrective action must be taken to improve this situation.

First, the land transportation sector -- the bottleneck of the overall transportation system -- should be improved and strengthened. Then it will be necessary to organize the transportation system to allow cargo at the port to be smoothly transferred from ship to land transportation vehicles.

Secondly, it will be necessary for SRTC to appeal to transportation companies -- even though they belong to other transportation organizations -- to use the Port of Laksi. SRTC

must also make an effort to have a greater amount of cargo delivered to the Port of Laksi in order to increase the cargo handling volume.

As a result of attracting transportation companies to the Port of Laksi for cargo handling purposes, cargo handling work at the port (transferring cargo from waterborne to land transportation (trucks), or vice versa) will be a complex operation. Thus, it will be necessary to improve to port services by fully utilizing the warehouse and the open storage areas in order to control the cargo flow.

The Keng Kabao Port and The Tha Deua/Pak Khone Port are located at small villages along the Mekong River; they are away from populated areas and are cargo transportation relay points. In order to fully utilize the full capabilities of these two ports, it is essential that their access roads be improved and that the land transportation department be strengthened.

Road conditions in LAO PDR are poor and roads are disrupted by flooding during these rainy seasons. Thus, river transportation becomes increasingly active during these seasons. However, unless present road conditions are improved, river transportation will not be able to meet increased transportation demands.

The north-south river transportation system on the Mekong River will be firmly established as a result of the completion of the Port of Laksi improvement project. To fully utilize the functions of the ports, it is necessary to improve road conditions, and to strengthen land transportation.

9.2 Subjects for Further Examination

In order to meet the future cargo volume increase, SRTC should examine the following matters.

9.2.1 Cargo Handling System

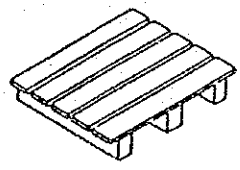
To cope with cargo volume increase in future, it will be necessary to temporarily store some amounts of cargo in the warehouse and at the open storage areas. For this reason, it will be necessary to strengthen the Cargo Handling Department. Especially, it will be necessary to examine the operating system in the warehouse and open storage areas and the management method.

The utilization of forklifts or trucks to transport unloaded cargo from the apron to the warehouse and the open storage area should be considered. Judging from the apron slope and the transporting distance, it is desirable to determine through experimentation which is the most efficient cargo handling method.

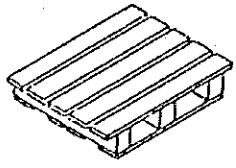
Pallet boards are generally used when handling cargo to and from large ships, and by using forklifts in the ship hold, effective cargo handling can be achieved. Because of the limited size of the boats at the Port of Laksi, it is impossible to use a forklifts in such a manner. However, it is desirable to study the effective use of cargo handling equipment with a view toward improving the efficiency and safety of cargo handling operations.

There are various types and sizes of pallet boards. The square wing type, having 1,100 mm sides, is most commonly used.

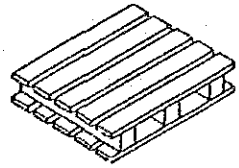
Single side single wing type (SU)



Single side use single wing type (DU)



Both side use double wing type (RW)



Source: '78 Pallet Data Book, Japan Pallet Association

The wing type pallet has the advantage of being easier to balance. By inserting a steel bar in each wing of the pallet, lifting can be accomplished from the ends of the bars. By placing two steel bars in the upper part of the sling and then covering the sling with a net, the cargo can be lifted without being tied to the pallet.

9.2.2 Cargo Backlog

As the present cargo handling work is constrained by the truck transportation's rotation rate, SRTC is required to strengthen its land transportation department. Further, the introduction of the following tariff system should be studied in order to expedite cargo pickup by consignees:

(1) To levy backlog charges for cargo at open storage area (the same as the present warehouse charge) to prompt expeditious cargo pickup.

(2) To levy overtime parking charges against consigners or consignees who leave vehicles parked in the truck parking area for periods exceeding certain time limits.

By introducing the above systems, it may become possible to determine who is responsible for transportation delays and thereby achieve effective cargo transportation.

9.2.3 Substantiating Maintenance and Repair Work

As described in the previous section, the present Port of Laksi is not sufficiently maintained and repaired.

The purpose of the Project is to construct new facilities to meet future cargo and passenger demands. In order to fulfil the demands, it is absolutely necessary to maintain the facilities over a long period of time and to keep them in good operating condition. For this reason, it is necessary to repair facilities properly and to conduct periodic inspection and maintenance work.

9.2.4 Port Statistic Study

Port statistical data are very important basic information needed to gain an understanding of the activities associated with cargo movement. This data becomes the basis of policy making, including port planning, and is used to forecasting future cargo movement trends. Therefore, establishing rules for the preparation of statistics covering the following basic items concerned with cargo handling and volume is essential, and, under the guidance of MOTP, that each transportation organization must be compelled to prepare thorough port statistical data:

(1) Information on boats entering the port.

(2) Number of boarding and disembarking ferryboat passengers.

(3) Information relating to outbound and inbound waterborne cargo.

(4) Incoming and outgoing land transportation cargo information.

(5) Description of boat cargo handling methods.

(6) Information on cargo volume and types of cargo in warehouse and at open storage area.

It is desirable to determine cargo item classification by referring to the "Standard International Trade Goods Classification, 3rd Edition."

9.2.5 Technical Cooperation

There are various related matters for effectively managing the Port of Laksi, such as establishing a port management system, improving onshore cargo handling work, and systematizing basic statistical data preparation. After looking into these matters to determine the type of management most suitable for use in LAO PDR, it is recommended that training be provided to senior staff members of MOTP for a certain period of time in Japan.

CHAPTER 10 PROJECT EVALUATION

CHAPTER 10 PROJECT EVALUATION

10.1 Effect of the Project

The Port of Laksi, operated and managed by the Ministry of Transport and Post, is the gateway to LAO PDR; it is a facility that has a vitally important role in the country's development policy.

The development effects that would be achieved as a result of constructing the Port of Laksi were studied by classifying them into the following direct and indirect effects:

(1) Direct Effects

The following direct effects can be considered:

1) Because of improvements to berthing facilities, there will be an increase in cargo handling volume and a decrease in the amount of time, boats must wait in order to berth.

2) By introducing larger cargo handling equipment, cargo handling time will be reduced and heavier items of cargo can be loaded and unloaded.

3) Transportation costs will be reduced.

4) The number of accidents related to cargo handling will be reduced.

5) There will be additional passenger conveniences, and passenger safety will improve.

(2) Indirect Effects

The following indirect effects will evolve as a result of the Project implementation:

1) There will be an improvement in living standards as people will be able to obtain a stable supply of daily necessities.

2) Employment opportunities and income increases will result from work related to the port construction.

3) The port construction work will have a beneficial effect on the country's economy as new jobs are created at the port and personal incomes increase.

4) The country's transportation capacity will increase. Improvements will be made in the movement of cargo and passengers through the establishment of a north-south transportation network with the Port of Laksi becoming the network's center.

Described above are qualitative development effects. From this aspect it is considered that the implementation of the Project under grant aid cooperation is appropriate and well worthwhile.

10.2 Project Evaluation from Managerial and Organizational Viewpoints

From managerial and organizational viewpoints, the Project can be evaluated as follows:

- The existing ramp type wharf in LAO PDR differs from the Project's inland-side wharf in that it has a slope perpendicular to its wharf line. As the Project's wharf is vertical, it will be possible to moor boats alongside thereby permitting simple, efficient, and safe cargo handling.

- SRTC, the Customs Office, and the Police Station each have their own building at the present time, but, in order to organize and unify port management functions, they will be housed in the new Port Administration Office.

- Supplies of fuel, water and electricity are almost nil at the present time. After the completion of the Project port, there will be a smooth supply of these items to boats; hence port service functions will be improved.

10.3 Project Evaluation from Maintenance and Operational Viewpoints

From maintenance and operational viewpoints, the Project can be evaluated as follows:

- As the Project wharf is to be a steel sheet-pile structure, it will be durable and easy to maintain and operate.
- The riverside wharf is the ramp type that is most commonly used in LAO PDR. The wharf line is on its mild-sloped ramp. It can be said that the ramp type is the easiest wharf to operate in LAO PDR.
- Port safety will be improved as a result of the installation of fire fighting equipment for use in containing possible boat, building, or cargo fires.

10.4 Overall Evaluation

Improvements to the Port of Laksi, that is to be operated and managed by MOTP, are indispensable if it is to become the gateway to LAO PDR and thereby activate and develop the country's economy and industry and upgrade the people's living standards.

It was decided upon that the wharf, the port's main facility, would be the ramp type that is the easiest to operate in LAO PDR. As the wharf is to be a vertical sheet-pile structure, it will permit easy cargo handling, and, beside being durable, will be easy to maintain and operate.

It can be considered that the Port of Laksi under MOTP's present management system will fully function over a long period of time.

In view of the above evaluation, it can be judged that early implementation of the Project with grant aid cooperation from the Japanese Government is appropriate and worthwhile.

CHAPTER 11 CONCLUSION AND RECOMMENDATIONS

CHAPTER 11 CONCLUSION AND RECOMMENDATIONS

11.1 Conclusion

In LAO PDR, a farming country, 3.6 million people are living on approximately 240,000 km^2 of land. As major cities are developed along the Mekong River, river transportation is an extremely important means for moving cargo and people smoothly between them. This is especially true during rainy seasons when road networks are disrupted by flooding. At these times, river transportation becomes vital for maintaining north-south contact. This situation is not likely to change even in the future.

In view of the above, the modern Keng Kabao Port, located in the suburbs of Savannakhet, was built in 1986 with grant aid cooperation from the Netherlands. The amount of cargo and the number of passengers passing through the Keng Kabao Port is expected to increase in the future.

On the other hand, the Port of Laksi, whose hinterland is the capital Vientiane, is destined to become the major transportation point as well as the gateway to LAO PDR. The present Port of Laksi, however, is relatively small and its facilities are in the advanced stages of deterioration; the port is definitely not in condition to meet the demands for handling increased cargo and passenger loads.

By improving the Port of Laksi, the gateway to Vientiane and the country, will mean the building up of a key river transportation point that will become the main artery linking the northern and southern parts of LAO PDR. Improving this port will prove to be indispensable in activating the country's industries and economy, and it will also contribute to the raising of the standard of living.

Under the present situation, LAO PDR has economic and technological problems that prevent it from implementing the Project on their own. Thus, the delay or incompletion of the Project will be unavoidable if LAO PDR attempts to carry out the Project alone.

To carry out the Project for Improving the Vientiane river port (Port of Laksi) with grant aid cooperation during its early stages from the Government of Japan is deemed to be appropriate and well worthwhile.

11.2 Recommendations

In order to attain sufficient effects by improving the Port of Laksi, the following recommendations are proposed:

(1) Improvement of Safety

It is a prerequisite to keep truck cranes in a horizontal position when in use. To do this, it might be necessary to place sleeper-type lumber underneath the crane while being used on the ramp.

For lifting loads, it is necessary to fully understand the rating load of the truck crane. Further, it is desirable to use supplemental implements, such as pallet boards, in order to improve cargo handling safety.

When a "roll-on/roll-off" boat is being used, and there is a wide space between the ramp and the boat itself, it is recommended to that a pontoon be placed in the space in order to increase cargo handling efficiency and to provide for greater safety.

(2) Establishment of a Maintenance and Repair System and Securing Their Budget

Proper maintenance and repair is essential to keep facilities and equipments operating efficiently and to prolong their serviceable life.

Presently, maintenance and repair to port facilities and its associated equipments is not being carried out properly in LAO PDR. Therefore, it will be necessary to establish such a system to ensure that periodic maintenance and repair work to Project facilities and equipments is conducted; it will be essential to obtain a budget sufficient to accomplish the necessary maintenance and repair work.

Further, to ensure that the fire fighting equipment is always ready for emergency use, it should be inspected periodically.

(3) Improvement of Transportation Network

Being the nodal point between waterborne transportation and land transportation is a port function. However, the Port of Laksi on the outskirts of Vientiane, even though it is expected to become more prosperous in the future, is presently not functioning systematically, this is especially true for each of its transportation modes; boats continually must remain in port waiting for trucks. For this reason, it is necessary that improvements be made to the transportation network by integrating the waterborne transportation and land transportation systems into one body.

(4) Improvement of Port Data Keeping

It is necessary to carry out continuous surveys in order to obtain information concerning boats entering the harbour and the types and amounts of cargo being handled. This data is needed to understand seasonal and yearly changes, and for use in making possible future port improvement plans.

(5) Staff Training

In order to run the port efficiently, it is essential that its staff be provided with training. The training of staff members in such fields as port planning, construction engineering, operations and management, and transportation is of great importance.

(6) Data Processing

Increase in cargo volume will result in a proportional increase to related information. It is necessary that a data processing system be established in order to quickly comprehend the scheduling of ferryboats, warehouse management, operational schedules of port facilities and equipments, etc.

(7) For Smooth Project Implementation

The following points are indispensable for smooth Project implementation:

1) The work to be accomplished by LAO PDR (clearing and relocating existing buildings, etc., and installing water supply piping, electrical wiring, and telephone cable to the port area) must be completed on schedule.

2) Large amounts of steel material and large construction equipment will be required for Project use and they must be transported through a foreign country. As it is planned to transport this material and equipment through Thailand --the most common route -- the Government agencies concerned to The Project should cooperate for their smooth transportation.

3) Taxes must be exempted on the imported construction equipment and materials for Project use by the Japanese contractors for Project implementation.

APPENDICES

APPENDICES

APPENDIX 1. Members of the Basic Design Study Team

(1st time)

Name	Task	Affiliation
Hiroaki Ozasa	Team Leader	5th District Port Construction Bureau Ministry of Transport
Akira Ouchi	Grant Aid Cooperation	Economic Cooperation Bureau, Ministry of Foreign Affairs
Yutaka Sunohara	Port Planner	Overseas Coastal Area Development Institute of Japan
Kunio Masunaga	Demand Forecast and Management	Overseas Coastal Area Development Institute of Japan
Nobuo Kawamura	Port Engineer	Pacific Consultants Internationa
Akira Ichihara	Port Structure Engineer	Pacific Consultants International
Masaru Ohno	Hydrologist	Pacific Consultants International
Toshio Yamada	Equipment, Building, Utility and Cost Estimate Engineer	Pacific Consultants International
Ryoichi Minami	Surveyor	Pacific Consultants International

(2nd time)

Name	Task	Affilication
Hiroaki Ozasa	Team Lader	5th District Port Construction Bureau Ministry of Transport
Nobuo Kawamura	Port Engineer	Pacific Consultants International
Akira Ichihara	Port Structure Engineer	Pacific Consultants International

APPENDIX 2. Minutes of Discussions, June 16, 1987

MINUTES OF DISCUSSIONS FOR THE PRELIMINARY STUDY ON THE PROJECT FOR IMPROVING THE VIENTIANE RIVER PORT (PORT OF LAKSI) IN THE LAO PEOPLE'S DEMOCRATIC REPUBLIC

In response to the request of the Government of the LAO PEOPLE'S DEMOCRATIC REPUBLIC (hereinafter referred to as "LAO PDR"), the Government of Japan decided to conduct a preliminary study on the Project for improving the Vientiane River Port (Port of Laksi) (hereinafter referred to as "the Project"), and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to the LAO PDR the study team headed by Dr. Hiroaki OZASA, Director, Designing Department, 5th District Port Construction Bureau, Ministry of Transport (hereinafter referred to as "the Team") from June 9 to June 18, 1987.

The team had a series of discussions on the Project with the staff concerned of the Government of the LAO PDR headed by Mr. Phetsamone VIRAPHANH, Deputy Director of Economic Planning Department, Ministry of Transport and Post and conducted a field servey at the Project site.

As a result of the study, both parties agreed to recommend to their respective Governments that the major points of understanding reached between them, attached herewith, should be examined towards the realization of the Project.

Vientiane, June 16, 1987

小笹博昭 H. O.

Dr. Hiroaki OZASA
Team Leader
Preliminary Study Team
Japan International
Cooperation Agency.

Mr. Phetsamone VIRAPHANH
Deputy Director of Economic
Planning Department,
Ministry of Transport and
Post.

ATTACHEMENT

1. Objective of the Project

The objective of the Project is to contribute to attaining the target of the second five-year development plan; self sufficiency of foodstuff and stabilization of the social welfare from the view point of upgrading inland waterway transportation through the improvement of Laksi Port in Vientiane.

2. Organization

The Ministry of Transport and Post of the LAO PDR is responsible for executing the Project.

3. Project site

The Project site is located at KM4 point in the capital city Vientiane, along a bank of Mekong River. The site has some port facilities operated by the State River Transport Company :(SRTC).

(The Site map is attached as ANNEX)

4. The major items requested by the LAO PDR for the Project are as follows :

1) Mooring facility
2) Crane for loading and unloading
3) Cargo handling equipments
4) Warehouse and Open Storage Area
5) Road inside the port
6) Other facilities such as,
   - port administration office
   - toilet
   - supplying facilities of water, fuel oil, electricity etc.
   - passenger station

11.0

5. Agreed points for further consideration are as follows :

(1) The both parties recognized that the Project is much contributable for upgrading of social welfare of people of the LAO PDR.

(2) The size and the type of port facilities necessary for the Project and those layout plan will be carefully studied and determined in detail at the time of the Basic Design Study.

(3) It should be considered that the construction work of the Project be performed without the obstruction of the existing port operation..

(4) The facilities built and supplied by the Project must be utilized exclusively for economic and social objectives and not to be used for the military purposes.

6. The Team explained to the Government of the LAO PDR on the scheme of the Grant Aid Program by the Japanese Government including hiring the Japanese consultant and the Japanese firms.

APPENDIX 3. Minutes of Discussions, October 14, 1987

MINUTES OF DISCUSSIONS
ON
THE PROJECT FOR IMPROVING THE VIENTIANE RIVER PORT (PORT OF LAKSI)
IN
THE LAO PEOPLE'S DEMOCRATIC REPUBLIC

In response to the request of the Government of the Lao People's Democratic Republic (hereinafter referred to as "LAO PDR"), the Government of Japan had decided to conduct a basic design study on the Project for Improving The Vientiane River Port (Port of Laksi) and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to the Lao People's Democratic Republic the Basic Design Study Team headed by Dr. Hiroaki OZASA, Director, Designing Department, 5th District Port Construction Bureau, Ministry of Transport (hereinafter referred to as "the Team") from Oct. 6 to Oct. 31, 1987.

The Team had a series of discussions on the Project with the officials concerned of the Government of the LAO PDR headed by Mr. Phetsamone VIRAPHANH, Deputy Director, Department of Economic Planning, Ministry of Transport and Pos and conducted a field survey at the Project Site and other concerned areas.

As a result of the study, both parties agreed to recommend to their respective Governments that the major points of understanding reached between them, attached herewith, should be examined towards the realization of the Project.

Vientiane, October 14, 1987

小笹博昭 H.O

Dr. Hiroaki OZASA
Team Leader, Japanese Basic Design Study Team
Japan International Cooperation Agency (JICA)

Mr. Phetsamone VIRAPHANH
Deputy Director, Department of Economic Planning
Ministry of Transport and Post

ATTACHEMENT

1. Objective of the Project

The objective of the Project is to contribute to attaining the target of the second five-year development plan; self sufficiency of foodstuff and stabilization of the social welfare from the view point of upgrading inland waterway transportation through the improvement of Laksi Port in Vientiane.

2. Implementing Body

The Ministry of Transport and Post of the LAO PDR is responsible for the implementation of the Project.

3. Project Site

The Project site is located at Laksi KM4 point along the bank of Mekong River in the capital Vientiane. The site has some port facilities operated by the State River Transport Company (SRTC).
(The Site map is attached as ANNEX-I)

4. Agreed points are as follows :

(1) Considering maintenance/operational conditions at present in the LAO PDR, the fixed type of mooring facilities will be selected. The floating type will not be preferable.
(2) Both parties have recognized the importance of the improvement for the present port operational system.
(3) The facilities built and supplied under this Project must be utilized exclusively for economic and social objectives, not for the military purposes.

H. O.

5. Technical Cooperation

The Team introduced the international training program in the field of port and harbour in Japan. The LAO PDR side showed interest in the program.

6. Request by the Government of the LAO PDR

The Team will convey the desire of the Government of the LAO PDR to the Government of Japan that the latter will take necessary measures to cooperate in implementing the Project and provide necessary facilities and equipment as listed in Annex II within the scope of the grant aid program of Japanese Government.

