

**WORK PLAN
FOR
IRRIGATION ENGINEERING**

**Irrigation Technology Center Project
Irrigation Department**

by

**Mr. C. Kajiwara
and
Counterparts**

August 26, 1993

IRRIGATION ENGINEERING

1. Background

The Union of Myanmar is an agriculture-based country with 75% of its population living in rural areas. Its economy depends chiefly on agriculture sector accounting for 40% of the 1989/90 GDP and employed 66% of the labor force. It plays a vital role in fulfilling the food requirements for domestic consumption and obtaining foreign exchange as well.

There is enough food for all in the country but the population is fast growing. The population of the country rose above 40 million and expected to reach 50 million by the end of this century.

The government publication review of the financial, Economic and Social conditions for 1992/93 says out of the total area 167 million acres, the net area sown is only 20 million acres or 12%.

The cultivable waste land is about 20.6 million acres and the fallow land is about 4.8 million acres that could be reclaimed.

Irrigation in Myanmar is presently applied to 12.3% or crop land of 2,520,927 acres. The area sown more than once, multiple cropping is only 2.0% of the net area sown. The remaining 98% of the land is idle of more than six months of the year because of two extremes in the water situation, the flooding in monsoon season and the drought in the dry season.

It is clear that water procurement is the major constraint for agriculture in Myanmar. Therefore, for future land and water resources development and construction of irrigation networks together with drainage, and in certain parts of the flood protection, are essential for agriculture development.

2. Objectives

The Irrigation Technology Center Program is to be carried out mainly for the purpose of upgrading irrigation technology in Myanmar. To this end six fields of activities such as Irrigation Engineering, Data Analysis, and Design Criteria had been selected.

The objectives of this field's activities are to transfer technical knowledge for irrigation and drainage. For this purpose, the technical discussion between the Myanmar counterpart personnel and the Japanese experts will be made in order to improve techniques in planning,

design and construction of irrigation and drainage projects. These personnel, in turn, will diffuse the technical knowledge to the engineers in the Irrigation Department.

3. Plan of Activities in 1993/94

The main activities of this field consist of collection and analysis of relevant data and information on irrigation projects, survey and analysis of field irrigation practice and conduct case study on irrigation network project.

3-1. Collection and analysis of data and information irrigation projects

Following data and information concerning irrigation and drainage projects will be collected and examined depending on the project features.

- Source and storage of irrigation water
- Main structures (Works)
- Water resource
- Topographical and geographical data
- Agro-economic data
- Others

2-2. Survey and study on practice of field irrigation management

Collection of data, information, and field survey will be made on order to analyze practice of irrigation and drainage in Myanmar. Items for investigation are as follows.

- Irrigation practices
- On-farm irrigation and drainage system
- Operation and maintenance
- On-farm water management

2-3. Case study on Irrigation Network Project

The Irrigation Technology Center is located near Bago, with total land area of 40 acres approximately. One third of these acres is occupied by buildings and two thirds of them are open fields that can be cultivated.

According to the instruction given by Director General of Irrigation Department, Irrigation Technology Center introduces a mini irrigation scheme in its campus. The main objectives of the construction of irrigation network are to get the knowledge of irrigation and

water management works in the field and to give practical training to the Irrigation Department personnel through training.

This project was proposed to be carried out in cooperation with Japanese experts and Myanmar counterparts.

Seminar on the case study will be held at the end of the technical cooperation period. The result of activities of the case study is to be presented at the seminar by respective counterparts.

This project will be included with construction of small hydraulic structures such as Siphon, Check, Drop, Weir, Culvert, Flume, Check-drop and Tune-out structures. Sprinkler systems and drip irrigation system will be also included in this project.

Farm roads, artificial river, and Earth dam with conduit and spillway will be constructed. This case study will be implemented up to the end of ITC project.

4. Evaluation

The objective of this fields activities are to contribute for planning and designing of irrigation development works in ITC. These objectives could be materialized through the counterparts who do the activities with the experts. The experts will transfer their technical knowledge to the counterpart, who will put acquired knowledge into practical application in planning, design, and construction work of irrigation projects.