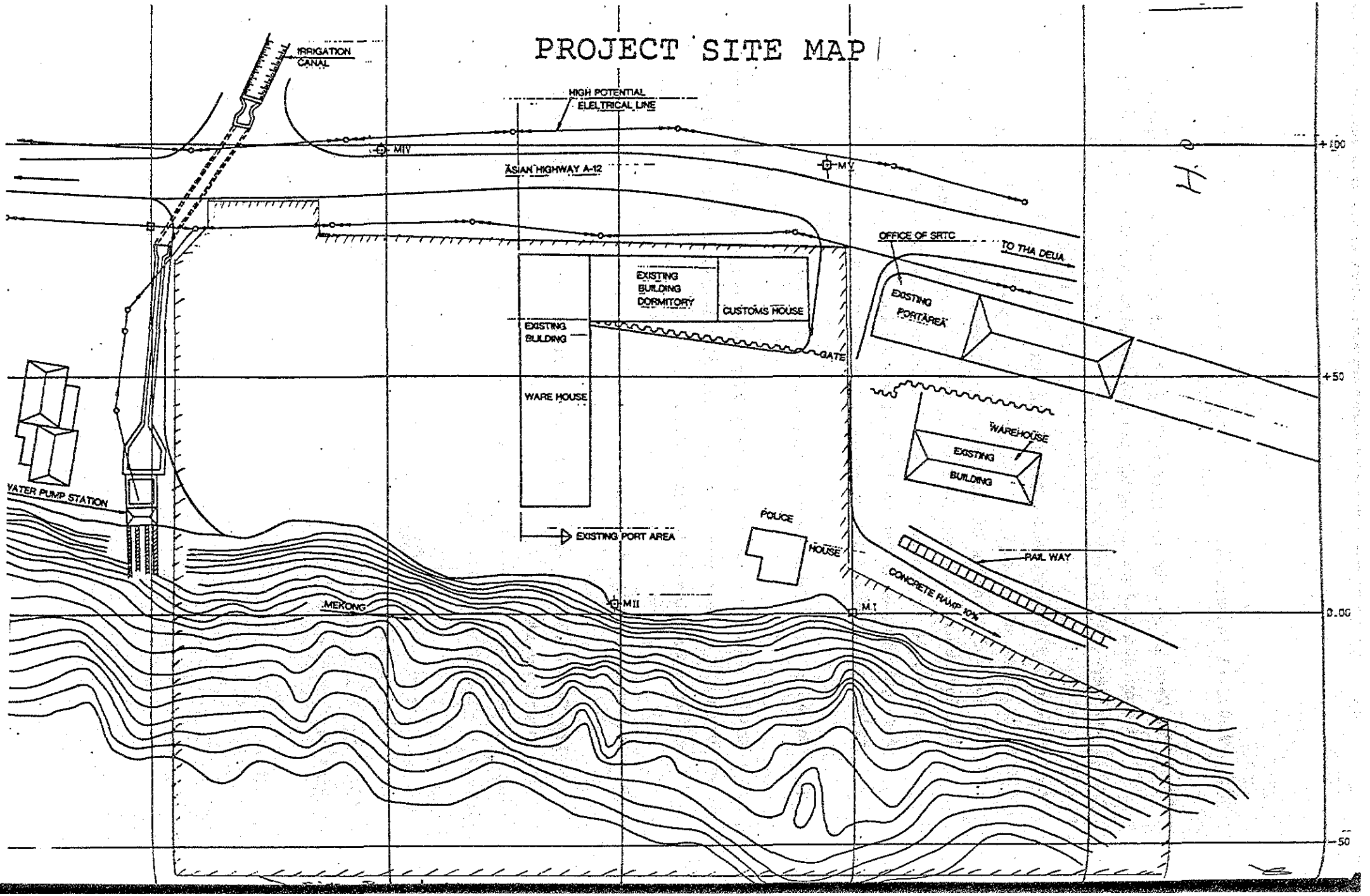
7. Measures to Be Taken by the Government of the LAO PDR

The Government of the LAO PDR will take the necessary measures listed in Annex III on conditions that the Grant Aid program by the Government of Japan is extended to the Project.

8. System of Japan's Grant Aid

The Team explained Japan's Grant Aid System to the LAO PDR side and they understood it.

H. O.


PROJECT SITE MAP
IRRIGATION CANAL
HIGH POTENTIAL ELELTRICAL LINE
MIV
MV
ASIAN HIGHWAY A-12
OFFICE OF SRTC
TO THA DUA
EXISTING BUILDING DORMITORY
CUSTOMS HOUSE
EXISTING BUILDING
GATE
EXISTING PORTAREA
WARE HOUSE
WAREHOUSE EXISTING BUILDING
WATER PUMP STATION
EXISTING PORT AREA
POLICE HOUSE
RAIL WAY
CONCRETE RAMP 10%
MEKONG
MII
MI
+100
+50
0.00
-50

ANNEX II

The major items requested by the Government of the LAO PDR for the Project are as follows :

1) Mooring facility
2) Cargo handling equipment (including mobile crane)
3) Warehouse and Open Storage Area
4) Road inside the port
5) Other facilities such as,
   - port administration office
   - supplying facilities of water, fuel oil, electricity etc.
   - passenger station

H. O.

ANNEX III

Necessary measures to be taken by the Government of the LAO PDR.

1. To secure land necessary for the execution of the Porject and provide enough space for such construction as temporary offices, working area, stockyard and others.

2. To ensure that river area necessary for the construction of the facilities be freely accessible.

3. To provide necessary facilities for construction and port operation such as electricity, water supply, drainage and sewage, telephone and other incidental facilities up to the Project site.

4. To ensure prompt unloading, tax exemption, customs clearance at ports of disembarkation in the LAO PDR and prompt internal transportation, to be paid under the Grant, therein of the products purchased under the Grant.

5. To exempt Japanese nationals from customs duties, international taxes and other fiscal levies which may be imposed in the LAO PDR with respect to the supply of the products and services under the verified contracts.

6. To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the LAO PDR and stay therein for the performance of their work.

7. To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid.

8. To bear all the expenses including the periodical dredging (if necessary), other than those to be borne by the Grant Aid.

9. To vacate all existing buildings inside the Project Site (See ANNEX-I) and clean the site by the start of the Project.

H. O.

MINUTES OF DISCUSSIONS

ON

THE BASIC DESIGN STUDY

OF

THE PROJECT FOR IMPROVING

THE VIENTIANE RIVER PORT (PORT OF LAKSI)

IN

THE LAO PEOPLE'S DEMOCRATIC REPUBLIC

In response to the request of the Government of the Lao People's Democratic Republic (hereinafter referred to as "LAO PDR") for Grant Aid on the Project for improving the Vientiane River Port (Port of Laksi) (hereinafter referred to as "The Project"), the Government of Japan decided to conduct a basic design study on the Project and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the LAO PDR the basic Design study team headed by Dr. Hiroaki OZASA, Director, Design Department, 5th District Port Construction Bureau, Ministry of Transport from September 30 to November 3, 1987.

As a result of the study, JICA prepared a draft report and dispatched a team headed by Dr. Hiroaki OZASA to explain and discuss it from February 2, to February 9,1988.

Both parties had a series of discussions on the report and agreed to recommend their respective Governments that the major points of understandings reached between them, attached herewith, should be examined towards the realization of the Project.

Vientiane, February 5, 1988

H. O.

小笹博昭

Dr. Hiroaki OZASA
Team Leader
Japanese Basic Design Study Team
Japan International
Cooperation Agency (JICA)

Mr. Phetsamone VIRAPHANH
Deputy Director,
Department of Economic Planning
Ministry of Transport and Post

ATTACHMENT

1. The Government of LAO PDR agreed in principle on the basic design proposed in the Draft Final Report with additional request and minor alteration as shown in Annex 1.

2. The LAO PDR side ensured the provision of the necessary budget for the adequate works such as site clearance, etc, for the project execution and the personnel services, maintenance and operation expenses for the new port facilities.

3. Both parties agreed to cooperate for the smooth transportation of construction materials and equipment.

4. The Final Report (10 copies in English) will be submitted to the Government of LAO PDR in April.

H. O.

Annex 1.

1. Additional facilities and equipment requested from the LAO PDR to be included in the Japanese Grant Aid Cooperation are as follows :

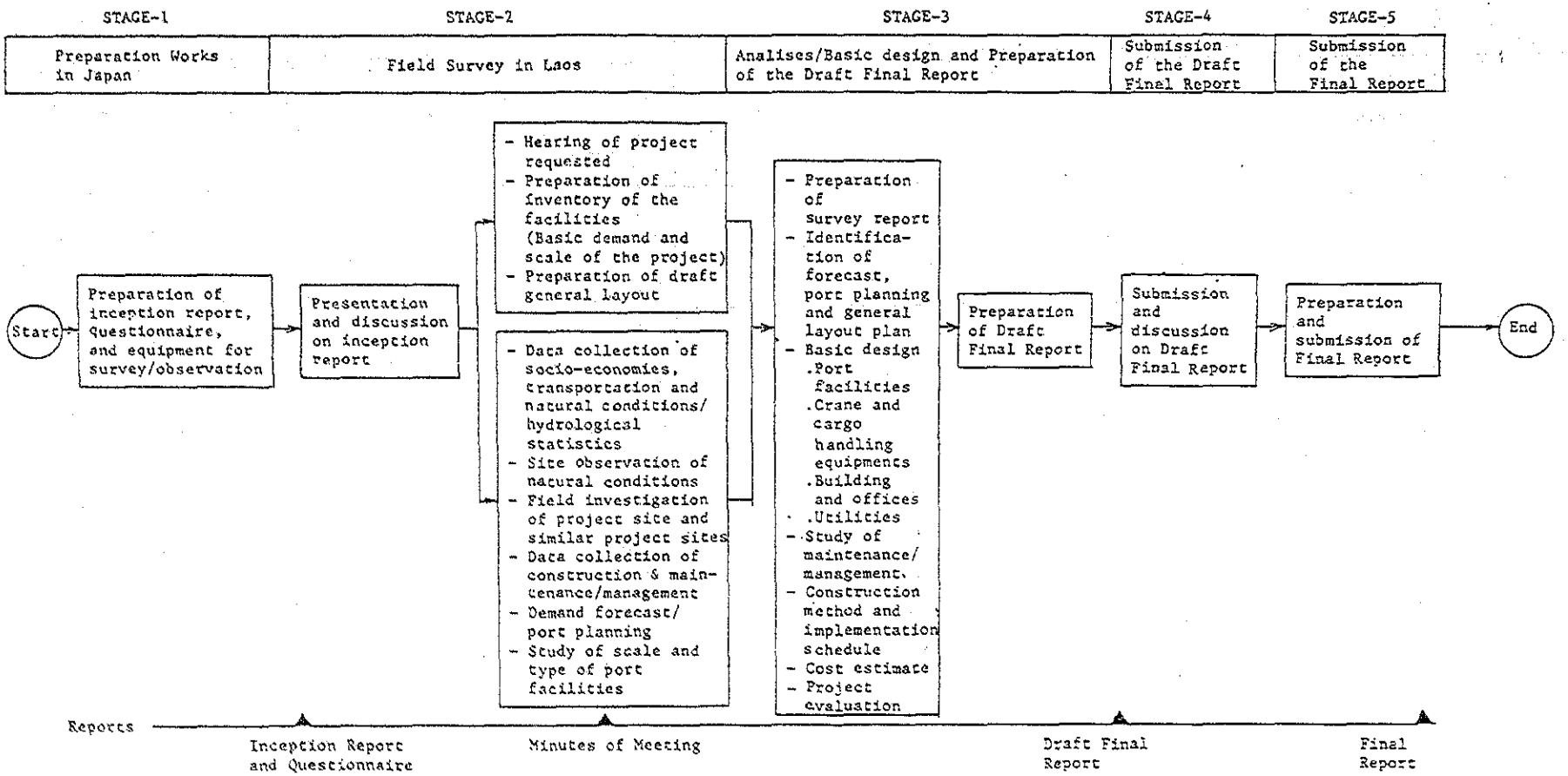
1) Port Control Tower
2) Fire Fighting Facility
3) Trucks for Cargo Transport which are used exclusively inside Laksi Port
4) Inter Communication Telephone
5) Pallet Board and Net for Cargo Handling.

2. Minor alteration requested from the LAO PDR are as follows :

1) To adopt the oil tank by underground type or semi-underground type substituting erected type on the ground considering safety measurement.
2) To use the roof material of administration office by corrugated asbestos sheeting substituting colour aluminum.
3) To examine drainage system in the port area.

H. O.

APPENDIX 5. Flow Chart of Basic Design Study



APPENDIX 6. Basic Design Study Schedule

Year / Month / Work Item in Stage	1987 September	October	November	December	January	February
Stage - 1 Preparation Works in Japan						
Stage - 2 Field Survey in Lao PDR						
Stage - 3 Preparation of the Draft Final Report						
Stage - 4 Submission of the Draft Final Report						
Stage - 5 Preparation and Submission of the Final Report						

Remarks: ——— Preparation ▬▬ Study works in Lao PDR ═══ Study works in Japan

APPENDIX 7. Schedule of the Study Team (1st Time)

DATE (1987)	ACTIVITIES
Sept 30, Wednesday	Team Leader, Dr. Ozasa, Mr. Sunohara, and Mr. Masunaga departed Tokyo for Bangkok and arrived at Bangkok.
Oct 1, Thursday	Held a meeting with Mekong River Committee members.
Oct 2, Friday	Ditto
Oct 3, Saturday	Ditto
Oct 4, Sunday	Confirmed collected data. Preparation work in Japan.
Oct 5, Monday	Messrs. Kawamura, Ohno, Ichihara, and Minami departed Tokyo for Bangkok, and arrived at Bangkok.
Oct 6, Tuesday	Team Leader, Dr. Ozasa, Messrs. Sunohara, Masunaga, Kawamura, Ohno, Ichihara, and Minami departed for Vientiane, and arrived at Vientiane. Visited the Japanese Embassy.
Oct 7, Wednesday	Mr. Ouchi departed Tokyo for Bangkok and arrived at Bangkok. The Study Team paid a courtesy visit upon the Ministry of Foreign Affairs, the National Development Planning Committee, the Ministry of Transport and Post. Made an on-the-spot inspection of the Port of Laksi.
Oct 8, Thursday	The team members, except for Messrs. Ouchi, Yamada, and Minami, arrived at Savannakhet and inspected the Keng Kabao Port. Prepared for field surveys of natural conditions. Mr. Ouchi departed Bangkok for Vientiane, and arrived at Vientiane.
Oct 9, Friday	The team members, except for Messrs. Ouchi, Yamada, and Minami, inspected the Savannakhet Port and moved to Vientiane. Conducted field surveys of natural conditions.

DATE (1987)	ACTIVITIES
Oct 10, Saturday	Held a meeting with counterpart members. Conducted field surveys of natural conditions.
Oct 11, Sunday	Inspected the Nam Ngum Dam and the Tha Deua Port.
Oct 12, Monday	Explained the Inception Report of the Basic Design and the Japanese grant aid system to the LAO PDR officials concerned, and discussed matters concerning the Project. Conducted levelling survey. Mr. Yamada departed Tokyo for Bangkok, and arrived at Bangkok.
Oct 13, Tuesday	Discussed the contents of the Minutes of Discussions on the Project. Conducted levelling survey and prepared for boring tests. Mr. Yamada departed Bangkok for Vientiane, and arrived at Vientiane.
Oct 14, Wednesday	The Minutes of Discussions on the Project was signed. Explained the Minutes of Discussions to the Japanese Embassy. Started No. 1 boring test. Conducted levelling survey.
Oct 15, Thursday	Made data collection and had a meeting with counterpart members. Continued No. 1 boring test and conducted plane-table survey. Team Leader, Dr. Ozasa and Mr. Ouchi departed Veintiane for Bangkok, and arrived Bangkok.
Oct 16, Friday	Continued data collection and No. 1 boring test, and current surveys. Held a meeting with counterpart members. Team Leader, Dr. Ozasa, departed Bangkok for Tokyo, and arrived at Tokyo.
Oct 17, Saturday	Continued data collection, No. 1 boring test, and current surveys. Held a meeting with counterpart members. Mr. Ohno departed Vientiane for Bangkok and arrived at Bangkok.

DATE (1987)	ACTIVITIES
Oct 18, Sunday	Held a meeting among the study team members and classified collected data. Continued No. 1 boring test.
Oct 19, Monday	Finished No. 1 boring test, and started No. 2 boring test. Mr. Ohno departed Bangkok for Tokyo, and arrived at Tokyo. Made a data collection and held a meeting with counterpart members. Moved to Luang Prabang.
Oct 20, Tuesday	Continued No. 2 boring test and conducted levelling survey. Messrs. Sunohara, Masunaga, and Kawamura inspected the Sayabouri Port.
Oct 21, Wednesday	Continued No. 2 boring test and conducted traverse survey. Collected and classified data. Moved from Luang Prabang to Vientiane.
Oct 22, Thursday	Continued No. 2 boring test and traverse survey. Collected and classified data.
Oct 23, Friday	Finished No. 2 boring test. Conducted current survey and data collection. Studied facility arrangement of the Port of Laksi.
Oct 24, Saturday	Conducted sounding survey and data collection. Studied facility arrangement of the Port of Laksi.
Oct 25, Sunday	Held a meeting among Study Team members.
Oct 26, Monday	Conducted sounding survey and data collection. Collected samples of riverbed materials. Reported the field survey results to the Japanese Embassy.

DATE (1987)	ACTIVITIES
Oct 27, Tuesday	Conducted supplemental surveys. Classified and analyzed collected data. Messrs. Sunohara and Masunaga departed Vientiane for Bangkok, and arrived at Bangkok.
Oct 28, Wednesday	Conducted supplemental surveys. Made rough basic design of the Port of Laksi. Messrs. Sunohara and Masunaga departed Bangkok for Tokyo, and arrived at Tokyo.
Oct 29, Thursday	Classified collected data. Continued the basic design study.
Oct 30, Friday	Classified collected data and continued the basic design study.
Oct 31, Saturday	Messrs. Kawamura, Ichihara, and Minami departed Vientiane for Bangkok, and arrived at Bangkok.
Nov 1, Sunday	Held a meeting among the Study Team members and classified collected data.
Nov 2, Monday	Conducted market research concerned with construction materials and also made surveys about related land transportation matters.
Nov 3, Tuesday	Messrs. Kawamura, Ichihara, and Minami departed Bangkok for Tokyo, and arrived at Tokyo.

APPENDIX 8. Schedule of the Study Team (2nd time)

DATE (1988)	ACTIVITIES
Jan 31, Sunday	Team Leader, Dr. Ozasa, Mr. Kawamura, and Mr. Ichihara departed Tokyo for Bangkok and arrived at Bangkok.
Feb 1, Monday	The Study Team visited the Japanese Embassy in Thailand.
Feb 2, Tuesday	The Team members left Bangkok and arrived at Vientiane, and visited the Japanese Embassy in LAO PDR.
Feb 3, Wednesday	The Team members paid a courtesy visit upon the LAO PDR's Ministry of Foreign Affairs, National Development Committee, and Ministry of Transport and Post. Presented and explained the Basic Design Study Report draft to the officials concerned the Government of LAO PDR.
Feb 4, Thursday	Explained the Basic Design Study Report draft to the officials concerned the Ministry of Transport and Post and had a discussions concerned with the contents of the report.
Feb 5, Friday	The Minutes of Discussions on the Project was signed.
Feb 6, Saturday	The Team Leader, Dr. Ozasa left Vientiane and arrived at Bangkok. The Team Members Messrs. Kawamura and Ichihara had a discussions with the officials concerned of the Ministry of Transport and Post.
Feb 7, Sunday	The Team Leader, Dr. Ozasa left Bangkok and arrived at Tokyo. The Team Members Messrs. Kawamura and Ichihara classified obtained data.

DATE (1988)	ACTIVITIES
Feb 8, Monday	The Team Members, Messrs. Kawamura and Ichihara held a meeting with the officials concerned of the Ministry of Transport and Post and discussed about the contents of the report. Explained the results of the Basic Design Study Report draft presentation to the Japanese Embassy in LAO PDR.
Feb 9, Tuesday	The Team Members left Vientiane and arrived at Bangkok.
Feb 10, Wednesday	Left Bangkok and arrived at Tokyo.

APPENDIX 9. List of Interviewed Personnel

(1) LAO PDR's Government Officials Concerned:

Interviewed LAO PDR's Government Officials concerned during the basic design study survey period were as follows:

1) Ministry of Foreign Affairs

Mr. Sombath CHOUNLAMANY
Director

2) State Planning Committee:

Mr. Thongphachanh SONNASINH
Director
External Economic Relations Department

3) Ministry of Transport and Post

Mr. Phao BOUNNAPHONH
Minister

Mr. Thungsavath PRASEVTH
Vice-Minister

Mr. Bouasy LOVANHSAY
Vice-Minister

Mr. Thougsouk SAISANGKHI
Vice-Minister

Mr. Phetsamone VIRAPHANH
Deputy Director
Dept of Economic Planning

Mr. Kanngeun KHAMVONGSA
Chief of Services,
Dept of Economic Planning

Mr. Veth KHAIKHAMPHITHOUNE
Director
River Work Construction Company

Mr. Khamsing LUANGLATH
Project Manager
Laksi Port Project

Mr. Somphong CHOULAMANY
Deputy Director
State River Transport Company

Mr. Channala CHOUNLAMANY
Director
Communication Design and Research Institute

Mr. Khamsay HONGSOUVANH
Civil Engineer
Communication Design and Research Institute

Mr. Boun PHET
Port Engineer
Dept of Communication

Mr. Pothong NGONPHACHANH
Soil Engineer
Communication Design and Research Institute

Mr. Phonemany NHOTTHONGBAY
Port Engineer
River Work Construction Company

Mr. Orady KHANTHISANE
Hydro Technician
River Work Construction Company

Mr. Vilaphonh XAYYAVONG
Civil Engineer
Economic and Planning Department

Mr. Chanthaphone PHANVISOUK
Project Manager
Tha Deua Pak Khone Ports Project

(2) Japanese Embassy in LAO PDR

Mr. Teruo HAYAKAWA
Ambassador

Mr. Teruo KAMIHIGASHI
Minister-Counsellor

Mr. Hiroshi MANABE
First Secretary

(3) Japanese Embassy in Thailand

Mr. Masato KAKAMI
First Secretary

Mr. Nobuyuki SAMEJIMA
First Secretary

Mr. Shigeru ISE
First Secretary

(4) The Mekong River Committee

Dr. -ING Hartmut BRUHL
Senior Advisor for Basin Development

Mr. Somboon SOMABHA
Irrigation Engineer

Mr. Koshiyuki KASAI
Irrigation Engineer

Mr. Takashi KAWAI
Irrigation Engineer

Mr. Samran CHOODUANGNGERN
Agricultural Economist

Mr. Thaipuck THAMMONGKOL
Hydrologist

(5) Counterpart Members

The LAO PDR's counterpart members to the Basic Design Study Team were as follows:

Mr. Phetsamone VIRAPHANH
Leader

Mr. Somphong CHOULAMANY
Port Planning, Operation & Management

Mr. Khamsing LUANGLATH
Port Management and Operation

Mr. Kamsay HONGSOUVANH
Port Design, Survey, Geological Survey

Mr. Boun PHET
River Engineering

Mr. Vilaphonh XAYYAVONG
River Engineer

Mr. Phonemany NHOTTHONGBAY

Mr. Orady KHANTHISANE

Mr. Chanthaphone PHANVISOUK

APPENDIX 10. Data of Natural Conditions

Table A-1 Characteristics of Existing River Ports

No.	Name	Distance from River mouth (km)	Riverbed Slope	River Channel Width	Max. Flood Discharge. (m^3 /s)	Minimum Discharge (m^3 /s)
1	Pak Beng	2330	1:3400			
2	Luang Prabang Ferry	2060	1:3790	550	25,200 (1966)	652 (1956)
3	M. Tha Dua		1:3790			
4	Vientiane	1580	1:10,000	700	2600	701 (1956, 58)
5	Thanaleng Ferry	1560	1:10,000	600		
6	Ban Thamoung Ferry		1:10,000	600		
7	Ban Thadua Ferry		1:10,000	600		
8	Thakhek	1220	1:17,000			
9	Keng Kabao	1160	1:5140			
10	Savannakhet	1120	1:21,300	1,500		
11	Pakse Ferry	860	1:40,000	1,600	57,800 (1978)	1060 (1932.33)

Note: 1) Riverbed slopes were estimated from the recorded water levels in April 1960.

2) River channel widths were obtained from the topographic maps (scale of 1 : 50,000) made in 1970.

Table A-2 Yearly Maximum and Minimum River Stages

(in Vientiane)

Year	maximum		minimum		max.−min. (m)
	Stage (MSL m)	month occured	Stage (MSL m)	month occured	
1960	169.40	Aug	157.76	Apr	11.24
1961	169.26	Sep	158.20	Mar	10.10
1962	168.40	Aug	158.16	Mar	10.24
1963	168.51	Aug	157.92	Apr	10.59
1964	169.10	Aug	158.32	Mar	10.78
1965	167.27	Oct	158.20	Apr	9.07
1966	170.75	Sep	158.30	Apr	12.45
1976	169.31	Aug	158.57	Mar	10.74
1977	167.94	Aug	158.72	Mar	9.22
1978	170.12	Aug	158.42	Apr	11.70
1979	168.24	Sep	158.27	Apr	9.97
1980	169.94	Sep	158.58	Mar	11.36
1981	168.76	Aug	158.69	Mar	10.07
1982	168.78	Aug	158.62	Mar	10.16
1983	168.01	Aug	158.67	Apr	9.34
1984	167.46	Sep	158.44	Apr	9.02

Source: . River Stage and Longitudinal Profile (1960-1966), LAO PDR

. Statistic Book, LAO PDR

Table A-3 Low Water Stage of the Mekong River and Occurrence Probability

(Recorded at Wat Sop Gauging Station)

In Order of Year		In Order of Magnitude	
Year	Stage (m)	Year	Stage (m)
1960	157.760	1960	157.760
1961	158.200	1963	157.920
1962	158.160	1962	158.160
1963	157.920	1961	158.200
1964	158.320	1965	158.200
1965	158.200	1978	158.270
1966	158.300	1966	158.300
1976	158.570	1964	158.320
1977	158.720	1976	158.420
1978	158.420	1984	158.440
1979	158.270	1979	158.570
1980	158.580	1980	158.580
1981	158.690	1982	158.620
1982	158.620	1983	158.670
1983	158.670	1981	158.690
1984	158.440	1977	158.720

Low Water Recurrence Year	Stage & Year Stage (m)
2	158.36
5	158.13
10	158.01
20	157.91
30	157.85
40	157.82
50	157.79
60	157.74
100	157.72
200	157.65
500	157.57

Table A-4 Daily River Stages in Each Month for 62 Years (from 1923 to 1984) in Vientiane

1) Daily Highest Stage in Each Month (MSL m)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MAX	161.59	160.44	159.94	160.36	164.37	165.73	169.14	170.70	170.74	168.58	167.14	163.88
MIN	160.15	159.80	159.57	159.44	160.37	162.92	166.54	168.73	167.93	164.94	162.94	160.8
AVE	160.62	160.03	159.73	159.69	162.15	164.32	168.02	170.15	169.59	167.34	165.17	162.4

2) Daily Lowest Stage in Each Month (MSL m)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MAX	159.14	158.56	158.27	157.93	158.59	160.11	162.18	164.49	164.45	163.67	160.93	159.75
MIN	158.58	158.18	157.88	157.76	157.79	158.53	159.77	161.95	162.92	160.94	159.83	158.25
AVE	158.82	158.38	158.08	157.84	158.04	159.36	160.73	163.58	163.79	162.16	160.57	159.29

3) Daily Average Stage in Each Month (MSL m)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MAX	159.98	159.37	158.98	159.02	160.13	162.52	165.89	167.43	167.11	165.55	163.02	161.1
MIN	159.38	159.00	158.73	158.73	159.01	160.17	162.71	166.07	165.61	163.04	161.19	160.0
AVE	159.68	159.17	158.83	158.85	159.45	161.43	164.16	167.00	166.50	164.19	162.04	160.5

Fig. A-1 DAILY WATER STAGE IN METERS AT VIENTIANE

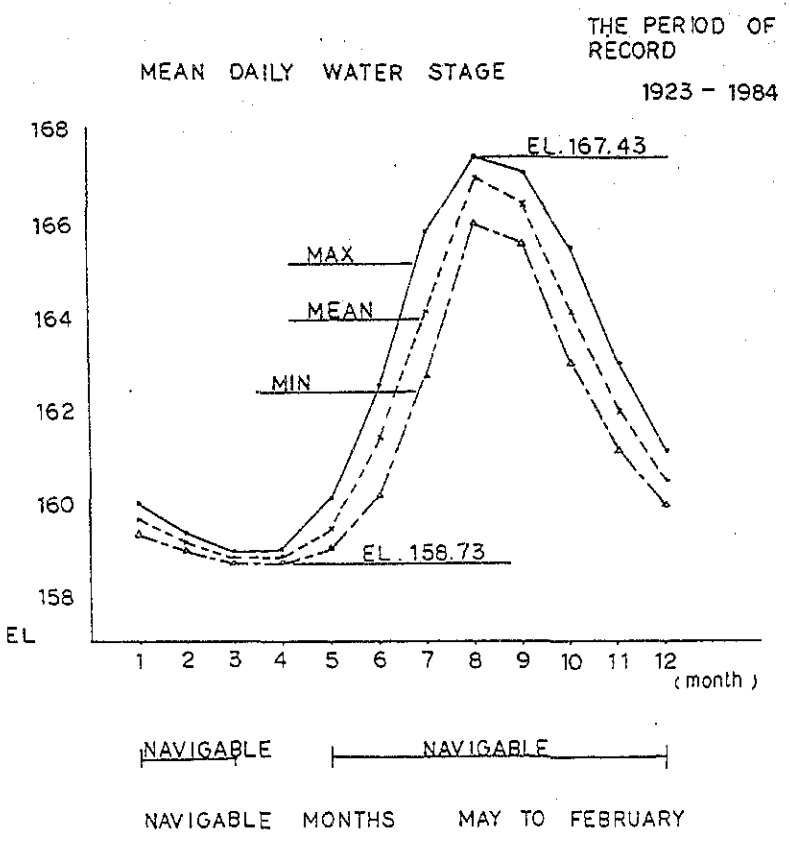


Fig. A-2 DAILY WATER STAGE IN METERS AT VIENTIANE

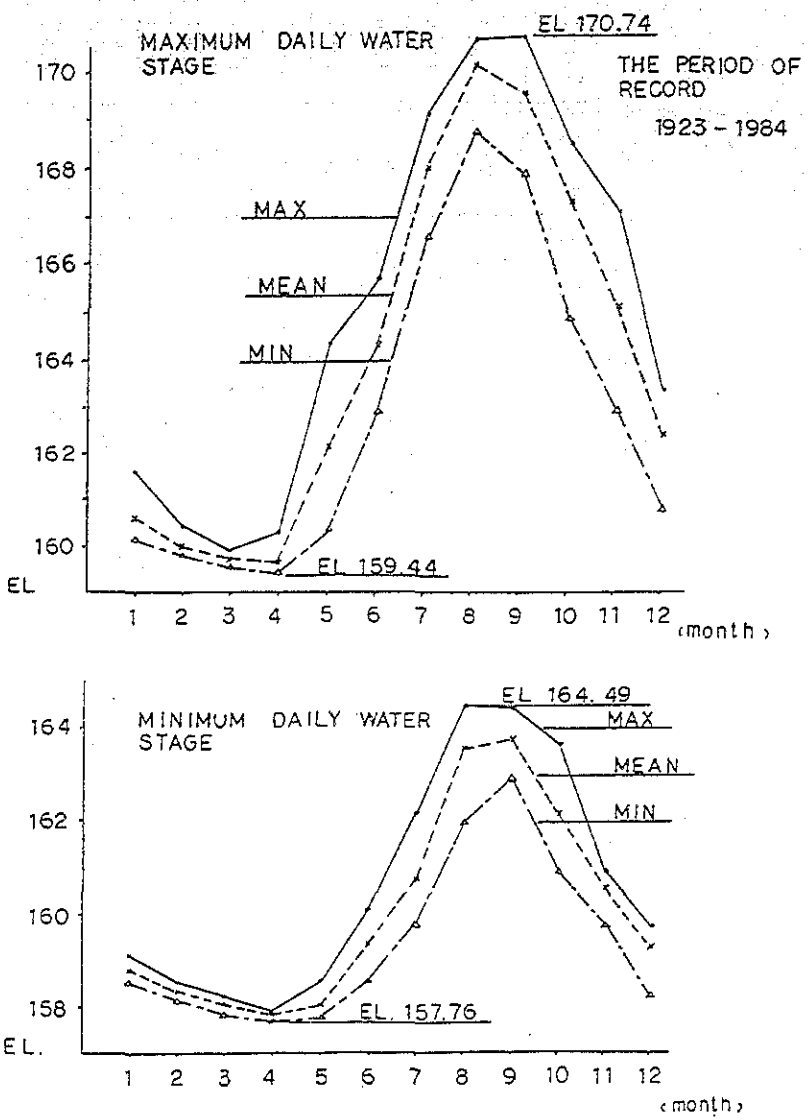


Table A-5 Climatological Data at the Vientiane Weather Station

Year	Temperatare (℃)			Sunshine (hrs/year)	Humidity (%)		Rainfall (hrs/year)
	mean	min.	max.		min.	max.	
1976	25.6	21.7	30.6	2559.4	51	90	1614.9
1977	26.0	22.1	31.2	1693.0	49	92	1144.2
1978	26.0	22.2	30.0	1985.0	53	92	1986.7
1979	26.3	22.1	31.8	2621.7	49	91	1301.1
1980	26.4	22.4	31.5	2334.6	52	89	2291.4
1981	26.1	22.3	31.1	2255.5	52	90	1921.8
1982	26.2	22.4	31.2	2298.4	51	92	1641.5
1983	26.0	22.0	31.2	2505.1	54	92	1368.5
1984	26.3	22.0	31.0	2513.1	53	91	1636.8
Average	26.1	22.1	31.1		51.6	91.0	1656.3

Source: LAO PDR

Table A-6 Wind Direction and Wind Velocity

Wind Direction and Average Wind Velocity Dir: Wind Direction; Ff: Average Wind Velocity During 24 Hrs (m/sec)

HONTH	JAN.		FEB.		MAR.		APR.		MAY		JUN		JULY		AUG.		SEPT.		OCT.		NON.		DEC.	
YEAR	Dir	Ff	Dir	Ff	Dir	Ff	Dir	Ff	Dir	Ff	Dir	Ff	Dir	Ff	Dir	Ff	Dir	Ff	Dir	Ff	Dir	Ff	Dir	Ff
1981	N	1.4	E	1.5	N	1.5	N	1.6	S	1.8	S	1.6	S	1.9	W	1.8	N	1.5	N	1.8	N	1.8	N	1.9
82	N	1.3	N	1.7	NW	1.6	N	1.7	S	1.8	N	1.7	N	2.0	S	1.8	N	2.0	N	1.5	N	1.6	N	1.8
83	N	1.7	N	1.3	N	2.0	E	1.4	N/S	2.5	S	2.0	N	1.8	N	1.4	S	1.5	E	1.7	NE	1.6	E	1.6
84	S	1.8	E	2.2	E	1.8	N	2.2	E	2.3	S	2.8	E	2.3	S	2.5	N	1.7	NE	1.6	N	1.7	S	1.5
85	E	1.6	E	1.8	E	2.1	E	2.4	E	1.7	S	1.8	S	1.9	S	2.4	E	1.7	NE	1.8	N	1.3	E	1.5
86	E	1.5	E	1.9	E	1.7	N	2.2	var	2.2	S	2.1	S	2.0	N	2.2	N	1.9	N	1.8	E	1.7	E	1.3

Maximum Wind Velocity and its Direction During 24 Hrs (m/sec)

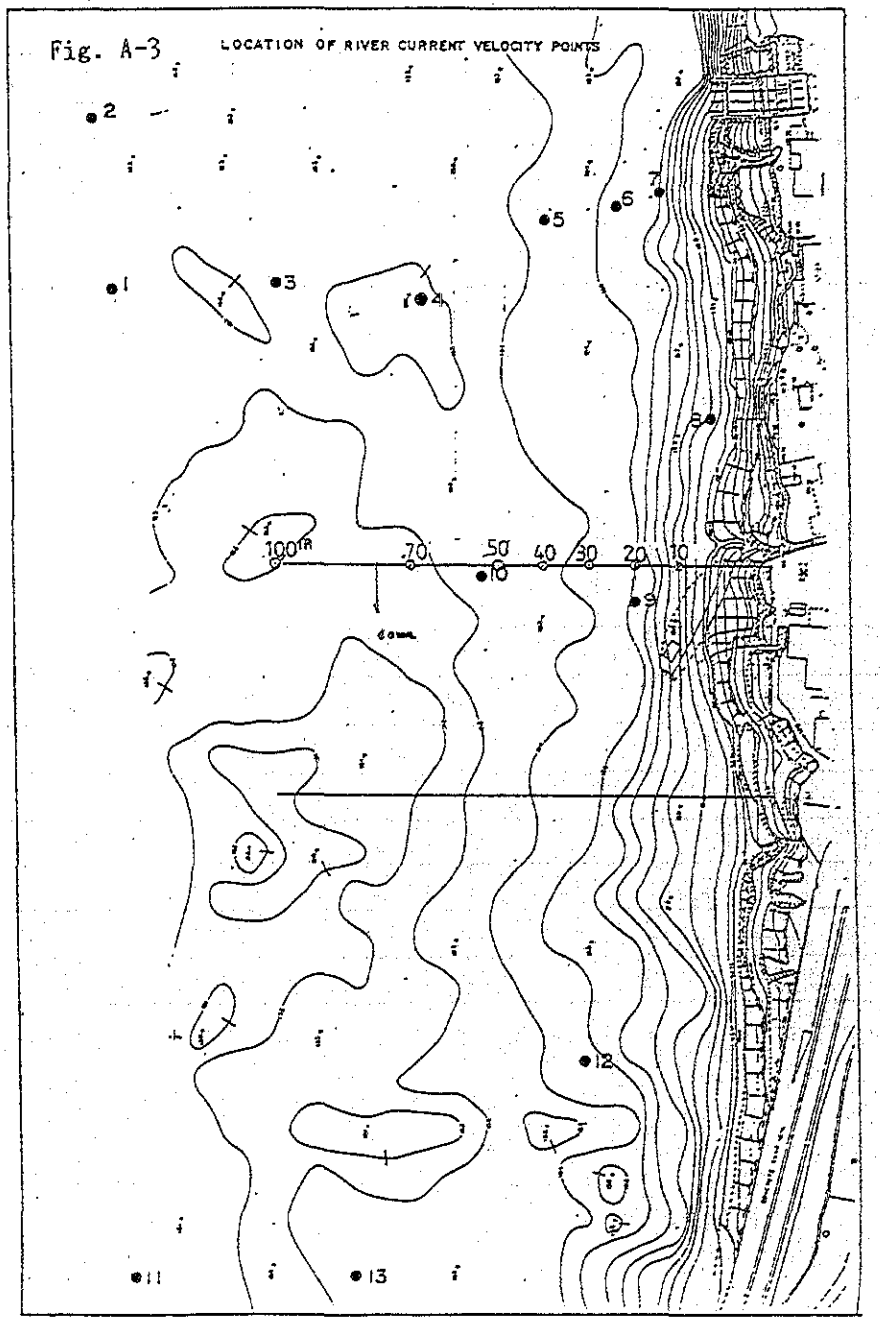
1981	E	5	W	5	W	29	W	33	N	21	W	14	N	8	S	10	NW	10	N	10	N	9	N	6
82	NNW	6	E	6	NW	10	SW	12	W	15	S	15	S	10	SSE	10	NE	19	N	7	E	6	NE	8
83	SE	6	N	6	NE	8	W	15	E	37	W	10	SW	8	N	6	S	19	E	10	NE	5	ENE	7
84	E	7	N	8	WNW	20	SW	15	SSW	20	NW	15	SW	25	ESE	14	NW	25	N	15	N	15	N	10
85	E	10	W	35	E	15	E	25	SW	20	SSW	12	SSE	30	S	15	W	10	E	11	SE	10	ENE	12
86	E	10	W	20	E	10	NW	30	SW	30	SW	30	W	9	E	13	N	20	N	5	N	10	E	10

Measurement of River Current Velocity

pint \ depth (m)	0.5	2.5	3.0	5.0	7.0	8.0	10.0	8+1
1	1.60			1.60		1.50		
2	1.85			1.75		1.85		
3	1.93			1.95		1.90		
4	1.85			1.80		1.80		
5	1.35			1.35		1.40		
6	0.80		0.90	0.70				(6.2) 0.65
7	0.18	0.20						(4.5) 0.25
8	0.17	(1.5) 0.10						
9	0.70			0.55	0.40			0.52
10	1.85			1.80			1.85	
11	1.85			1.80			1.60	
12	0.60			0.85	0.50			
13	1.65			1.60			1.80	(12.0) 1.75

(depth)..... m
velocity ..... m/s

Fig. A-3 LOCATION OF RIVER CURRENT VELOCITY POINTS



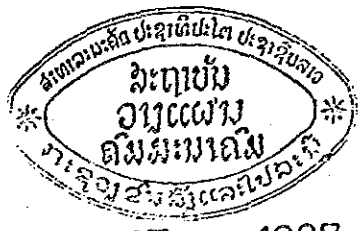
MINISTRY OF TRANSPORT AND POST

COMMUNICATION DESIGN AND RESEARCH INSTITUTE

REPORT TEST RESULTS

PROJECT : IMPROVING THE VIENTIANE RIVER PORT (LAKSI)

BORING Nº 1



OCT . 1987

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Ministry of Transport
and Post
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REPORT TEST RESULTS

Project : IMPROVING THE VIENTIANE RIVER PORT (LAXSI)
Boring Number : 1 Sample Number 1 Depth: 1.70 - 2.00 m
Lab. Number : 098/87
Type of Material: Brown Clayey Soils
Test Begun on : 16/10/87 Completed on : 21/10/87

TEST RESULTS

(A) ATTERBERG LIMIT:
-Liquid Limit (L.L) 29.1 %
-Plastic Limit (P.L) 17.4 %
-Plasticity Index (P.I) 11.7 %
(B) SIEVE ANALYSIS:
-Sieve Size mm: 19.7 : 12.7 : 9.52 : 4.76 : 2.00 : 0.42 : 0.149
- % Passing : 100 : 99.2 : 99.2 : 96.4 : 92.6 : 86.8 : 83.8
-Sieve Size mm: 0.074
-% Passing : 81.3
(C) CLASSIFICATION (AASHO DESIGNATION: M 145-66) A-6 (8)
(D) SPECIFIC GRAVITY OF SOILS:
- Temperature at 30°C 2.74 g/cm^3
(E) MOISTURE CONTENT:
-Water Content (Natural) 20.39 %
(F) UNIT WEIGHT:
-Wet Density 2.05 g/cm^3
-Dry Density 1.70 g/cm^3
(G) DEGREE OF SATURATION,S 91.83 %
(H) VOID RATIO,e 0.61

Chief Eng.
Adj:
P. [illegible]
Seuk Soukaseum.

Vientiane 21 October 1987
Material-Laboratory Chief

Kingkham Ratthalangsy.

-147-

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Ministry of Transport
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REPORT TEST RESULTS

Project : Improving the Vientiane River Port (LAXSI)
Boring Number : 1 Sample Number : 2 Depth : 3.70 - 4.00 m
Lab. Number : 098/87
Type of Material : Brown Clayey Soils
Test Begun on : 16/10/87 Completed on : 21/10/87

TEST RESULTS

(A) ATTERBERG LIMIT:
-Liquid Limit (L.L) 30.3 %
-Plastic Limit (P.L) 18.9 %
-Plasticity Index (P.I) 11.4 %
(B) SIEVE ANALYSIS:
-Sieve Size mm: 2.00 : 0.42 : 0.149 : 0.074
- % Passing : 100 : 97.5 : 96.4 : 94.8
(C) CLASSIFICATION (AASHO DESIGNATION: M 145-66) A-6 (10)
(D) SPECIFIC GRAVITY OF SOILS:
- Temperature at 30°C 2.70 g/cm^3
(E) MOISTURE CONTENT:
-Water Content (Natural) 18.57 %
(F) UNIT WEIGHT:
-Wet Density 2.10 g/cm^3
-Dry Density 1.77 g/cm^3
(G) DEGREE OF SATURATION,S 95.11 %
(H) VOID RATIO,e 0.53

Chief Eng.
Adj.
P. [illegible]
Seuk Soukaseum.

Vientiane 21 October 1987
Material-Laboratory Chief

Kingkham Ratthalangsy.