It must be required as soon as possible to achieve the final result of this field. The performance of these field activities will have to be evaluated by means of some programs.

5. Implementing plan

5-1. Japanese Expert

According to the Record of Discussions, the field of Irrigation Engineering is covered by the team leader.

Short-term experts in irrigation engineering will be dispatched from Japan as occasion demands.

5-2. Counterparts

Appendix - 4

The Irrigation Department should assign counterpart personnel who are engaged in the activities together, They shall make all necessary arrangement for field survey, collection of materials and coordination with other of the government works concerned in Myanmar.

Table 1. Long-term Experts and Counterparts

Name	From	To	Remarks
Long Term Experts			
1. Mr. M. Taguchi	27 - 9 - 89	31 - 3 - 92	Coordinator
2. Mr. N. Tamura	1 - 4 - 92	31 - 3 - 93	Team Leader
3. Mr. C. Kajiwara	19 - 5 - 93	31 - 3 - 95	"
Counterparts			
1. U MD Than Aung	14 - 8 - 91	28 - 9 - 92	Assistant Director
2. U Myo Myint Aung	25 - 5 - 93	Present	Staff Officer
3. U Khin Maung Myint	25 - 5 - 93	"	"
4. U Zaw Htut Oo	25 - 5 - 93	"	"

5-3. Provision of equipment

Technical aids and necessary apparatus should be supplied to ITC within the budget.

5-4. Implementation schedule

The tentative schedule of Irrigation Engineering and the annual schedule in 1993/94 are shown in Table 2 and Table 3, respectively.

Table 2. Tentative Schedule of Irrigation Engineering

Activities	Fiscal year:		1991		1992		1992		1993		1993		1994		1994		1995		
	Apr:	Mar:	Apr:	Mar:	Apr:	Mar:	Apr:	Mar:	Apr:	Mar:	Apr:	Mar:	Apr:	Mar:	Apr:	Mar:	Apr:	Mar:	
- Collection and analysis of data information Concerning irrigation technology																			
(1) Collection of data and information on Irrigation Projects																			
(2) Survey and study on practice of field irrigation management																			
(3) Case study on Irrigation Network Project included with seminar.																			

Table 3. Annual Schedule in 1993/94

Activities	Month	1993 A	1993 M	1993 J	1993 J	1993 A	1993 S	1993 O	1993 N	1993 D	1994 J	1994 F	1994 M
- Collection of data / information for the irrigation Network project													
- Survey and study on practice of field work.													
- Preparation for Case study.													
- Field investigations and Construction													

WORK PLAN
FOR
DATA ANALYSIS

Irrigation Technology Center Project
Irrigation Department

by

Mr. M. Kashiwabara
and
Counterparts of Data Analysis

August 26, 1993

WORK PLAN OF DATA ANALYSIS

1. Introduction

This work plan is prepared to deepen mutual understanding of the activities in the field of Data Analysis in the ITC Project. The master plan has been made in accordance with the Record of Discussions, TSI and the master plan of ITC. This Work Plan has been modified suitably for the present condition of the Irrigation Department according to progress of activities of past 2 fiscal years (1991, 1992). The detail is given in Article 7.

2. Background

Nowadays, computer technology in the world is progressing remarkably. Irrigation Technology such as planning, designing, estimating and constructing are carried out using the computer in order to calculate and analyze on every study. It is not too much to say that progress of this field is supported by computer technology.

In the Irrigation Department, it is strongly desired that computer utilization will become popular in the field of Irrigation Technology and in daily office work.

Since computer utilization in Myanmar has been carried out only partly in the field of irrigation and drainage technology, systematization of computer utilization has not yet established up to now. The actual condition is that almost all of the engineer staff personnel have a little knowledge of computer utilization in their work, because there were only a few computers used in the office work in the Irrigation Department.

Therefore, further utilization of the computer is absolutely essential for upgrading and rationalizing irrigation technology in future.