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REPORT TEST RESULTS

Project : Improving the Vientiane River Port (LAXSI)
Boring Number : 1 Sample Number : 3 Depth: 5.70 - 6.00 m
Lab. Number : 098/87
Type of Material: Brown Silty Soils
Test Begun on : 16/10/87 Completed on : 21/10/87

TEST RESULTS

(A) ATTERBERG LIMIT:

-Liquid Limit	(L.L)	23.6 %
-Plastic Limit	(P.L)	17.1 %
-Plasticity Index	(P.I)	6.5 %

(B) SIEVE ANALYSIS:

-Sieve Size mm: 19.1 : 12.7 : 9.52 : 4.76 : 2.00 : 0.42 : 0.149
-% Passing : 100 : 99.0 : 98.5 : 95.2 : 93.3 : 92.5 : 82.5
-Sieve Size mm: 0.074
-% Passing : 65.3

(C) CLASSIFICATION (AASHO DESIGNATION: M 145-66) A-4 (3)

(D) SPECIFIC GRAVITY OF SOILS:

-Temperature at 29°C 2.66 g/cm^3

(E) MOISTURE CONTENT:

-Water Content (Natural) 22.65 %

(F) UNIT WEIGHT:

-Wet Density 2.07 g/cm^3
-Dry Density 1.69 g/cm^3

(G) DEGREE OF SATURATION,S 104.29 %

(H) VOID RATIO,e 0.58

Chief Eng.
Adj.
Sauk Saukaeum.

Vientiane 21 October 1987
Material-Laboratory Chief
Kingkham Ratthalangsy.

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REPORT TEST RESULTS

Project : Improving the Vientiane River Port (LAXSI)
Boring Number : 1 Sample Number : 4 Depth: 7.70 - 8.00 m
Lab. Number : 098/87
Type of Material : Brown Silty Soils
Test Begun on : 16/10/87 Completed on : 21/10/87

TEST RESULTS

(A) ATTERBERG LIMIT:

-Liquid Limit	(L.L)	23.8 %
-Plastic Limit	(P.L)	18.5 %
-Plasticity Index	(P.I)	5.3 %

(B) SIEVE ANALYSIS:

-Sieve Size mm: 9.52 : 4.76 : 2.00 : 0.42 : 0.149 : 0.074
-% Passing : 100 : 99.9 : 99.7 : 99.5 : 98.6 : 79.8

(C) CLASSIFICATION(DESIGNATION: M 145-66) .. A-4 (5)

(D) SPECIFIC GRAVITY OF SOILS:

- Temperature at 30°C 2.70 g/cm^3

(E) MOISTURE CONTENT:

-Water Content (Natural) 27.65 %

(F) UNIT WEIGHT:

-Wet Density 2.04 g/cm^3
-Dry Density 1.60 g/cm^3

(G) DEGREE OF SATURATION,S 107.79 %

(H) VOID RATIO,e 6.69

Chief. Eng.
Sauk Saukaeum.

Vientiane 21 October 1987
Material-Laboratory Chief
Kingkham Ratthalangsy.

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REPORT TEST RESULTS

Project : Improving the Vientiane River Port (LAXSI)
Boring Number : 1 Sample Number : 5 Depth: 9.20-9.50 m
Lab. Number : 098/87
Type of Material : Brown Silty Soils
Test Begun on : 16/10/87 Completed on : 21/10/87

TEST RESULTS

(A)	ATTERBERG LIMIT:		
	-Liquid Limit	§L.L)	23.8 %
	-Plastic Limit	(P.L)	16.3 %
	-Plasticity Index	(P.I)	7.5 %
(B)	SIEVE ANALYSIS;		
	-Sieve Size mm: 9.52 : 4.76 : 2.00 : 0.42 : 0.149 : 0.074		
	- % Passing : 100 : 99.6 : 98.5 : 97.5 : 96.6 : 77.5		
(C)	CLASSIFICATION (AASSHO DESIGNATION: M 145-66)		A-4 (5)
(D)	SPECIFIC GRAVITY OF SOILS:		
	- Temperature	at 30°C	2.70 g/cm^3
(E)	MOISTURE CONTENT:		
	-Water Content (Natural)		23.91 %
(F)	UNIT WEIGHT:		
	-Wet Density		2.05 g/cm^3
	-Dry Density		1.65 g/cm^3
(G)	DEGREE OF SATURATION,S		102.27 %
(H)	VOID RATIO,e		0.63

Chief Eng.
Adj.
Souk Soukseum.

Vientiane 21 October 1987
Material-Laboratory Chief

Kingkham Ratthalangsy

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REPORT TEST RESULTS

Project : Improving the Vientiane River Port (LAXSI)
Boring Number : 1 Sample Number : 6 Depth: 11.70-12.00 m
Lab. Number : 098/87
Type of Material : Blacksh Silty Soils
Test Begun on : 16/10/87 Completed on : 21/10/87

TEST RESULTS

(A)	ATTERBERG LIMIT:		
	-Liquid Limit	(L.L)	26.9 %
	-Plastic Limit	(P.L)	19.3 %
	-Plasticity Index	(P.I)	7.6 %
(B)	SIEVE ANALYSIS:		
	-Sieve Size mm: 9.52 : 4.76 : 2.00 : 0.42 : 0.149 : 0.074		
	- % Passing : 100 : 99.6 : 99.0 : 98.8 : 98.5 : 97.4		
(C)	CLASSIFICATION (AASHO DESIGNATION: M 145-66)		A-4 (8)
(D)	SPECIFIC GRAVITY OF SOILS:		
	- Temperature	at 30°C	2.72 g/cm^3
(E)	MOISTURE CONTENT:		
	-Water Content (Natural)		30.44 %
(F)	UNIT WEIGHT:		
	-Wet Density		1.95 g/cm^3
	-Dry Density		1.49 g/cm^3
(G)	DEGREE OF SATURATION,S		101.4 %
(H)	VOID RATIO,e		0.82

Chief Eng.
Adj.
Souk Soukseum.

Vientiane 21 October 1987
Material-Laboratory Chief

Kingkham Ratthalangsy.

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REPORT TEST RESULTS

Project: Improving the Vientiane River Port (LAXSI)
Boring Number : 1 Sample Number : 7 Depth: 13.70 - 14.00 m
Lab. Number : 098/87
Type of Material : Silty Soils
Test Begun on : 16/10/87 Completed on : 21/10/87

TEST RESULTS

(A) ATTERBERG LIMIT:		
-Liquid Limit	(L.L)	27.20 %
-Plastic Limit	(P.L)	19.30 %
-Plasticity Index	(P.I)	7.90
(B) SIEVE ANALYSIS:		
-Sieve Size mm: 4.76 : 2.00 : 0.42 : 0.149 : 0.074		
- % Passing : 100 : 99.9 : 99.8 : 99.7 : 90.5		
(C) CLASSIFICATION (AASHO DESIGNATION: M 145-66)		A-4 (7)
(D) SPECIFIC GRAVITY OF SOILS:		
Temperature	at 30°C	2.78 g/cm^3
(E) MOISTURE CONTENT:		
- Water Content (Natural)		30.14 %
(F) UNIT WEIGHT:		
-Wet Density		1.93 g/cm^3
-Dry Density		1.48 g/cm^3
(G) DEGREE OF SATURATION,S		95.76 %
(H) VOID RATIO,e		0.87

Chief Eng.
Adj. Lt. Col.
Seuk Soukasenm.

Vientiane 21 October 1987
Material-Laboratory Chief

Kingkham Ratthalangsy.

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REPORT TEST RESULTS

Project : Improving the Vientiane River Port (LAXSI)
Boring Number : 1 Sample Number : 8 Depth: 16.20-16.50 m
Lab. Number : 098/87
Type of Material : Silty Soils
Test Begun on : 16/10/87 Completed on : 21/10/87

TEST RESULTS

(A) ATTERBERG LIMIT:		
-Liquid Limit	(L.L)	27.5 %
-Plastic Limit	(P.L)	21.0 %
-Plasticity Index	(P.I)	6.5 %
(B) SIEVE ANALYSIS:		
-Sieve Size mm: 4.76 : 2.00 : 0.42 : 0.149 : 0.074		
- % Passing : 100 : 99.9 : 99.9 : 99.8 : 92.3		
(C) CLASSIFICATION (AASHO DESIGNATION: M 145-66)		A-4 (5)
(D) SPECIFIC GRAVITY OF SOILS:		
- Temperature	at 30°C	2.74 g/cm^3
(E) MOISTURE CONTENT:		
- Water Content (Natural)		25.68 g/cm^3
(F) UNIT WEIGHT:		
-Wet Density		2.03 g/cm^3
-Dry Density		1.61 g/cm^3
(G) DEGREE OF SATURATION,S		100.72 %
(H) VOID RATIO,e		0.70

Chief Eng.
Adj.
Lt. Col.
Seuk Soukasenm.

Vientiane 21 October 1987
Material. Laboratory Chief

Kingkham Ratthalangsy.

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REPORT TEST RESULTS

Project: Improving the Vientiane River Port (LAXSI)
Boring Number : 1 Sample Number : 9 Depth: 18.20 - 18.50 m
Lab. Number : 098/87
Type of Material : Sandy Gravel
Test Begun on : 16/10/87 Completed on : 21/10/87

TEST RESULTS

(A) ATTERBERG LIMIT:
-Liquid Limit (L.L) 0
-Plastic Limit (P.L) 0
-Plastic Index (P.I) 0

(B) SIEVE ANALYSIS:
-Sieve Size mm: 38.1 : 25.4 : 19.1 : 12.7 : 9.52 : 4.76 : 2.00
-% Passing : 100 : 94.4 : 92.0 : 87.8 : 83.6 : 73.4 : 71.19
-Sieve Size mm: 0.42 : 0.149: 0.074
-% Passing : 62.3 : 30.2 : 27.7

(C) CLASSIFICATION (AASHO DESIGNATION: M 145-66) A-2 (0)

(D) SPECIFIC GRAVITY OF AGGREGATE:
- Temperature at 29°C < 2mm 2.69g/cm^3
> 2mm 2.55g/cm^3
- Absorption 1.401 %

Chief Eng.
Adj.
Seuk Soukaseum.

Vientiane 21 October 1987
Material-Laboratory Chief
Kingkham Ratthalangsy.

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REPORT TEST RESULTS

Project : Improving the Vientiane River Port (LAXSI)
Boring Number : 1 Sample Number : 10 Depth: 19.00-19.10 m
Lab. Number : 098/87
Type Material : Clayey Soils (Hard Clay)
Test Begun on : 16/10/87 Completed on : 21/10/87

TEST RESULTS

(A) ATTERBERG LIMIT:
-Liquid Limit (L.L) 45.4 %
-Plastic Limit (P.L) 26.7 %
-Plasticity Index (P.I) 18.7 %

(B) SIEVE ANALYSIS:
-Sieve Size mm: 0.149 : 0.074
-% Passing : 100 : 99.9

(C) CLASSIFICATION (AASHO DESIGNATION: M 145-66) A-7 (21)

(D) SPECIFIC GRAVITY OF SOILS:
-Temperature at 31°C 2.77 g/cm^3

(E) MOISTURE CONTENT:
-Water Content(Natural) 20.25 %

(F) UNIT WEIGHT:
-Wet Density 2.08 g/cm^3
-Dry Density 1.73 g/cm^3

(G) DEGREE OF SATURATION,S 93.94 %

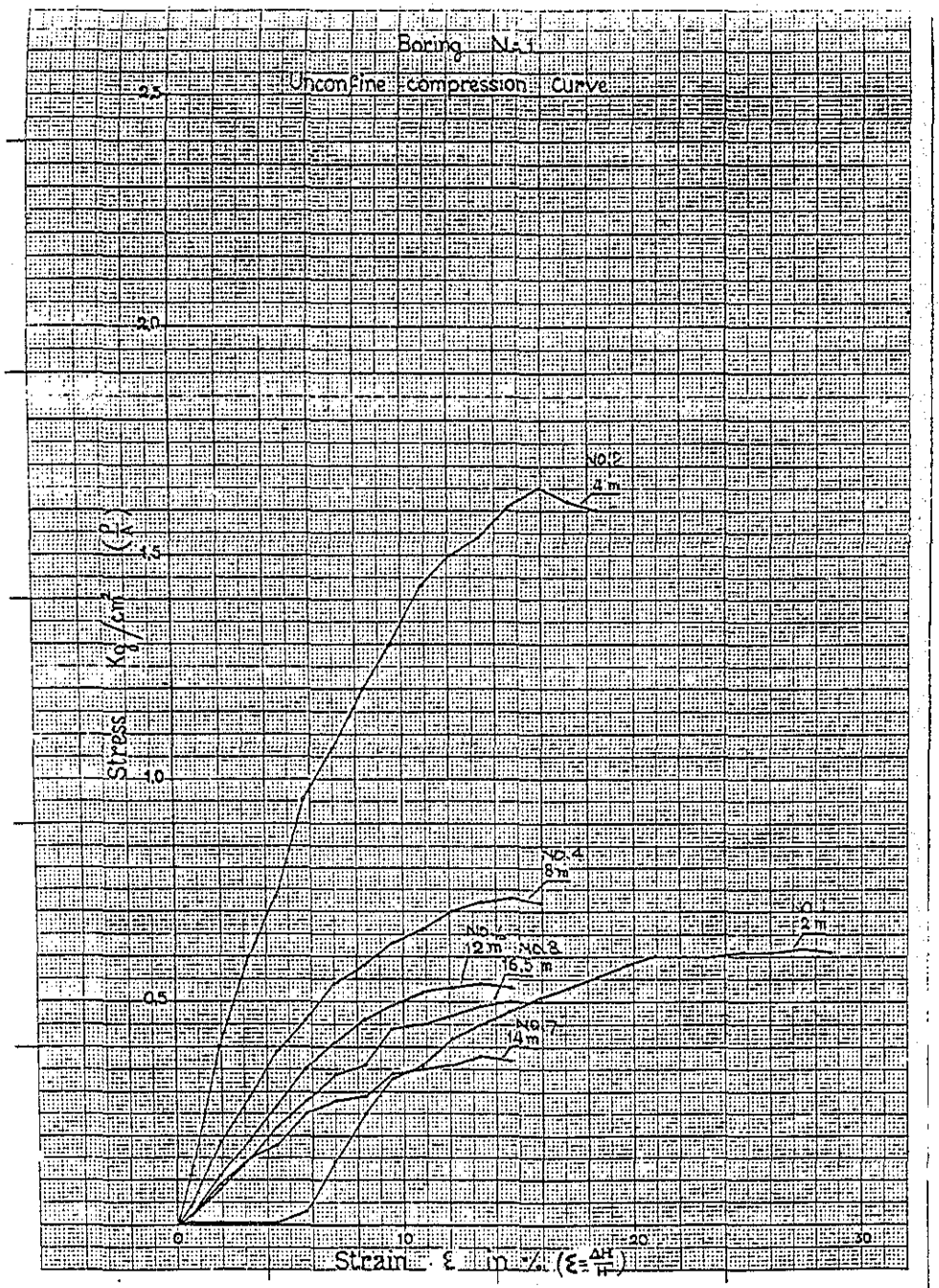
(H) VOID RATIO,e 0.60

Chief Eng.
Adj.

Seuk SOUKASEUM.

Vientiane 21 October 1987
Material-Laboratory Chief

Kingkham RATTHALANGSY



Project : Improving the Vientiane River Port (LAOS)
Description of Sample : Brown Clayey Soild
Boring No. 1 Sample No. 1 Tested by Khamkone
Specific Gravity, G 2.74 Sample Depth 1.70-2.00 Date 16/10/87

1. WT. Wet Soils+Type	304.28 g	305.16 g	g
2. WT. Type	118.82 g	118.82 g	g
3. WTD Wet Soils	185.46 g	186.34 g	g
4. Diameter of Specimen	3.8 cm	3.8 cm	cm
5. Height of Sample	3.15" 8.0 cm	8.0 cm	cm
6. Area Ao	11.32 cm²		
7. Volumne of Sample	90.64 cm³		
8. Unit Weight	Wet Density 2.05 g/cm³	Dry Density 1.79 g/cm³	

Water Content

9. Wet Wt. Soils+can	84.49 g	81.47 g	g
10. Dry Wt. Soils+can	74.06 g	71.95 g	g
11. Wt. Can	22.30 g	21.10 g	g
12. Wt. of Water	10.43 g	10.32 g	g
13. Wt. Dry soils	51.76 g	49.99 g	g
14. Moisture Content	20.15 %	20.64 %	%
	Average = 20.39 %		

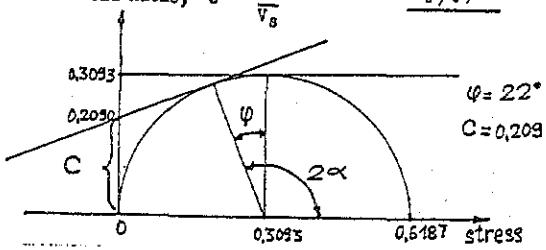
Elapsed Time min	Vertical Dial ΔH 0.001"	Strain ε=ΔH/H	1-ε	Corrected A = Ao/(1-ε)	Load Dial in 0.0001"	Axial Load P Kg	Stress P/A Kg/cm²	τ
15"	0.020	0.002524	0.997475	11.40	.00005	0.056	0.0049	
75"	0.060	0.007575	0.992424	11.55	.00005	0.056	0.0048	
2'05"	0.100	0.012625	0.987374	11.70	.00005	0.056	0.0047	
2'55"	0.140	0.017676	0.982324	11.86	.00005	0.056	0.0047	
3'45"	0.180	0.022726	0.977274	12.02	.0003	0.340	0.0283	
4'35"	0.220	0.027776	0.972224	12.18	.0012	1.700	0.1396	
5'25"	0.260	0.032826	0.967174	12.35	.0021	2.961	0.2479	
6'15"	0.300	0.037876	0.962124	12.52	.0028	4.082	0.3260	
7'05"	0.340	0.042926	0.957074	12.70	.0033	4.647	0.3659	
7'55"	0.380	0.047976	0.952024	12.89	.0038	5.403	0.4191	
8'45"	0.420	0.053026	0.946974	13.07	.0042	5.896	0.4511	
9'35"	0.460	0.058076	0.941924	13.27	.0045	6.250	0.4709	
10'25"	0.500	0.063126	0.936874	13.47	.0049	6.817	0.5125	
11'15"	0.540	0.068176	0.931824	13.67	.0052	7.312	0.5349	
12'05"	0.580	0.073226	0.926774	13.87	.0054	7.711	0.5561	
12'55"	0.620	0.078276	0.921724	14.11	.0058	8.165	0.5787	
13'45"	0.660	0.083326	0.916674	14.33	.0060	8.618	0.6014	
14'35"	0.700	0.088376	0.911624	14.56	.0061	8.732	0.6000	
15'25"	0.740	0.093426	0.906574	14.81	.0063	8.858	0.6044	
16'15"	0.780	0.098476	0.901524	15.06	.0065	9.240	0.6135	
17'05"	0.820	0.103526	0.896474	15.32	.0066	9.412	0.6144	
17'55"	0.860	0.108576	0.891424	15.58	.0068	9.699	0.6187	
18'49"	0.900	0.113626	0.886374	15.86	.0069	9.850	0.6209	

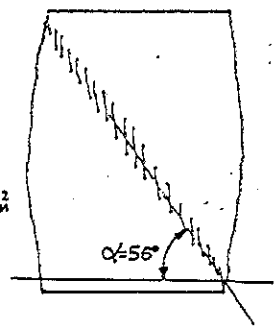
Volume of Solids, $V_s = \frac{W_s}{G}$ = 56.35 cm³

Volume of Voids, $V_v = V - V_s$ = 34.29 cm³

Degree of Saturation, $S = \frac{V_w}{V_v}$ = 91.83 %

Void Ratio, $e = \frac{V_v}{V_s}$ = 0.61





Project :.....
Description of Sample .....
Boring No....1..... Sample No. ...4..... Tested by ...Kishan.Kazaa.....
Specific Gravity, G ..2.70.. Sample Depth.3.70-4.00. Date ...19.11.1987.....

1. WT. Wet Soils+Type	....303.44.. g	....309.27. g	..... g
2. WT. Type	....118.32.. g	....118.32.. g	..... g
3. WTD Wet Soils	....185.12.. g	....190.95.. g	..... g
4. Diameter of Specimen	....3.8.. cm	....3.8.. cm	..... cm
5. Height of Sample	(3.15")...8.0.. cm	....8.0.. cm	..... cm
6. Area Ao		....11.35..cm^2	
7. Volumme of Sample		....90.64..cm^3	
8. Unit Weight	Wet.Density 2.10..g/cm^3	Dry Density....1.77.. g/cm^3	

Water Content

9. Wet Wt. Soils+can	....88.69.. g	....[illegible].. g	..... g
10. Dry Wt. Soils+can	....74.17.. g	....[illegible].. g	..... g
11. Wt. Can	....24.69.. g	....[illegible].. g	..... g
12. Wt. of Water	....9.52.. g	....7.18.. g	..... g
13. Wt. Dry soils	....49.48.. g	....37.95.. g	..... g
14. Moisture Content	....19.19.. %	....10.04.. %	..... %
	Average = 15.07 %		

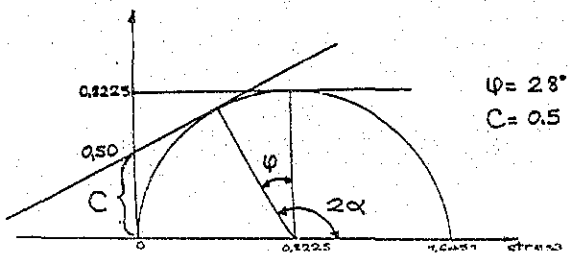
Elapsed Time min	Vertical Dial ΔH 0.001"	Strain ε=ΔH/H	1-ε	Corrected A = Ao/(1-ε)	Load Dial in 0.0001"	Axial Load P Kg	Stress P/A Kg/cm2
25"	0.020	0.00635	0.99365	11.40	0.0004	1.25	0.1046
1'15"	0.060	0.01905	0.98095	11.55	0.0042	4.54	0.3930
2'05"	0.100	0.03175	0.96825	11.70	0.0080	7.84	0.6017
2'55"	0.140	0.04444	0.95556	11.86	0.0060	8.63	0.7276
3'45"	0.180	0.05714	0.94286	12.02	0.0081	11.45	0.9550
4'35"	0.220	0.06984	0.93016	12.18	0.0093	12.67	1.0730
5'25"	0.260	0.08254	0.91746	12.35	0.0107	14.35	1.2203
6'15"	0.300	0.09524	0.90476	12.52	0.0115	16.25	1.2959
7'05"	0.340	0.10794	0.89206	12.70	0.0125	18.18	1.4314
7'55"	0.380	0.12064	0.87937	12.88	0.0136	19.32	1.5000
8'45"	0.420	0.13332	0.86667	13.07	0.0142	20.11	1.5336
9'35"	0.460	0.14603	0.85397	13.27	0.0150	21.36	1.6096
10'25"	0.500	0.15873	0.84127	13.47	0.0156	22.16	1.6451
11'15"	0.540	0.17143	0.82857	13.67	0.0156	22.16	1.6210
12'05"	0.580	0.18413	0.81587	13.89	0.0156	22.16	1.5953

Volume of Solids, $V_s = \frac{Ws}{G} =$ 54.35 cm^3

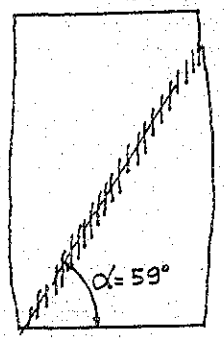
Volume of Voids, $V_v = V - V_s$ 31.29 cm^3

Degree of Saturation, $S = \frac{V_w}{V_v} =$ 95.11 %

Void Ratio, $e = \frac{V_v}{V_s} =$ 0.53



φ= 28°
C= 0.5 kg/cm^2



Project : Improving the Vientiane River Port (Laos).....
Description of Sample ...Brown Silty Sand.....
Boring No....1..... Sample No. ...3..... Tested by .Kishan.Kazaa.....
Specific Gravity, G 2.70... Sample Depth.7.70-8.00 Date .19.11.1987.....

1. WT. Wet Soils+Type	...302.62.. g	...304.16.. g	..... g
2. WT. Type	...112.32.. g	...113.32.. g	..... g
3. WTD Wet Soils	...182.29.. g	...185.24.. g	..... g
4. Diameter of Specimen	....3.8.9.. cm	....3.89.. gm	..... cm
5. Height of Sample	(3.15")...8.00.. cm	....8.00.. gm	..... cm
6. Area Ao		...11.32..cm^2	
7. Volumme of Sample		...90.64..cm^3	
8. Unit Weight	Wet.Density 2.04 g/cm^3	Dry Density...1.82. g/cm^3	

Water Content

9. Wet Wt. Soils+can	..74.1.0.. g	...20.42.. g	..... g
10. Dry Wt. Soils+can	..62.20.. g	...67.44.. g	..... g
11. Wt. Can	..41.60.. g	...22.39.. g	..... g
12. Wt. of Water	..11.70.. g	...12.76.. g	..... g
13. Wt. Dry soils	..41.40.. g	...45.34.. g	..... g
14. Moisture Content	..27.18... %	...22.13.. %	..... %
	Average: 27.65 %		

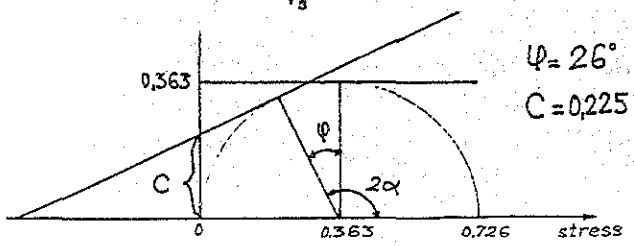
Elapsed Time min	Vertical Dial ΔH 0.001"	Strain ε=ΔH/H	1-ε	Corrected A = Ao/(1-ε)	Load Dial in 0.0001"	Axial Load P Kg	Stress P/A Kg/cm2
25"	0.020	0.00634	0.99366	11.40	0.0004	0.453	0.040
75"	0.160	0.0190	0.9810	11.54	0.0015	2.154	0.187
2'05"	0.100	0.0317	0.9683	11.70	0.0024	3.402	0.291
2'55"	0.140	0.0444	0.9556	11.85	0.0033	4.649	0.392
3'45"	0.180	0.571	0.9429	12.01	0.0039	5.556	0.463
4'35"	0.220	0.0698	0.9302	12.18	0.0046	6.557	0.540
5'25"	0.260	0.0825	0.9175	12.35	0.0051	7.198	0.583
6'15"	0.300	0.0952	0.9048	12.52	0.0055	7.924	0.625
7'05"	0.340	0.1079	0.8921	12.70	0.0059	8.391	0.661
7'55"	0.380	0.1206	0.8794	12.88	0.0063	8.958	0.695
8'45"	0.420	0.1333	0.8667	13.07	0.0066	9.412	0.720
9'35"	0.460	0.1460	0.8540	13.27	0.0068	9.639	0.726
10'25"	0.500	0.1587	0.8413	13.46	0.0068	9.639	0.716

Volume of Solids, $V_s = \frac{Ws}{G} =$ 53.55 cm^3

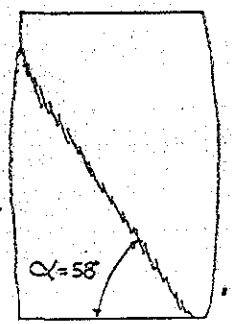
Volume of Voids, $V_v = V - V_s$ 37.09 cm^3

Degree of Saturation, $S = \frac{V_w}{V_v} =$ 107.79 %

Void Ratio, $e = \frac{V_v}{V_s} =$ 0.69



φ= 26°
C= 0.225 kg/cm^2



Project : Improving the Vientiane River ... part (LAKSI)
Description of Sample : Blackish Silty Soils
Boring No. 1 Sample No. 4 Tested by Kham Kone
Specific Gravity, G 2.72 Sample Depth 1.70-1.80 Date 20/10/87

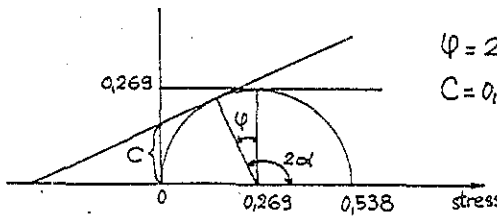
1. WT. Wet Soils+Type	299.58 g	297.19 g	... g
2. WT. Type	118.82 g	118.82 g	... g
3. WTD Wet Soils	175.70 g	178.37 g	... g
4. Diameter of Specimen	3.80 cm	3.80 cm	... cm
5. Height of Sample	(3.15") 8.00 cm	8.00 cm	... cm
6. Area Ao	11.33 cm²		
7. Volumne of Sample	90.64 cm³		
8. Unit Weight	Wet.Density 1.95 g/cm³	Dry Density 1.49 g/cm³	

Water Content

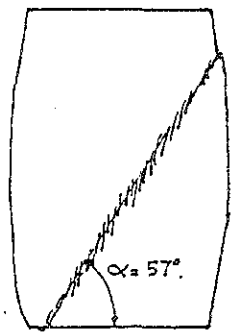
9. Wet Wt. Soils+can	88.92 g	102.72 g	... g
10. Dry Wt. Soils+can	73.78 g	85.59 g	... g
11. Wt. Can	42.30 g	31.20 g	... g
12. Wt. of Water	15.14 g	17.13 g	... g
13. Wt. Dry soils	31.48 g	54.39 g	... g
14. Moisture Content	31.40 %	31.49 %	... %
	Average = 10.44 %		

Elapsed Time min	Vertical Dial ΔH 0.001"	Strain ε=ΔH/H	1-ε	Corrected A = Ao/(1-ε)	Load Dial in 0.0001"	Axial Load P Kg	Stress P/A Kg/cm2
25"	0.020	0.00634	0.9936	11.40	0.0002	0.227	0.020
75"	0.060	0.0190	0.9810	11.54	0.0009	1.247	0.108
2'05"	0.100	0.0317	0.9683	11.70	0.0016	2.268	0.194
2'55"	0.140	0.04441	0.9556	11.85	0.0022	3.175	0.268
3'45"	0.180	0.0571	0.9429	12.01	0.0029	4.196	0.349
4'35"	0.220	0.0698	0.9302	12.18	0.0035	4.930	0.405
5'25"	0.260	0.0825	0.9175	12.35	0.0040	5.670	0.459
6'15"	0.300	0.0952	0.9049	12.52	0.0044	6.143	0.489
7'05"	0.340	0.1079	0.8921	12.70	0.0046	6.577	0.518
7'55"	0.380	0.1206	0.8794	12.88	0.0048	6.804	0.528
8'45"	0.420	0.1333	0.8667	13.07	0.0050	7.031	0.538
9'35"	0.460	0.1460	0.8540	13.27	0.0050	7.031	0.530

Volume of Solids, $V_s = \frac{Ws}{G}$ = 49.90 cm³
Volume of Voids, $V_v = V - V_s$ 40.74 cm³
Degree of Saturation, $S = \frac{V_w}{V_v}$ = 101.40 %
Void Ratio, $e = \frac{V_v}{V_s}$ = 0.82



φ = 24°
C = 0,172 kg/cm².



Project : Improving the Vientiane River ... part (LAKSI)
Description of Sample : Blackish Silty Soils
Boring No. 1 Sample No. 5 Tested by Kham Kone
Specific Gravity, G 2.78 Sample Depth 13.70-14.00 Date 19/10/87

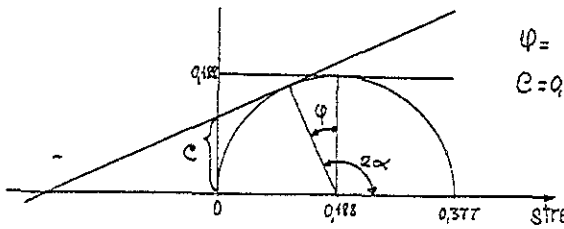
1. WT. Wet Soils+Type	293.96 g	294.49 g	... g
2. WT. Type	118.82 g	118.82 g	... g
3. WTD Wet Soils	174.14 g	125.67 g	... g
4. Diameter of Specimen	3.80 cm	3.80 cm	... cm
5. Height of Sample	(3.15") 8.00 cm	8.00 cm	... cm
6. Area Ao	11.33 cm²		
7. Volumne of Sample	90.64 cm³		
8. Unit Weight	Wet.Density 1.93 g/cm³	Dry Density 1.48 g/cm³	

Water Content

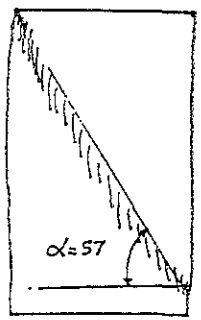
9. Wet Wt. Soils+can	95.00 g	84.70 g	... g
10. Dry Wt. Soils+can	78.18 g	69.70 g	... g
11. Wt. Can	41.10 g	31.60 g	... g
12. Wt. of Water	16.82 g	14.70 g	... g
13. Wt. Dry soils	37.08 g	43.70 g	... g
14. Moisture Content	28.47 %	30.81 %	... %
	Average = 30.14 %		

Elapsed Time min	Vertical Dial ΔH 0.001"	Strain ε=ΔH/H	1-ε	Corrected A = Ao/(1-ε)	Load Dial in 0.0001"	Axial Load P Kg	Stress P/A Kg/cm2
25"	0.020	0.00634	0.99366	11.40	0.0002	0.226	0.020
75"	0.060	0.0190	0.9810	11.54	0.0006	0.907	0.078
2'05"	0.100	0.0317	0.9683	11.70	0.0012	1.700	0.145
2'55"	0.140	0.04441	0.9556	11.85	0.0015	2.154	0.182
3'45"	0.180	0.0571	0.9429	12.01	0.0020	2.948	0.245
4'35"	0.220	0.0698	0.9302	12.18	0.0024	3.402	0.279
5'25"	0.260	0.0825	0.9175	12.35	0.0026	3.629	0.294
6'15"	0.300	0.0952	0.9049	12.52	0.0029	4.196	0.335
7'05"	0.340	0.1079	0.8921	12.70	0.0031	4.422	0.348
7'55"	0.380	0.1206	0.8794	12.88	0.0033	4.649	0.361
8'45"	0.420	0.1333	0.8667	13.07	0.0035	4.930	0.377
9'35"	0.460	0.1460	0.8540	13.27	0.0035	4.930	0.371

Volume of Solids, $V_s = \frac{Ws}{G}$ = 48.34 cm³
Volume of Voids, $V_v = V - V_s$ 42.30 cm³
Degree of Saturation, $S = \frac{V_w}{V_v}$ = 95.76 %
Void Ratio, $e = \frac{V_v}{V_s}$ = 0.87



φ = 24°
C = 0,125 kg/cm².



Project : Improving the Vietnam River port [illegible]
Description of Sample ...... Silty Soils
Boring No. .... 1 ...... Sample No. .... 6 ...... Tested by .... Kham Kone
Specific Gravity, G 2,74 .. Sample Depth 16,20-16,50 Date 19/10/87

1. WT. Wet Soils+Type	303,82 g	301,35 g	g
2. WT. Type	118,82 g	118,82 g	g
3. WTD Wet Soils	185,00 g	182,53 g	g
4. Diameter of Specimen	3,80 cm	3,80 cm	cm
5. Height of Sample	(3,15") 8,00 cm	8,00 cm	cm
6. Area Ao		11,33 cm^2	
7. Volume of Sample		90,64 cm^3	
8. Unit Weight	Wet Density 2,03 g/cm^3	Dry Density 1,61 g/cm^3	

Water Content

9. Wet Wt. Soils+can	113,25 g	109,22 g	g
10. Dry Wt. Soils+can	96,19 g	91,71 g	g
11. Wt. Can	31,20 g	22,00 g	g
12. Wt. of Water	17,06 g	17,51 g	g
13. Wt. Dry soils	64,99 g	69,71 g	g
14. Moisture Content	26,25 %	25,12 %	%
	Average = 25,68 %		

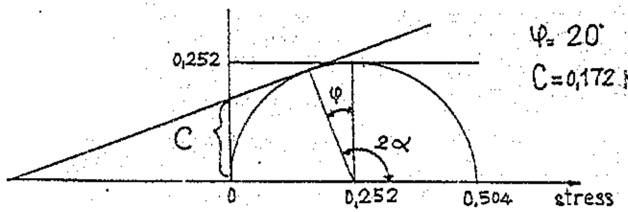
Elapsed Time min	Vertical Dial ΔH 0.001"	Strain $\varepsilon = \frac{\Delta H}{H}$	$1-\varepsilon$	Corrected $A = \frac{A_o}{1-\varepsilon}$	Load Dial in 0.0001"	Axial Load P Kg	Stress $\frac{P}{A}$ Kg/cm2
25"	0,020	0,00634	0,99366	11,40	0,0002	0,226	0,020
75"	0,060	0,0190	0,9810	11,54	0,0007	1,020	0,088
2'05"	0,100	0,0317	0,9683	11,70	0,0012	1,700	0,145
2'55"	0,140	0,0444	0,9556	11,85	0,0018	2,608	0,220
3'45"	0,180	0,0571	0,9429	12,01	0,0024	3,402	0,279
4'35"	0,220	0,0698	0,9302	12,18	0,0028	4,082	0,335
5'25"	0,260	0,0825	0,9175	12,35	0,0033	4,649	0,361
6'15"	0,300	0,0952	0,9048	12,52	0,0038	5,443	0,435
7'05"	0,340	0,1079	0,8921	12,70	0,0040	5,670	0,446
7'55"	0,380	0,1206	0,8794	12,88	0,0043	6,010	0,467
8'45"	0,420	0,1333	0,8667	13,07	0,0045	6,350	0,486
9'35"	0,460	0,1460	0,8540	13,27	0,0047	6,690	0,504
10'25"	0,500	0,1587	0,8413	13,46	0,0047	6,690	0,497

Volume of Solids, $V_s = \frac{W_s}{G}$ = 53,36 cm^3

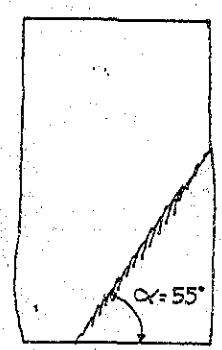
Volume of Voids, $V_v = V - V_s$ = 37,28 cm^3

Degree of Saturation, $S = \frac{V_w}{V_v}$ = 100,72 %

Void Ratio, $e = \frac{V_v}{V_s}$ = 0,70



φ = 20°
C = 0,172 Kg/cm^2



MINISTRY OF TRANSPORT AND POST

COMMUNICATION DESIGN AND RESEARCH INSTITUTE

REPORT TEST RESULTS

PROJECT : IMPROVING THE VIENTIANE RIVER PORT (LAKSI)

BORING Nº 2

OCT . 1987

LAO PEOPLE'S DEMOCRATIC REPUBLIC
PEACE INDEPENDANCE UNIT SOCIALIST
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Ministry of Transport
and Post
Communication Design and
Research Institute

REPORT TEST RESULTS

Project : Improving the Vientiane River Port (LAXSI)
Boring Number : 2 Sample Number : 1 Depth : 1.70 - 2.00 m
Lab. Number : 099/87
Type of Material : Clayey Soils
Test Begun on : 22 / 10 / 87 Completed on : 26 / 10 / 87

TEST RESULTS

(A) ATTERBERG LIMIT:		
-Liquid Limit	(L.L)	29.7 %
-Plastic Limit	(P.L)	18.1 %
-Plasticity Index	(P.I)	11.6 %
(B) Sieve analysis:		
-Sieve Size mm: 12.7 : 9.52 : 4.76 : 2.00 : 0.42 : 0.149 : 0.074		
- % Passing : 100 : 99.7 : 99.3 : 98.1 : 95.6 : 93.6 : 92.6		
(C) CLASSIFICATION (AASHO DESIGNATION: M 145-66)		A-6 (10)
(D) SPECIFIC GRAVITY OF SOILS:		
-Temperature	at 29°C	2.76 g/cm^3
(E) MOISTURE CONTENT:		
-Water Content (Natural)		22.50 %
(F) UNIT WEIGHT:		
-Wet Density		1.90 g/cm^3
-Dry Density		1.55 g/cm^3
(G) DEGREE OF SATURATION,S		80.07 %
(H) VOID RATIO,e		0.77

Chief Eng.
Adj.
Sauk Soukaseum.

Vientiane 26 October 1987
Material-Laboratory Chief
Kingkham Ratthalangsy.

LAO PEOPLE'S DEMOCRATIC REPUBLIC
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Ministry of Transport
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REPORT TEST RESULTS

Project : Improving the Vientiane River Port (LAXSI)
Boring Number : 2 Sample Number : 2 Depth : 3.70 - 4.00 m
Lab. Number : 099/87
Type of Material : Clayey Soils
Test Begun on : 22/10/87 Completed on : 26/10/87

TEST RESULTS

(A) ATTERBERG LIMIT:		
-Liquid Limit	(L.L)	36.2 %
-Plastic Limit	(P.L)	21.7 %
-Plascity Index	(P.I)	14.5 %
(B) SIEVE ANALYSIS:		
-Sieve Size mm: 12.7 : 9.52 : 4.76 : 2.00 : 0.42 : 0.149 : 0.074		
- % Passing : 100 : 99.9 : 99.8 : 99.6 : 99.2 : 95.8 : 94.7		
(C) CLASSIFICATION (AASHO DESIGNATION: M 145-66)		A-6 (15)
(D) SPECIFIC GRAVITY OF SOILS:		
-Temperature	at 29°C	2.70 g/cm
(E) MOISTURE CONTENT:		
-Water Content (Natural)		20.22 %
(F) UNIT WEIGHT:		
-Wet Density		1.99 g/cm^3
-Dry Density		1.65 g/cm^3
(G) DEGREE OF SATURATION,S		86.56 %
(H) VOID RATIO,e		0.63

Chief Eng.
Adj.
Sauk Soukaseum.

Vientiane 26 October 1987
Material- Laboratory Chief
Kingkham Ratthalangsy.

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Ministry of Transport
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REPORT TEST RESULTS

Project : Improving the Vientiane River Port (LAXSI)
Boring Number : 2 Sample Number : 3 Depth : 5.80 - 6.20 m
Lab. Number : 099/87
Type of Material : Clayey Soils
Test Begun on : 22/10/87 Completed on : 26/10/87

TEST RESULTS

(A) ATTERBRG LIMIT:
-Liquid Limit (L.L) 36.7 %
-Plastic Limit (P.L) 22.9 %
-Plasticity Index (P.I) 13.8 %
(B) SIEVE ANALYSIS:
-Sieve Size mm: 25.4 : 19.1 : 12.7 : 9.52 : 4.76 : 2.00: 0.42
- % Passing : 100 : 99.0 : 99.0 : 98.9 : 98.7 : 98.4: 97.8
-Sieve Size mm: 0.149: 0.074:
- % Passing : 97.7 : 97.3 :
(C) CLASSIFICATION (AASHO DESIGNATION: M 145-66) A-6 (14)
(D) SPECIFIC GRAVITY OF SOILS:
-Temperature at 29°C 2.80 g/cm^3
(E) MOISTURE CONTENT:
- Water Content (Natural) 24.06 %
(F) UNIT WEIGHT:
-Wet Density 1.98 g/cm^3
-Dry Density 1.60 g/cm^3
(G) DEGREE OF SATURATION,S 88.96 %
(H) VOID RATIO,e 0.76

Chief Eng.
Adj.
N. Saukalaum.
Sauk Saukalaum.

Vientiane 26 October 1987
Material- Laboratory Chief
Kingkham Ratthalangsy.