3. Objective

The main objective is to establish computer utilization for irrigation technology and to upgrade existing condition of it.

Concept of Computer System for Irrigation Department (Proposal future plan) is shown in ANNEX-1.

For accomplishing this work, it could take a lot of time and needs a steady effort. Elements for computer utilization consist of the following four;

- Computer facility : Equipment for computer utilization.
- Human resources : Person who has an ability to use computer effectively in his work.
- Organization : Computer, data and program are utilized effectively in the Irrigation Department.
- Technology : Application of computer utilization in irrigation technology.

When these elements function effectively in the Irrigation Department, stored data, developed technical calculation program and so on will be utilized sufficiently in daily office work through systematic utilization such as Data Base Management System and Program Library System.

The most important thing is that engineers become skilled persons who can systematically put the computer utilization into practice on irrigation technology and can manage and maintain it by themselves.

The field of Data Analysis covers many various fields such as not only irrigation and drainage technology but also computer science, training technique and so on. Technical cooperation is to be carried out to give technical guidance and advice to the counterpart personnel on the most fundamental part of using the computer in order to promote and upgrade irrigation and drainage technology.

Main parts of this field for technical transfer to be carried out are as follows:

- 1) Know-how of System development for data analysis.
- 2) Know-how of System development for technical calculation program library.
- 3) Maintenance and improvement of the existing computer system.
- 4) Know-how of training technique on computer utilization.

4. Plan of Activity (4/1992 - 3/1995)

4.1 Case Study of System Development for Data Analysis

The objective of this part is to establish systematization of 3 (three) items, data collection, data analysis and information exchange. Accordingly know-how of these 3(three)

items are to be studied through the case study on the data of existing projects at different location.

4.1.1 Data Base Management System on Technical Data

This item aims at mastering know-how of DBMS and publishing yearbook regularly every year.

- To establish the "Plan of DBMS" in future.
- To collect the hydrometeorological data of the case study areas.
- To create file management system and data structure on case study using HYMOS application software.
- To publish sample yearbook for hydrological and meteorological data on case study.

4.1.2 Analysis on Data Stored DBMS

This item aims at mastering know-how of analysis system that engineer can easily analyze using computer on irrigation technology data.

- To introduce outline of analysis for stored Hydrological and Meteorological data on case study.
- To instruct basic knowledge on hydrometeorological analysis by short- term expert.

4.1.3 Study of Information Exchange on Data Stored DBMS

This item aims to establish data communication system by using personal computers in future.

- To investigate possibility of data communication system by considering existing conditions.
- To introduce basic knowledge of data communication by short-term expert.
- To establish data communication system for Hydrometeorological data between ITC and ID (Yangon) to cooperate with other sections.

4.2 System Development of Technical Calculation Program Library

The objective of this part is to establish 2(two) items, one of them is development of a systematic manual for Technical Calculation Program and the other is development of a cooperation system between concerned sections. Accordingly, know-how of these 2(two) items should be studied through case study.

4.2.1 Study of the Existing Technical Programs

This item aims to master know-how of editing and publishing on program library so that engineers can easily understand how to use technical calculation programs in their works. In addition, it needs to cooperate with concerned sections so that program library could be established by reflection of user's opinion.

- To establish the "Program Library System" in Irrigation Department.
- To collect computer programs and make a list.
- To develop sample program manual.

4.2.2 Cooperation on Computer Utilization

This item aims to establish cooperation on computer utilization system for advanced technology requested by other technical sections such as Hydraulic design, Hydraulic simulation, structural design, Irrigation project planning and so on.

This item is difficult to implement under the present condition.

4.3 Study on Other Technical Supporting System

The objective of this part is to establish the plan of computer utilization and improvement of the existing computer system suitable for progress of the project. Accordingly, computer utilization in future should be studied through considering case study and other fields of technical cooperation.

- To establish the "plan of computer utilization" in future.
- To support improvement of existing computer system.
- To train operating and maintenance of MS-4100 Computer System.