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REPORT TEST RESULTS

Project : Improving the Vientiene River Port (LAXSI)
Boring Number : 2 Sample Number : 4 Depth : 7.70 - 8.00 m
Lab. Number : 099/87
Type of Material : Clayey Soils
Test Begun on : 22/10/87 Completed on : 26/10/87

TEST RESULTS

(A) ATTERBERG LIMIT:
-Liquid Limit (L.L) 29.3 %
-Plastic Limit (P.L) 18.4 %
-Plasticity Index (P.I) 10.9 %
(B) SIEVE ANALYSIS:
-Sieve Size mm: 9.52 : 4.76 : 2.00 : 0.42 : 0.149 : 0.074
- % Passing : 100 : 99.9 : 99.7 : 99.6 : 96.9 : 95.3
(C) CLASSIFICATION (AASHO DESIGNATION: M 145-66) A-6 (12)
(D) SPECIFIC GRAVITY OF SOILS:
- Temperature at 29°C 2.75 g/cm^3
(E) MOISTURE CONTENT:
- Water Content (Natural) 23.75 %
(F) UNIT WEIGHT:
- Wet Density 2.07 g/cm^3
- Dry Density 1.67 g/cm^3
(G) DEGREE OF SATURATION,S 101.55 %
(H) VOID RATIO,e 0.64

Chief Eng.
Adj.
N. Saukalaum.
Sauk Saukalaum.

Vientiane 26 October 1987
Material-Laboratory Chief
Kingkham Ratthalangsy.

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Ministry of Transport
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Communication Design and
Research Institute

REPORT TEST RESULTS

Project : Improving the Vientiane River Port (LAXSI)
Boring Number : 2 Sample Number : 5 Depth : 9.70 - 10.00 m
Lab. Number : 099/87
Type of Material : Silty Soils
Test Begun on : 22/10/87 Completed on 26/10/87

TEST RESULTS

(A) ATTERBERG LIMIT:
-Liquid Limit (L.L) 25.5 %
-Plastic Limit (P.L) 15.8 %
-Plasticity Index (PI) 9.7 %
(B)SIEVE ANALYSIS:
-Sieve Size mm: 0.42 : 0.149 : 0.074
- % Passing : 100 : 99.9 : 88.9
(C) CLASSIFICATION (AASHO DESIGNATION: M 145-66) A-4 (7)
(D) SPECIFIC GRAVITY OF SOILS:
- Temperature at 29°C 2.73 g/cm^3
(E) MOISTURE CONTENT:
- Water Content (Natural) 2 7.00 %
(F) Unit Weight:
-Wet Density 2.03 g/cm^3
-Dry Density 1.60 g/cm^3
(G) DEGREE OF SATURATION,S 103.69 %
(H) VOID RATIO,e 0.71

Chief Eng.
Adj.
Seuk Soukasaum.

Vientiane 26 October 1987
Material-Laboratory Chief
Kingkham Ratthalangsy.

LAO PEOPLE'S DEMOCRATIC REPUBLIC
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Ministry of Transport
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Communication Design and
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REPORT TEST RESULTS

Project : Improving the Vientiane River Port (LAXSI)
Boring Number : 2 Sample Number : 6 Depth : 11.70 - 12.00 m
Lab. Number : 099/87
Type of Material : Silty Soils
Test Begun on : 22/10/87 Completed on : 26/10/87

TEST RESULTS

(A) ATTERBERG LIMIT:
-Liquid Limit (L.L) 24.3 %
-Plastic Limit (P.L) 17.2 %
-Plasticity Index (P.I) 7.1 %
(B)SIEVE ANALYSIS:
-Sieve Size mm: 2.00 : 0.42 : 0.149 : 0.074
- % Passing : 100 : 99.7 : 99.1 : 80.9
(C) CLASSIFICATION (AASHO DESIGNATION: M 145-66) A-4 (6)
(D) SPECIFIC GRAVITY OF SOILS:
- Temperature at 29°C 2.71 g/cm^3
(E) MOISTURE CONTENT:
-Water Content (Natural) 30.51 %
(F) UNIT WEIGHT:
-Wet Density 1.99 g/cm^3
-Dry Density 1.52 g/cm^3
(G) DEGREE OF SATURATION,S 106.85 %
(H) VOID RATIO,e 0.77

Chief Eng.
Adj.
Seuk Soukasaum.

Vientiane 26 October 1987
Material-Laboratory Chief
Kingkham Ratthalangsy.

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REPORT TEST RESULTS

Project : Improving the Vientiane River Port (LAXSI)
Boring Number : 2 Sample Number : 7 Depth: 13.70 - 14.00 m
Lab. Number : 099/87
Type of Material : Silty Soils
Test Begun on : 22/10/87 Completed on : 26/10/87

TEST RESULTS

(A) ATTERBERG LIMIT:

-Liquid Limit	(L.L)	23.3 %
-Plastic Limit	(P.L)	16.1 %
-Plasticity Index	(P.I)	7.2 %

(B) SIEVE ANALYSIS:

-Sieve Size mm:	¢.76	2.00	0.42	0.149	0.074
- % Passing	100	99.9	99.8	99.6	86.8

(C) CLASSIFICATION (AASHO DESIGNATION: M 145-66) A-4 (6)

(D) SPECIFIC GRAVITY OF SOILS:
-Temperature at 29°C 2.72 g/cm³

(E) MOISTURE CONTENT:
-Water Content (Natural) 26.24 %

(F) UNIT WEIGHT:
-Wet Density 2.06 g/cm³
-Dry Density 1.63 g/cm³

(G) DEGREE OF SATURATION,S 107.03 %

(H) VOID RATIO,e 0.67

Chief Eng.
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REPORT TEST RESULTS

Project : Improving the Vien tiane River Port (LAXSI)
Boring Number : 2 Sample Number : 8 Depth: 15.70 - 16.00 m
Lab. Number : 099/87
Type of Material : Silty Sand Gravel
Test Begun on : 22/10/87 Completed on : 26/10/87

TEST RESULTS

(A) ATTERBEG LIMIT:

-Liquid Limit	(L.L)	17.8 %
-Plastic Limit	(P.L)	1422 %
-Plasticity Index	(P.I)	3.6 %

(B) SIEVE ANALYSIS:

-Sieve Size mm:	38.1	25.1	19.1	12.7	9.52	4.76	2.00
- % Passing	100	91.2	86.4	81.9	77.2	74.0	72.5

-Sieve Size mm:	0.42	0.149	0.074
- % Passing	67.8	33.4	29.8

(C) CLASSIFICATION (AASHO DESIGNATION: M 145-66) A-2-4 (0)

(D) SPECIFIC GRAVITY OF SOILS:
- Temperature at 28°C 2.69 g/cm³

Chief Eng.
Adj.
Seuk Souksaseum.

Vientiane 26 October 1987
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Kingkham Ratthalangsy.

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REPORT TEST RESULTS

Project : Improving The Vientiane River Port (LAXSI)
Boring Number : 2 Sample Number : 9 Depth: 16.30 - 16.60 m
Lab.Number : C99/87
Type of Material: SANDY GRAVEL
Test Begun on : 22/10/87 Completed on : 26/10/87

TEST RESULTS

(A) ATTERBERG LIMIT:
- -Liquid Limit (L.L) 0
- -Plastic Limit (P.L) 0
- -Plasticity Index (P.I) 0

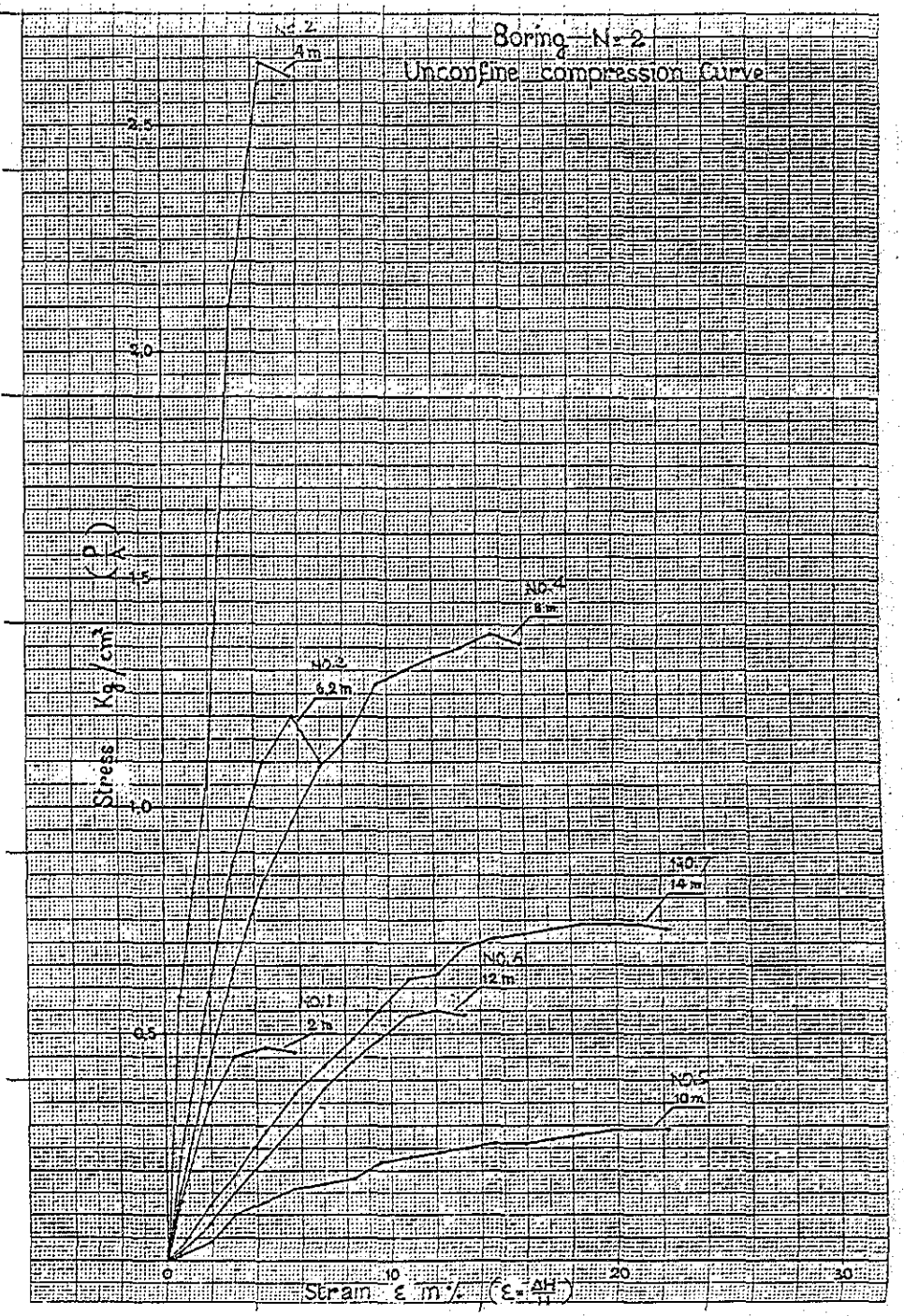
(B) SIEVE ANALYSIS:
- -Sieve Size mm: 50.8 : 38.1 : 25.4 : 19.1 : 12.7 : 9.52: 4.76
- - % Passing : 88.8 : 80.9 : 75.5 : 65.6 : 50.3 : 42.7: 32.8
- -Sieve Size mm: 2.00 : 0.42 : 0.149: 0.074
- - % Passing : 27.1 : 19.6 : 14.2 : 12.8

(C) CLASSIFICATION (AASHO DESIGNATION: M 145-66) A-1-a (0)

(D) SPECIFIC GRAVITY OF AGGREGATE:
- Temperature at 28°C ≥ 2mm 2.65 g/cm³
  ≤ 2mm 2.71 g/cm³
- Absorption 1.01 %

Chief Eng.
Adj
Seuk Soukaseum.

Vientiane 26 October 1987
Material-Laboratory Chief
Mrs
Kingkham Ratthalangsy.



SOIL MECHANICS LABORATORY

UNCONFINED COMPRESSION TEST

Project : Improving the Vientiane River Port (LAKSI)
Description of Sample : Clayey Soils
Boring No. 2 Sample No. 4 Tested by Kham Kone
Specific Gravity, G 2.76 Sample Depth 370-400m Date 21/10/87

1. WT. Wet Soils+Type	38.7.71	g	20.5.11	g
2. WT. Type	11.8.82	g	11.8.82	g
3. WT. Wet Soils	168.82	g	176.89	g
4. Diameter of Specimen	3,80	cm	3,80	cm
5. Height of Sample (3,15")	8,02	cm	8,00	cm
6. Area Ao			11.33	cm^2
7. Volumne of Sample			90.64	cm^3
8. Unit Weight	Wet.Density 1.90 g/cm^3		Dry Density 1.55	g/cm^3

Water Content

9. Wet Wt. Soils+can	87,31	g	77,27	g
10. Dry Wt. Soils+can	75,21	g	67,14	g
11. Wt. Can	21,60	g	22,00	g
12. Wt. of Water	12,10	g	10,13	g
13. Wt. Dry soils	53,61	g	45,14	g
14. Moisture Content	22,57	%	22,44	%

Average = 22.50 %

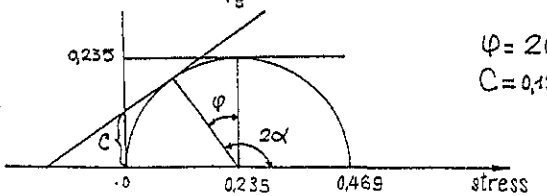
Elapsed Time min	Vertical Dial AH : 0.001"	Strain ε=ΔH/H	1-ε	Corrected A = Ao/(1-ε)	Load Dial in 0.0001"	Axial Load P Kg	Stress P/A Kg/cm2
15"	0.020	0,00634	0,99366	11,40	0,0011	1,529	0,134
75"	0,060	0,0190	0,9810	11,54	0,0028	4,082	0,354
2.05"	0,100	0,0317	0,9683	11,70	0,0037	5,270	0,450
2'55"	0,140	0,0444	0,9556	11,85	0,0039	5,556	0,469
3'45"	0,180	0,0571	0,9429	12,01	0,0039	5,556	0,463

Volume of Solids, $V_s = \frac{Ws}{G} = 51.05$ g/cm^3

Volume of Voids, $V_v = V - V_s = 39.59$ cm^3

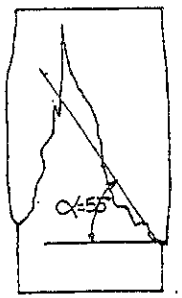
Degree of Saturation, $S = \frac{V_w}{V_v} = 80.07$ %

Void Ratio, $e = \frac{V_v}{V_s} = 0.77$



φ = 20°

C = 0,12 kg/cm²



SOIL MECHANICS LABORATORY

UNCONFINED COMPRESSION TEST

Project : Improving the Vientiane River port (LAKSI)
Description of Sample : Clayey Soils
Boring No. 2 Sample No. 2 Tested by Kham Kone
Specific Gravity, G 2.79 Sample Depth 370+400m Date 21/10/87

1. WT. Wet Soils+Type	191,64	g	206,84	g
2. WT. Type	118,82	g	118,82	g
3. WT. Wet Soils	172,84	g	188,02	g
4. Diameter of Specimen	3,80	cm	3,80	cm
5. Height of Sample (3,15")	8,00	cm	8,00	cm
6. Area Ao			11.33	cm^2
7. Volumne of Sample			90.64	cm^3
8. Unit Weight	Wet.Density 1.99 g/cm^3		Dry Density 1.65	g/cm^3

Water Content

9. Wet Wt. Soils+can	89,60	g	86,24	g
10. Dry Wt. Soils+can	78,33	g	75,35	g
11. Wt. Can	22,00	g	21,60	g
12. Wt. of Water	11,27	g	10,99	g
13. Wt. Dry soils	56,33	g	53,75	g
14. Moisture Content	20,00	%	20,44	%

Average = 20.22 %

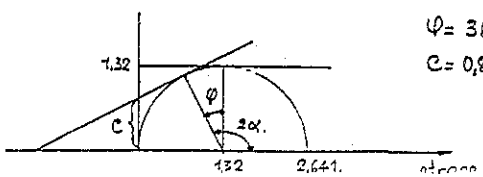
Elapsed Time min	Vertical Dial AH : 0.001"	Strain ε=ΔH/H	1-ε	Corrected A = Ao/(1-ε)	Load Dial in 0.0001"	Axial Load P Kg	Stress P/A Kg/cm2
25"	0,020	0,00634	0,9936	11,40	0,0046	6,577	0,577
75"	0,060	0,0190	0,9810	11,54	0,0085	12,020	1,041
2'05"	0,100	0,0317	0,9683	11,70	0,0174	24,607	2,103
2'55"	0,140	0,0444	0,9556	11,85	0,0220	31,298	2,641
3'45"	0,180	0,0571	0,9429	12,01	0,0220	31,298	2,606

Volume of Solids, $V_s = \frac{Ws}{G} = 55.58$ g/cm^3

Volume of Voids, $V_v = V - V_s = 35.06$ cm^3

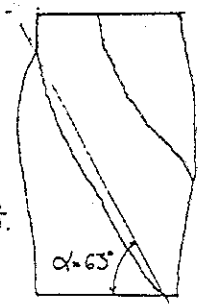
Degree of Saturation, $S = \frac{V_w}{V_v} = 86.56$ %

Void Ratio, $e = \frac{V_v}{V_s} = 1.63$



φ = 36°

C = 0,84 kg/cm²



Project :..Improving..the..Vientiane..River..port...(LAKSI).....
Description of Sample ....Clayey..Soils.....
Boring No....2..... Sample No. ....3..... Tested by ...Kham..Kone.....
Specific Gravity, G 2.89.. Sample Depth..5.80÷6.00m Date ....21/10/87.....

1. WT. Wet Soils+Type	....296.47 g	...299.57. g	..... g
2. WT. Type	....118.82 g	...118.82. g	..... g
3. WTD Wet Soils	....177.65 g	...180.69. g	..... g
4. Diameter of Specimen	....3.80 gm	.....3.80. gm	..... gm
5. Height of Sample	(3.15")....8.00. gm	.....8.00.. gm	..... mm
6. Area Ao	....11.33..cm^2		
7. Volumme of Sample	....90.64..cm^3		
8. Unit Weight	Wet.Density 1.98 g/cm^3	Dry Density...1.60. g/cm^3	

Water Content

9. Wet Wt. Soils+can	....85.38. g	..89.53. g	..... g
10. Dry Wt. Soils+can	....73.21. g	...69.39. g	..... g
11. Wt. Can	....22.80 g	...21.20. g	..... g
12. Wt. of Water	....12.17. g	...9.14.. g	..... g
13. Wt. Dry soils	....50.41. g	..39.19.. g	..... g
14. Moisture Content	...24.14. %	..23.98.. %	..... %
	Average = 24.06 %		

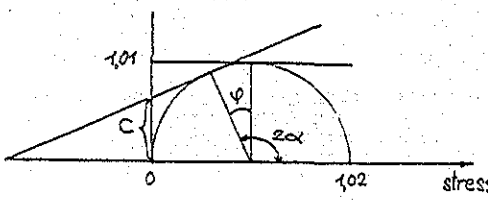
Elapsed Time min	Vertical Dial AH : 0.001"	Strain ε=ΔH/H	1-ε	Corrected A = Ao/(1-ε)	Load Dial in 0.0001"	Axial Load P Kg	Stress P/A Kg/cm2
25"	0.020	0.00634	0.9936	11.40	0.0018	2.608	0.229
75"	0.060	0.0190	0.9810	11.54	0.0048	6.804	0.589
2' 05"	0.100	0.0317	0.9683	11.70	0.0072	10.206	0.872
2' 55"	0.140	0.0444	0.9556	11.85	0.0085	12.020	1.014
3' 45"	0.180	0.0571	0.9429	12.01	0.0086	12.147	1.020
4' 35"	0.220	0.0698	0.9302	12.18	0.0086	12.247	1.006

Volume of Solids, $V_s = \frac{Ws}{G}$ = 51.58 cm^3

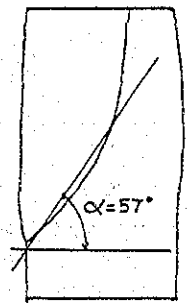
Volume of Voids, $V_v = V - V_s$ 39.06 cm^3

Degree of Saturation, $S = \frac{V_w}{V_v}$ = 88.96 %

Void Ratio, $e = \frac{V_v}{V_s}$ = 0.76



φ= 24°
C=0,31.



UNCONFINED COMPRESSION TEST

Project :..Improving..the..Vientiane..River..Port...(LAKSI).....
Description of Sample .....Clayey..Soils.....
Boring No....2..... Sample No. ....4..... Tested by ....Kham..Kone.....
Specific Gravity, G 2.75.. Sample Depth..7.20÷7.40mDate ...21/10/87.....

1. WT. Wet Soils+Type	.....306.82 g	..296.87. g	..... g
2. WT. Type	.....118.82 g	...118.82. g	..... g
3. WTD Wet Soils	....187.40 g	..178.05. g	..... g
4. Diameter of Specimen	.....3.80. gm	.....3.80.. gm	..... gm
5. Height of Sample	(3.15")....8.00. gm	.....8.00.. gm	..... mm
6. Area Ao	....11.33..cm^2		
7. Volumme of Sample	....90.64..cm^3		
8. Unit Weight	Wet.Density 2.07 g/cm^3	Dry Density...1.67.. g/cm^3	

Water Content

9. Wet Wt. Soils+can	....108.76 g	..107.18. g	..... g
10. Dry Wt. Soils+can	....92.19. g	...92.58. g	..... g
11. Wt. Can	....22.80 g	...21.20. g	..... g
12. Wt. of Water	....16.57. g	...14.60. g	..... g
13. Wt. Dry soils	....69.39. g	..71.38.. g	..... g
14. Moisture Content	...23.71. %	..23.79.. %	..... %
	Average = 23.75 %		

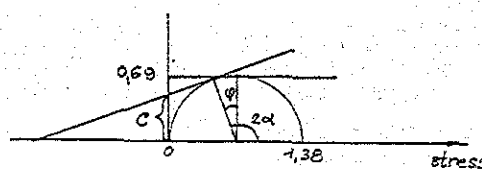
Elapsed Time min	Vertical Dial AH : 0.001"	Strain ε=ΔH/H	1-ε	Corrected A = Ao/(1-ε)	Load Dial in 0.0001"	Axial Load P Kg	Stress P/A Kg/cm2
25"	0.020	0.00634	0.9936	11.40	0.0012	1.700	0.149
75"	0.060	0.0190	0.9810	11.54	0.0035	4.930	0.427
2' 05"	0.100	0.0317	0.9683	11.70	0.0053	7.539	0.644
2' 55"	0.140	0.0444	0.9556	11.85	0.0078	9.979	0.842
3' 45"	0.180	0.0571	0.9429	12.01	0.0083	11.680	0.972
4' 35"	0.220	0.0698	0.9302	12.18	0.0094	13.267	1.089
5' 25"	0.260	0.0825	0.9175	12.35	0.0101	14.288	1.157
6' 15"	0.300	0.0952	0.9048	12.52	0.0112	15.876	1.268
7' 05"	0.340	0.1079	0.8921	12.70	0.0117	16.443	1.295
7' 55"	0.380	0.1206	0.8794	12.88	0.0121	17.064	1.325
8' 45"	0.420	0.1333	0.8667	13.07	0.0125	17.577	1.345
9' 35"	0.460	0.1460	0.8540	13.27	0.0129	18.311	1.380
10' 25"	0.500	0.1587	0.8413	13.46	0.0129	18.311	1.360

Volume of Solids, $V_s = \frac{Ws}{G}$ = 55.16 cm^3

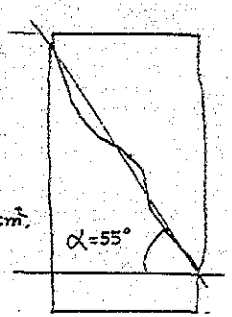
Volume of Voids, $V_v = V - V_s$ 35.48 cm^3

Degree of Saturation, $S = \frac{V_w}{V_v}$ = 101.55 %

Void Ratio, $e = \frac{V_v}{V_s}$ = 0.64



φ= 20°
C = 0,50 kg/cm^2



UNCONFINED COMPRESSION TEST

Project : Improving the Vientiane River port (LAKSI)
Description of Sample : Silty Soils
Boring No. 2 Sample No. 5 Tested by Kham Kone
Specific Gravity, G 2.72 Sample Depth 9.20-9.40m Date 22/10/87

1. WT. Wet Soils+Type	302.27 g	3.91.28 g		g
2. WT. Type	118.82 g	118.82 g		g
3. WTD Wet Soils	184.95 g	184.46 g		g
4. Diameter of Specimen	3.80 cm	3.80 cm		cm
5. Height of Sample	(3.15") 8.00 cm	8.00 cm		cm
6. Area Ao		11.33 cm^2		
7. Volumme of Sample		90.64 cm^3		
8. Unit Weight	Wet Density 2.03 g/cm^3	Dry Density 1.60 g/cm^3		

Water Content

9. Wet Wt. Soils+can	126.43 g	115.27 g		g
10. Dry Wt. Soils+can	104.65 g	95.38 g		g
11. Wt. Can	82.00 g	81.60 g		g
12. Wt. of Water	21.78 g	20.27 g		g
13. Wt. Dry soils	82.65 g	73.74 g		g
14. Moisture Content	26.50 %	27.50 %		%
	Average = 27.00 %			

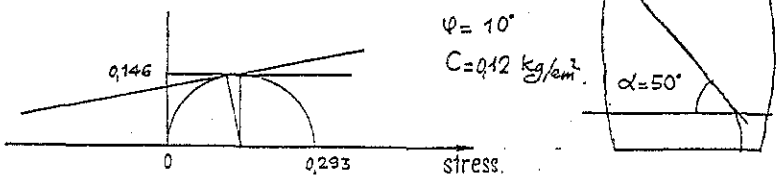
Elapsed Time min	Vertical Dial AH 0.001"	Strain ε=ΔH/H	1-ε	Corrected A = Ao/(1-ε)	Load Dial in 0.0001"	Axial Load P Kg	Stress P/A Kg/cm2
30"	0.020	0.00434	0.9936	11.40	0.0001	0.113	0.010
75"	0.060	0.0190	0.9810	11.54	0.0004	0.453	0.039
2'05"	0.100	0.0317	0.9683	11.70	0.0008	1.134	0.097
2'55"	0.140	0.0444	0.9556	11.85	0.0010	1.529	0.129
3'45"	0.180	0.0571	0.9429	12.01	0.0013	1.869	0.155
4'35"	0.220	0.0698	0.9302	12.18	0.0014	2.041	0.167
5'25"	0.260	0.0825	0.9175	12.35	0.0016	2.268	0.184
6'45"	0.300	0.0952	0.9048	12.52	0.0019	2.776	0.222
7'05"	0.340	0.1079	0.8921	12.70	0.0020	2.948	0.232
7'55"	0.380	0.1206	0.8794	12.88	0.0021	3.062	0.238
8'45"	0.420	0.1333	0.8667	13.07	0.0023	3.288	0.252
9'35"	0.460	0.1460	0.8540	13.27	0.0024	3.402	0.256
10'25"	0.500	0.1587	0.8413	13.46	0.0025	3.515	0.261
11'15"	0.540	0.1714	0.8286	13.67	0.0028	3.629	0.265
12'05"	0.580	0.1841	0.8159	13.88	0.0027	3.855	0.278
12'55"	0.620	0.1968	0.8032	14.10	0.0029	4.082	0.289
13'45"	0.660	0.2095	0.7905	14.33	0.0029	4.196	0.293
14'35"	0.700	0.2222	0.7778	14.57	0.0029	4.196	0.288

Volume of Solids, $V_s = \frac{Ws}{G} = 52.98\ cm^3$

Volume of Voids, $V_v = V - V_s = 37.66\ cm^3$

Degree of Saturation, $S = \frac{V_w}{V_v} = 103.69\ \%$

Void Ratio, $e = \frac{V_v}{V_s} = 0.71$



φ = 10°
C = 0,12 kg/cm².

UNCONFINED COMPRESSION TEST

Project : Improving the Vientiane River port (LAKSI)
Description of Sample : Silty Soils
Boring No. 2 Sample No. 6 Tested by Kham Kone
Specific Gravity, G 2.71 Sample Depth 10.60m Date 22/10/87

1. WT. Wet Soils+Type	302.19 g	296.92 g		g
2. WT. Type	118.82 g	113.82 g		g
3. WTD Wet Soils	183.37 g	178.10 g		g
4. Diameter of Specimen	3.80 cm	3.80 cm		cm
5. Height of Sample	(3.15") 8.00 cm	8.00 cm		cm
6. Area Ao		11.33 cm^2		
7. Volumme of Sample		90.64 cm^3		
8. Unit Weight	Wet Density 1.99 g/cm^3	Dry Density 1.52 g/cm^3		

Water Content

9. Wet Wt. Soils+can	87.23 g	97.25 g		g
10. Dry Wt. Soils+can	74.16 g	80.19 g		g
11. Wt. Can	31.20 g	22.20 g		g
12. Wt. of Water	13.07 g	17.06 g		g
13. Wt. Dry soils	42.96 g	57.99 g		g
14. Moisture Content	30.42 %	30.60 %		%
	Average = 30.51 %			

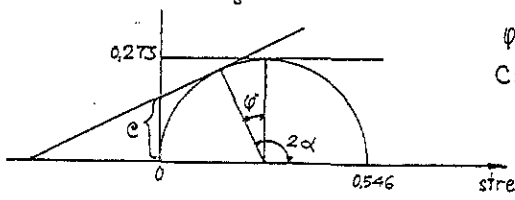
Elapsed Time min	Vertical Dial AH 0.001"	Strain ε=ΔH/H	1-ε	Corrected A = Ao/(1-ε)	Load Dial in 0.0001"	Axial Load P Kg	Stress P/A Kg/cm2
95"	0.020	0.00634	0.99366	11.40	0.0002	0.227	0.020
75"	0.060	0.0190	0.981	11.54	0.0006	0.907	0.078
2'05"	0.100	0.0317	0.9683	11.70	0.0012	1.701	0.145
2'55"	0.140	0.0444	0.9556	11.85	0.0019	2.776	0.234
3'45"	0.180	0.0571	0.9429	12.01	0.0026	3.628	0.302
4'35"	0.220	0.0698	0.9302	12.18	0.0033	4.649	0.382
5'25"	0.260	0.0825	0.9175	12.35	0.0038	5.443	0.441
6'15"	0.300	0.0952	0.9048	12.52	0.0044	6.123	0.489
7'05"	0.340	0.1079	0.8921	12.70	0.0048	6.804	0.536
7'55"	0.380	0.1206	0.8794	12.88	0.0050	7.031	0.546
8'45"	0.420	0.1333	0.8667	13.07	0.0050	7.031	0.538

Volume of Solids, $V_s = \frac{Ws}{G} = 51.10\ cm^3$

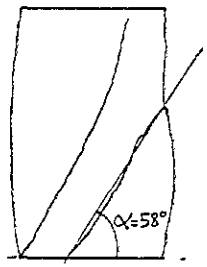
Volume of Voids, $V_v = V - V_s = 39.54\ cm^3$

Degree of Saturation, $S = \frac{V_w}{V_v} = 106.85\ \%$

Void Ratio, $e = \frac{V_v}{V_s} = 0.77$



φ = 26°
C = 0,17 kg/cm².



Project : Improving the Vientiane River port (AAKSI)
Description of Sample : Silty Sand
Boring No. 2 Sample No. 7 Tested by Kham Keo
Specific Gravity, G = 2.72 Sample Depth. 3.20 ÷ 3.40 m Date 22/10/87

1. WT. Wet Soils+Type	306.49 g	294.62 g		g
2. WT. Type	118.82 g	118.82 g		g
3. WTD Wet Soils	187.67 g	165.80 g		g
4. Diameter of Specimen	3.80 cm	3.80 cm		cm
5. Height of Sample (3.15")	8.00 cm	8.00 cm		cm
6. Area Ao		11.33 cm^3		
7. Volumme of Sample		90.64 cm^3		
8. Unit Weight	Wet.Density 2.06 g/cm^3	Dry Density 1.62 g/cm^3		
		Water Content		
9. Wet Wt. Soils+can	107.42 g	118.62 g		g
10. Dry Wt. Soils+can	89.53 g	98.44 g		g
11. Wt. Can	21.60 g	21.10 g		g
12. Wt. of Water	17.89 g	20.18 g		g
13. Wt. Dry soils	67.93 g	77.34 g		g
14. Moisture Content	26.40 %	24.09 %		%
	Average =	25.24 %		

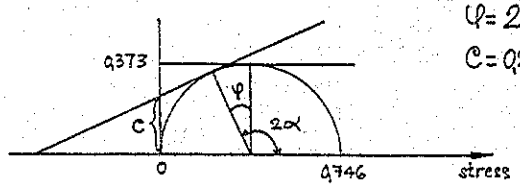
Elapsed Time min	Vertical Dial AH 0.001"	Strain E=ΔH/H	1-E	Corrected A = Ao/1-E	Load Dial in 0.0001"	Axial Load P Kg	Stress P/A Kg/cm2
25"	0.020	0.00634	0.9936	11.40	0.0003	0.340	0.029
75"	0.060	0.0198	0.9810	11.54	0.0010	1.360	0.118
2'05"	0.100	0.0317	0.9683	11.70	0.0016	2.268	0.194
2'55"	0.140	0.0444	0.9556	11.85	0.0024	3.402	0.287
3'45"	0.180	0.0571	0.9429	12.01	0.0031	4.422	0.368
4'35"	0.220	0.0698	0.9302	12.18	0.0037	5.274	0.433
5'25"	0.260	0.0825	0.9175	12.35	0.0043	6.010	0.487
6'15"	0.300	0.0952	0.9048	12.52	0.0049	6.917	0.552
7'05"	0.340	0.1079	0.8921	12.70	0.0055	7.824	0.616
7'55"	0.380	0.1206	0.8794	12.88	0.0058	8.165	0.634
8'45"	0.420	0.1333	0.8667	13.07	0.0063	8.958	0.685
9'35"	0.460	0.1460	0.8540	13.27	0.0066	9.412	0.709
10'25"	0.500	0.1587	0.8413	13.46	0.0068	9.638	0.716
11'15"	0.540	0.1714	0.8286	13.67	0.0072	10.206	0.746
12'05"	0.580	0.1841	0.8159	13.88	0.0073	10.349	0.743
12'55"	0.620	0.1968	0.8032	14.10	0.0074	10.432	0.740
13'45"	0.660	0.2095	0.7905	14.33	0.0075	10.600	0.740
14'35"	0.700	0.2222	0.7778	14.57	0.0075	10.600	0.727

Volume of Solids, $V_s = \frac{Ws}{G} = 54.38$ cm^3

Volume of Voids, $V_v = V - V_s = 36.26$ cm^3

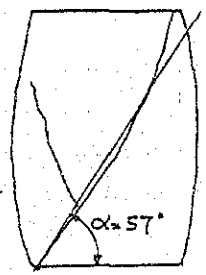
Degree of Saturation, $S = \frac{V_w}{V_v} = 107.03$ %

Void Ratio, $e = \frac{V_v}{V_s} = 0.67$



φ = 24°

C = 0.24 kg/cm^2



MINISTRY OF TRANSPORT AND POST

COMMUNICATION DESIGN AND RESEARCH INSTITUTE

REPORT TEST RESULTS

PROJECT : IMPROVING THE VIENTIANE RIVER PORT (LAKSI)

BED MATERIAL

(MEKONG RIVER)

OCT . 1987

LAO PEOPLE'S DEMOCRATIC REPUBLIC
PEACE INDEPENDANCE UNIT SOCIALIST
----ooo----

Ministry of Transport
and Post
Communication Design
and Research Institute

REPORT TEST RESULTS

Project : Improving the Vientiane River Port (LAKSI)
Origin of Sample :10Cm From Boring Number : 1 , Bed Material
(Mekong River)
Type of Material : Sand
Lab. Number : 0100/87
Test Begun on : 27/10/87 Completed on : 28/10/87

TEST RESULTS

(A) ATTERBERG LIMIT:

-Liquid Limit	(L.L)	0
-Plasticity Index	(P.I)	0

(B) SIEVE ANALYSIS:

-Sieve Size mm:	4.76	2.38	2.00	1.19	0.50	0.42 : 0.25
- % Passing	100	99.5	99.4	98.7	93.8	73.2 : 6.2

-Sieve Size mm:	0.149	0.074
- % Passing	1.7	0.1

(C) FINED MODULUS:

- F.M	2.001

(D) SPECIFIC GRAVITY AND ABSORPTION OF FINE AGGREGATE:

- Bulk Sp. Gr.	at 28°C	2.53 g/cm^3
- Bulk Sp. Gr. (Sat. Surface Dry Basis)		2.55 g/cm^3
- Apparent Sp. Gr.		2.59 g/cm^3
- Absorption Percent		0.928

Chief Eng.
Adj.

Seuk SOUKASEUM.

Vientiane 28 October 1987
Material-Laboratory Chief

Kingkham Ratthalangsy

LAO PEOPLE'S DEMOCRATIC REPUBLIC
PEACE INDEPENDANCE UNIT SOCIALIST
----ooo----

Ministry of Transport
and Post
Communication Design
and Research Institute

REPORT TEST RESULTS

Project : Improving the Vientiane River Port (LAKSI)
Origin of Sample : 20m From Boring Number :2,Bed Material
(Mekong River)
Type of Material : Silty Sand
Lab. Number : 0100/87
Test Begun on : 27/10/87 Completed on : 28/10/87

TEST RESULTS

(A) ATTERBERG LIMIT:

-Liquid Limit	(L.L)	0
-Plastic Limit	(P.L)	0
-Plasticity Index	(P.I)	0

(B) SIEVE ANALYSIS:

-Sieve Size mm:	2.00	1.19	0.50	0.42	0.25	0.149	:0.074
-% Passing	100	99.9	99.9	99.8	99.7	98.9	: 82.8

(C) SPECIFIC GRAVITY OF SOILS:

- Temperature	at 31°C	2.66 g/cm^3

Chief Eng.
Adj.

Seuk SOUKASEUM.

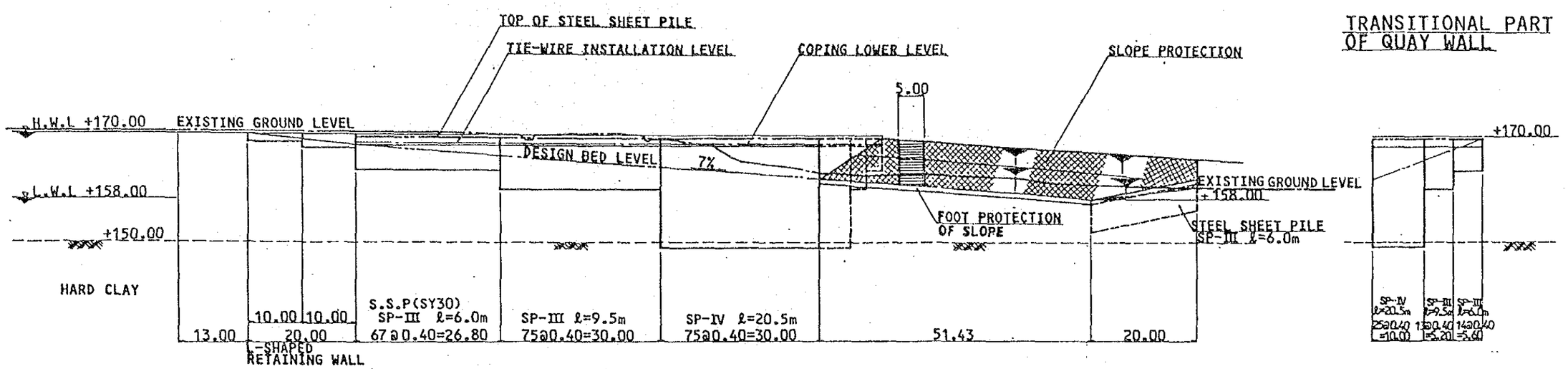
Vientiane 28 October 1987
Material-Laboratory Chief

KIngkham Ratthalangsy.

APPENDIX 12. Drawing of Mooring Facility

FRONT VIEW

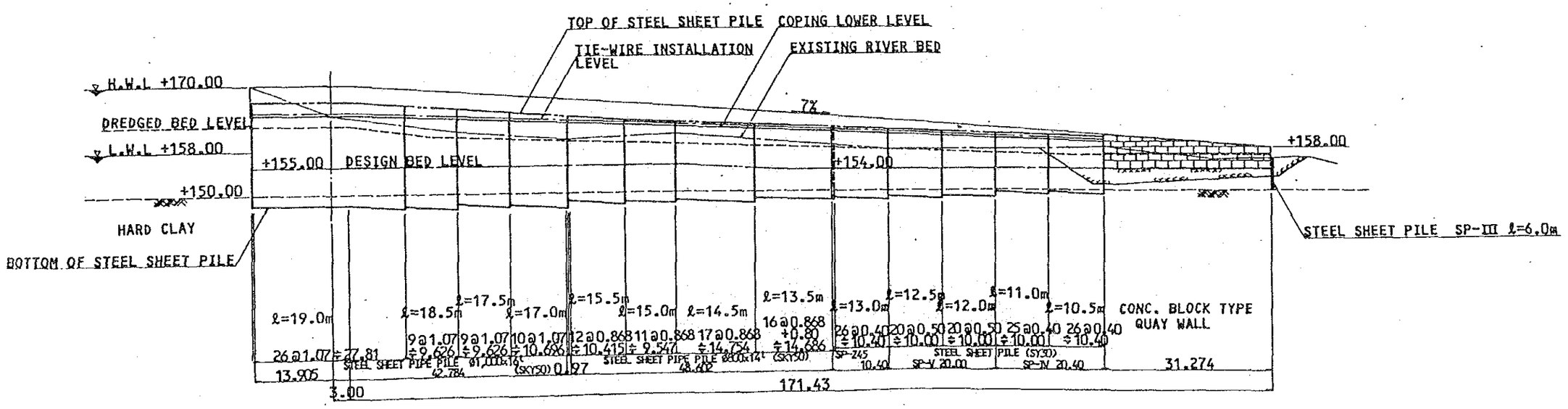
LAND - SIDE
(SECTION A-A)

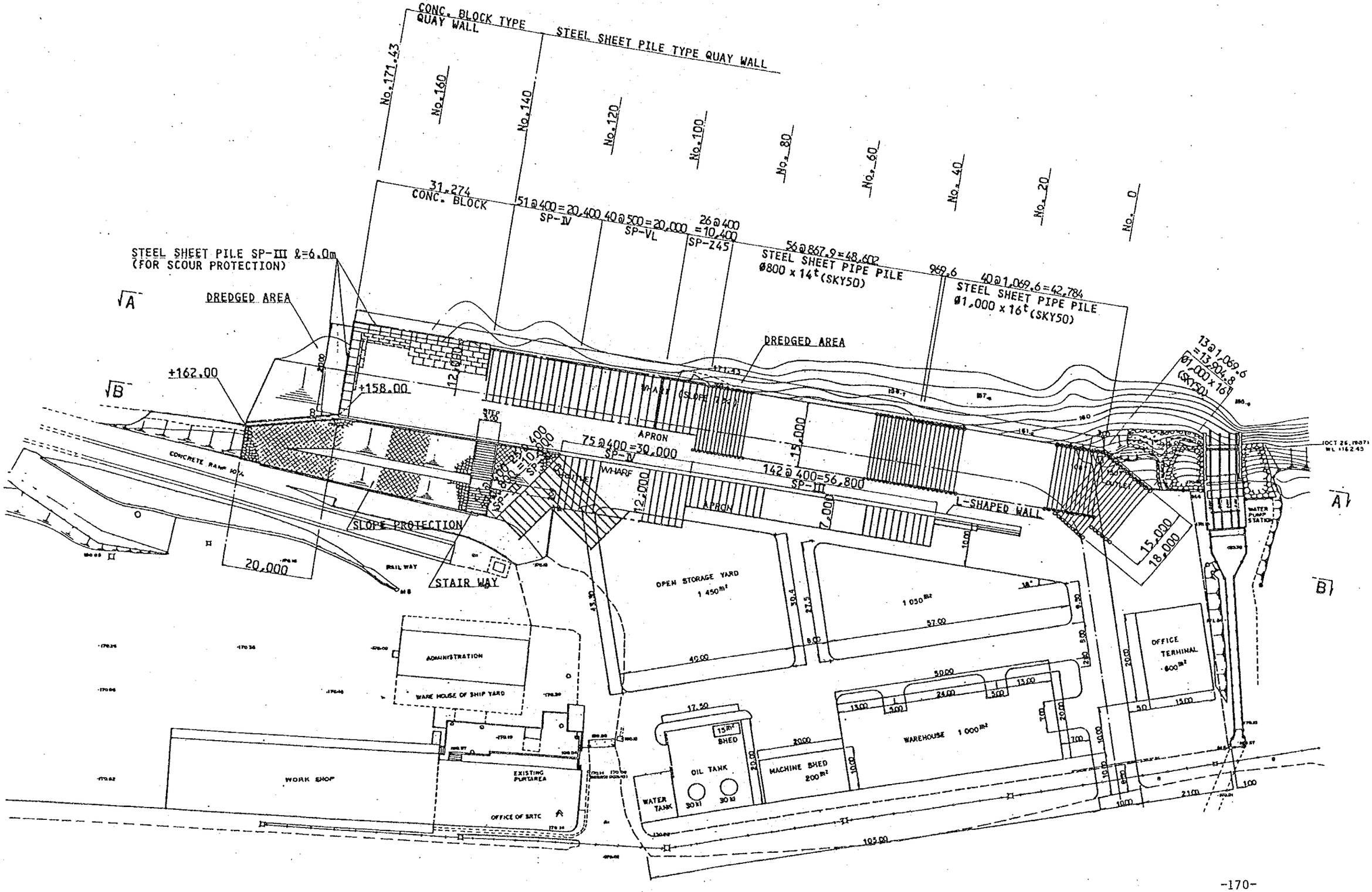


TRANSITIONAL PART OF QUAY WALL

No. 0 No. 20 No. 40 No. 60 No. 80 No. 100 No. 120 No. 140 No. 160 No. 171.43

RIVER - SIDE
(SECTION B-B)




CONC. BLOCK TYPE QUAY WALL
STEEL SHEET PILE TYPE QUAY WALL
No.171.43
No.160
No.140
No.120
No.100
No.80
No.60
No.40
No.20
No.0
31.274
CONC. BLOCK
51@400=20,400
SP-IV
40@500=20,000
SP-VL
26@400
=10,400
SP-245
56@867.9=48,602
STEEL SHEET PIPE PILE
Ø800 x 14t (SKY50)
969.6
40@1,069.6=42,784
STEEL SHEET PIPE PILE
Ø1,000 x 16t (SKY50)
13@1,069.6
=13,904.8
Ø1,000 x 16t
(SKY50)
STEEL SHEET PILE SP-III L=6.0m
(FOR SCOUR PROTECTION)
DREDGED AREA
DREDGED AREA
+162.00
+158.00
12.000
APRON
75@400=30,000
SP-IV
WHARF
142@400=56,800
SP-III
APRON
12.000
7.000
15.000
L-SHAPED WALL
SLOPE PROTECTION
CONCRETE RAMP ROAD
20.000
RAIL WAY
STAIR WAY
OPEN STORAGE YARD
1 450m²
1 050m²
40.00
57.00
ADMINISTRATION
WARE HOUSE OF SHIP YARD
WORK SHOP
EXISTING PUNTAREA
OFFICE OF SRTC
17.50
15m²
SHED
OIL TANK
30 kl
30 kl
WATER TANK
MACHINE SHED
200m²
20.00
WAREHOUSE 1 000m²
50.00
24.00
13.00
OFFICE
TERMINAL
600m²
15.00
21.00
105.00
15,000
18,000
WATER PUMP STATION
A
B
A
B

APPENDIX 13. Construction Situations in LAO PDR

Construction Situations

(1) Conditions Related to Construction Work:

1) Working Hours:

(a) Normal working hours (Monday to Saturday):
7:00 to 11:00 and 14:00 to 17:00, 7 hours a day. Sunday is an off day. Working hours vary slightly from the dry season to the rainy season, but the basic working hours are seven hours a day.

(b) Overtime Rate:
The overtime rate is 200% of the normal working hour rate. Work performed on Sunday's and holidays is considered to be overtime work.

2) Holidays:

There are six holidays in a year, they are:

New Year's Day:	1 January
Lao New Year:	14 to 16 April
Labour Day:	1 May
National Day:	2 December

3) Minimum Wage:

In LAO PDR, a minimum wage system has not been established.

4) Standards and Specifications for Design and Construction Work:

There are no set standards and specifications for the design and construction of structures. Each project uses it own standards and specifications decided upon by the engineers or cooperating countries concerned.

5) Actual Work Days:

Actual annual work days, after subtracting non work days due to heavy rains, etc., are assumed to be slightly less than 200 days.

(2) Construction Companies

1) Public Corporations:

In LAO PDR, actual construction work is undertaken by state companies that are substructures of Government offices. Some of the state companies are listed herewith:

- The Ministry of Transport and Post:
  - River Work Construction Co.: For construction work
  - State River Transport Co.: For management and transportation
- The Ministry of Construction:
  - State Construction Co.
  - Water Supply Co.
- The Ministry of Industry
  - State Electric Co.

The River Work Construction Co. engaged in the construction of the Keng Kabao Port under a Dutch main contractor, and the Tha Deua/Pak Khone Port under an Australian main contractor.

2) Private Companies:

There are private companies, but they are very small in size and their business activities are limited to small-scale construction, such as the building of houses.

3) General Description of the River Work Construction Company:

Seven Engineers:
- 4 port engineers
- 2 bridge and road engineers
- 1 hydrologist

Twelve technicians and temporary employees (when required).

The engineers were trained either in the U.S.S.R. or East Germany.

(3) Construction Equipment and Unit Rates

1) Construction Equipment:

Operational construction equipment owned by the River Work Construction Company are listed in Table A-7. The equipment was received from main contractors upon completion of large projects in the country. Generally speaking, equipment operation rates are low due to poor maintenance and lack of spare parts -- the equipment was made by a variety of manufacturers.

Renting equipment from other state companies is very difficult to do because each state company is under the control of a certain ministry and each ministry has its own priority projects.

2) Unit Rates:

The unit rate for each piece of equipment was obtained from the state company as shown in Table A-7.

Table A-7 Available Construction Equipment in the Project Area and Their Unit Rates

Equipment	Nos.	Efficiency	Price	Remarks
(1) Bulldozer D-6	1	50 %	117.u$/day	Excluding Fuel & Operator
(2) Grader 185HP 2.5mB	1	50 %	86.	
(3) Roller 8t	1	40 %	93.	
(4) Pay Loader 1.5	2	60 %	75.	
(5) Dump Truck 8t	6	50 %	46.	
(6) Hobile Crane 6t	1	60 %	2,060u$/month	All in
m nos (7) SEP with 4×4 Sput	1	60 %		L B 13.3m ×6.65m H D ×1.1m×0.5m.

Note: Equipment listed were obtained at the time of the Keng Kabao Port construction.

The River Construction Company also has a water tank (7 ton capacity), a 40 ton trailer, a concrete mixer, and a back hoe. All of this equipment is out of order.

As the above listed equipment is unreliable, new equipment must be imported for Project construction use.

(4) Wages

Wages (estimated by the state company) are listed in Table A-8.

Table A-8 List of Wages

Category	Rate (US$/day) (Normal Working Hours)	Remarks
· Engineer	3.80	
· Surveyor	3.80	
· Asst. Surveyor	3.00	
· Skilled Worker	3.40	Plasterer, Plumber, Carpenter, Painter,
· Heavy Eq.Op.	3.40	
· Driver & Light Eq.Op.	3.00	
· Foreman	3.40	
· Gen. Worker	2.60	incl.Watchman
· Secretary	2.60	

Received verbal confirmation that the wages of a technician dispatched from LAO Swedish Workship would be US$2.60 to $3.00/day; this is very reasonable pay.

(5) Material

The Study Team conducted market surveys for construction materials in three categories: local materials, available imported material, and Thai materials. Other materials necessary for Project construction must be shipped from Japan. Materials available in country are listed in Table A-9.

Table A-9 Construction Materials and Their Unit Prices

ITEMS	Given by River Construction Company	Surveyed by PCI Bangkok Office
a) Local Material:		
i) Stone & Sand:	US$	US$
. Filling Soil	2.90/m^3	
. Stone for rip-rap	16.00/m^3	
. Coarse aggregate for concrete	5.00/m^3	
. Sand for concrete	3.50/m^3	
ii) Timber:		
. Hard wood	120.00/m^3	
. Medium hard wood	100.00/m^3	
. Soft wood	86.00/m^3	
. Plywood, 120cm X 240cm X 2.5cm	8.60 to 9.00 ea	
. Plywood, 120cm X 240cm X 1.5cm	4.50 to 5.00 ea	
iii) Brick (strength of approx 100kg/cm^2):		
. 20.5cm X 10.5cm X 5.5cm	50.00/1,000 ea	
. 18.5cm X 8.5cm X 4.5cm	25.00/1,000 ea	
b) Available Imported Material:		
i) Cement		78.00/ton in Bangkok
. Thai made, ASTM Type I	87.00/ton at Thanaleng	116.00/ton in Bangkok
. Thai made, ASTM Type II		
ii) Reinforcing bar: (Made in Thailand)		
. Round bar, SR-24		432.00/ton in Bangkok
. Deformed bar, SD-30		420.00/ton in Bangkok
iii) . Bitumen (Made in Vietnam)	214/ton at Laksi	
iv) Ready-mixed concrete:		
. Strength of 200kg/cm^2	41.00/m^3*	

* Price was obtained from the state company of the Ministry of Construction.

(6) Transportation

1) Present Transportation Condition

As described in the previous section, major construction materials and equipment must be imported. There are two import routes: one is from the Da Nang Port in Vietnam via Routes 13 during the dry season or via the Mekong River during the rainy season; the other route is by making a boat crossing of the Mekong River between Nong Khai and Thanaleng ports. Presently, road improvement work to Routes 9 and 13 is being carried out; in any event, these routes are not reliable.

The import route via ferryboat from Vietnam is not suitable for transporting construction materials and equipment.

The import route via ferryboat from Thailand is a roll-on/roll-off type. It is suitable for transporting construction materials and equipment. In fact, the materials and equipment for the Tha Deua/Pak Khone Port construction were imported through this route.

As the latter route is the closest import route to the capital, Vientiane, more than half of the trade with Thailand passes over it.

For the above reasons, this import route will be used for transporting construction materials and equipment for the Project use.

2) Transportation Companies:

There are two transportation companies using the import route through Thailand:

(a) State Company (State River Transportation Company):
This state company is an external organization of the Ministry of Transport and Post and, specifically, is operating and managing the ferry transportation between Nong Khai and Thanaleng ports. However, it is possible to request that construction materials and equipment for the Project be transported from Nong Khai Port to the Port of Laksi.

(b) Express Transportation Organization (ETO):

This is a Thai transportation corporation that is conducting business exclusively with LAO PDR. This corporation will be available for transporting the Project's construction materials and equipment.

The unit transportation rates obtained from the above two companies are listed in Table A-10.

Table A-10 Unit Transportation Rates

----- Yokohama ——— (00) (0) ——— Nong Khai (1) ----- Thanaleng Ferry (2) - - Laksi (Project Site) (3)

Category	(0) - (1)	(1) - (2)	(2) - (3)
A) River Transportation Company		US$	
1. (Cargo + Vehicle) less than 23 tons		30.50/vehicle	
2. (Cargo + Vehicle) aove 23 tons		1.30/ton	
3. 10 ton truck			US$ 14.00 truck
4. Truck on road		9.00/truck	
5. Sedan on road		7.00/car	
B) River Construction Company			
1. 40 ton trailer			
2. On road from Da Hang to Laksi	US$ 41.00/ton		40.00 trailer
C) ETO /VLK	(0) - (2)		
1. From Bangkok Port to Thanaleng	43.50/m^3 or ton		
2. From Bangkok Port to Laksi	(0) - (3) 60.50/m^3 or ton		
3. From Japan to Laksi	(00)-(3) 110.00/m^3 or ton		

(7) Exchange Rate

Until recently, various exchange rates existed. With the stability of social conditions, the official exchange rate was fixed at 1 US$ to 350 Kips on September 1, 1987. However, the actual exchange rate in the markets varies from 350 to 400 Kips (average 380 Kips) per one U.S. dollar.

Most of the construction fees for two recent projects (construction of the Keng Kabao and the Tha Deua-Pakkhone ports) were paid for in U.S. dollars while some portion of the wages were paid for in Kips. As a matter of fact, most of the state companies desire to be paid in U.S. dollars for their services.

(8) State Electric Company and Water Supply Company

1) State Electric Company (EDL):

This company is the external organization of the Ministry of Industry (MOI); it performs electrical work exclusively.

The company's work includes not only the installation of power lines, but also branch lines. The company will install distribution power lines in the port area for the Project.

The prices for electrical work items are listed in Table A-11.

2) Water Supply Company:

This company is the external organization of the Ministry of Construction. The company undertakes the construction of main water supply lines exclusively. Piping installation in the port area of the Project may be undertaken by this company. Material costs estimated by the company are listed in Table A-12.

(9) Others

1) Communication Fee (Telephone and Telex):

US$5.00/minute.

2) Water Rates:

18 Kips/m^3 for household use.

Table A-11 Material Unit Price of EDL

Item	Description	unit	Unit Price
Pole (Concrete)	Approx, 12 m high	m	56
Wire	55mm²	m	0.80
Wire	1 mm²	m	0.20
Wire	2.5mm²	m	0.40
Fluorescent Lamp	100 w	ea	1.60
Fluorescent Lamp	60 w	ea	1.50
Switch	600 V, 15A	ea	1.40
Switch	sinple on/off switch	ea	0.40
Receptacle	single	ea	0.40
Bulb	Round Shape 100w	ea	0.40
Buld	Round Shape 60w	ea	0.40
Socket	for Fluorescent Lamp	ea	1.90
Socket	for Bulb (Round)	ea	0.40
Transformer(400KVA)	Main Volt /220V	ea	17,995
Switch Box	400 KVA	ea	5,065

Table A-12 Unit Price of Water Supply Work

Materials (only)	Description	Unit	Unit Price
φ75mm	PVC	m	7- US$
〃	Gal,Steel	m	13-
〃	Elbow	ea	15-
〃	Stopper(Plug)	ea	10.50 (36.50)
〃	Tap(Brass/Civalve)	ea	36.50 ／65.50
φ50mm	PVC	m	3.60
〃	Gal,Steel	m	7-
〃	Elbow(90°)	ea	5.40
〃	Stopper(Plug)	ea	2.10 (27-)
〃	Tap(Brass)	ea	27-
φ25mm	PVC	m	1.20
〃	Gal,Steel	m	3.10
〃	Elbow(90°)	ea	1.70
〃	Stopper(Plug)	ea	0.90 (13.50)
〃	Tap(Brass)	ea	13.50
φ12mm	PVC	m	0.90
〃	Gal,Steel	m	1.80
〃	Elbow(90°)	ea	0.60
〃	Stopper(Plug)	ea	0.40 (6.80)
〃	Tap(Brass)	ea	6.80

16 Kips/m^3 for official use
(Project use is in this category).

US$0.16/$m^3$ for diplomatic use.

3) Electricity Rates:

7 Kips/kw.hr for household use

5 Kips/kw.hr for official use
(Project use is in this category).

US$0.06/kw.hr for diplomatic use.

4) Fuel (State Fuel Company):

Gasoline:	0.42 US$/litre
Diesel Oil:	0.40
Lube Oil:	1.20
Spirax 90HD:	1.35
Retinax A:	1.70
Donax B:	2.70

5) Lao Swedish Workshop:

This workshop is the state company established under the Ministry of Transport and Post and undertakes the repair of heavy equipment. The workshop facilities and the staff's work skills are very reliable. Presently, six Swedish technicians are providing instructions to staff members regarding management and repair techniques.

6) Lodging:

(a) Hotel:

Monthly contract: US$12.00/day/single

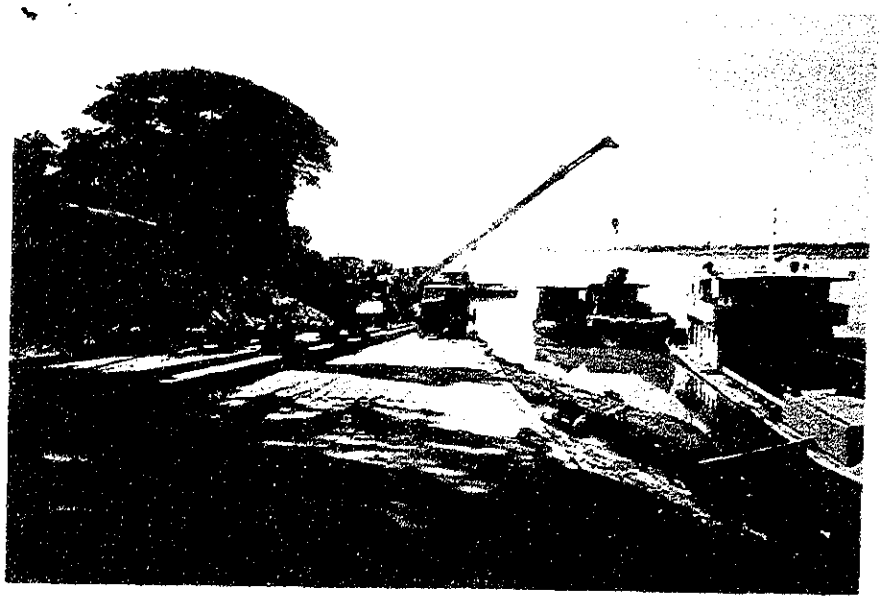
(b) Rental House:

The price varies largely from house to house, ranging from US$500 to $1,000/month for a three-bedroom house. A house for a foreigner costs about US$1,000/month.

APPENDIX 14. Area Photographs

Overall View of the Project Site

Ramp



Cargo Handling Work

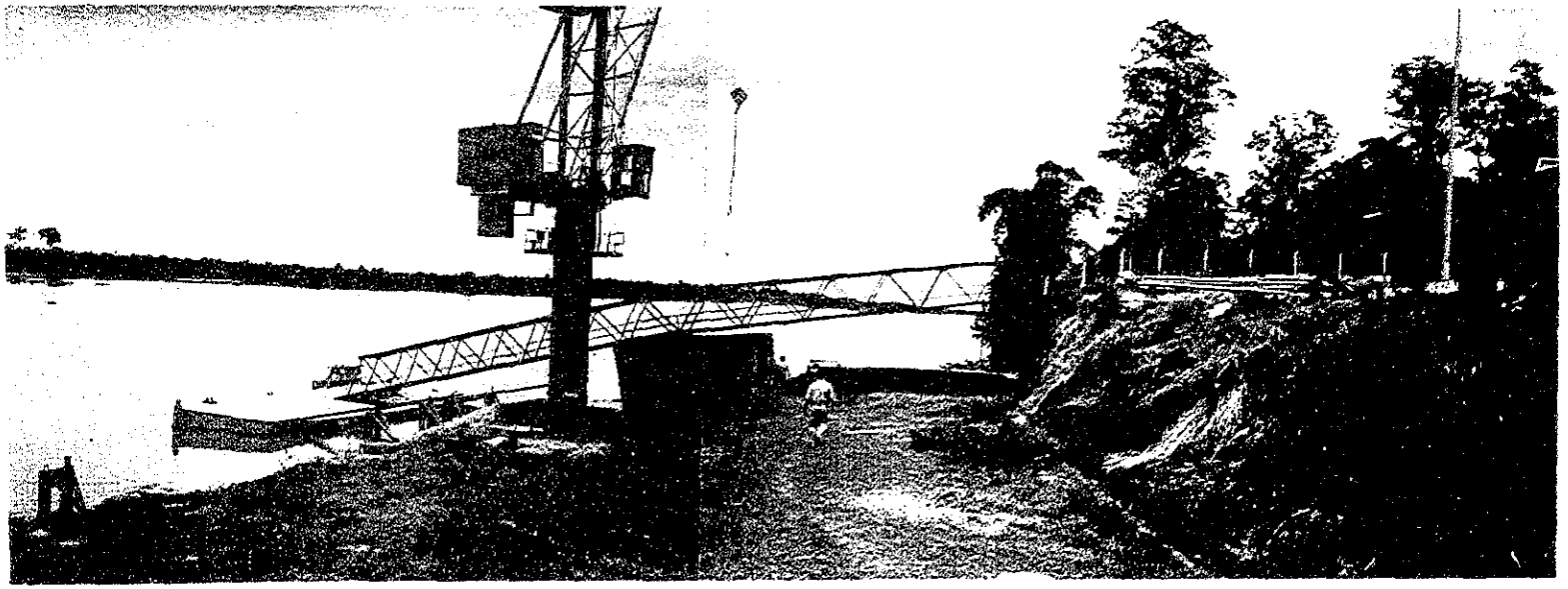
(1) Port of Laksi

Existing Ramp

Existing Warehouse,etc

Existing Gate

(1) Port of Laksi



(2) Keng Kabao Port

(3) Savannakhet Port