4.4 Training on Computer Utilization

The purpose of this part is to establish training system for computer utilization. Accordingly, training on computer utilization is to be carried out for irrigation engineers and staff personnel to build up skilled engineers in this field according to the schedule. In addition, know-how of giving instruction for training should be studied.

- Classification of computer training courses.
- To establish the "Training System" for computer utilization.
- To prepare teaching materials and lecture notes for each course.

4.4.1 Computer Training Course

1) Elementary Course (Basic Computer Training Course)

This training is for real beginners who have never used a computer and to have trainees take an interest in computer utilization. This training is to be carried out 2(two) times per year.

2) Intermediate Course (Intermediate Computer Training Course)

This training is for those who have completed the elementary course or have used computers in their work. This training is to be carried out 2(two) times per year.

3) Operator Course

This training is for the staff personnel of the Computer section who are to be engaged with MS-4100 as expert operators utilizing MS-4100 for the storage of future irrigation data. This training is to be carried out 1(one) time per year.

4) Special Course

This training is for mastering adaptation of special application software in the work. This training is to be carried out 1(one) time per year.

5. Evaluation

Performance of this field is to be evaluated at the end of the project. The key is whether engineers become skilled person who can systematically put the computer utilization into practice on irrigation technology and can manage and maintain it by themselves.

Therefore following items are to be evaluated.

5.1 Case Study of System Development for Data Analysis

- Whether the Plan of DBMS in future has been prepared.
- Whether the counterpart personnel has mastered know-how of DBMS.
- Whether the counterpart personnel has mastered basic knowledge of data analysis and basic knowledge of data communication system.

5.2 System Development of Technical Calculation Program Library

- Whether the Program Library System has been prepared.
- Whether the counterpart personnel has mastered know-how of development of program library.

5.3 Study on Other Technical Supporting System

- Whether the Plan of computer utilization in future has been prepared.
- Whether existing computer system has been studied and improved for computer utilization in future.
- Whether the counterpart personnel has mastered know-how of operating and maintenance system for the computer system.

5.4 Training on Computer Utilization

- Whether the Training System has been prepared.
- Whether the counterpart personnel has mastered know-how of teaching techniques.
- How many training courses has been carried out.

6. Implementing Plan

6.1 Assignment of work

Both the Japanese and the Myanmar sides must support the activities systematically to their utmost ability.

The expert and counterpart list is shown in Table - 1.1.

6.1.1 Japanese Expert

Technical guidance and training on data analysis are to be given to counterpart personnel and necessary arrangements for improvement of the computer utilization are to be supported according to the plan of activity. Short term experts on computer utilization are to be dispatched from Japan as occasion demands.

6.1.2 Counterpart

Working groups, in which the leader is counterpart, are to be organized to take charge of each item of the activity in the computer section of ITC. All planned activities of the field are to be carried out under the guidance of the expert which involve considering the detailed working plan, collecting necessary data and studying the technology which will be developed in the cooperation. Furthermore, counterpart should master know-how of them and transfer the mastered know-how to the younger generation.

Table - 1.1 Long-term Expert and Counterpart

Name	Duration	Remarks
Long-term Expert		
1. Mr. Y. Ishikawa	2 / 6 / 88 to 10 / 9 / 88	
2. Mr. M. Kashiwabara	1 / 4 / 91 to 31 / 3 / 93	
Counterpart		
1. U Maung Maung Than	4 / 91 to 4 / 93	
2. Daw Thwe Thwe	* 11 / 91 to 4 / 93	* Alternate up
3. Daw Htay Htay Win	* 11 / 91 to	to 4/93
4. Daw Aye Aye Hlaing	7 / 92 to	
5. Daw Toe Toe Maw	7 / 92 to	

6.2 Provision of Equipment

Necessary equipment for carrying out this field is to be supplied within the provided budget according to the progress of the project.

6.3 Implementing Schedule

- * The Tentative Schedule of Data Analysis (4/1991 - 3/1995) is shown in ANNEX-2.
- * Annual Schedule (1993/94) is shown in ANNEX- 3.

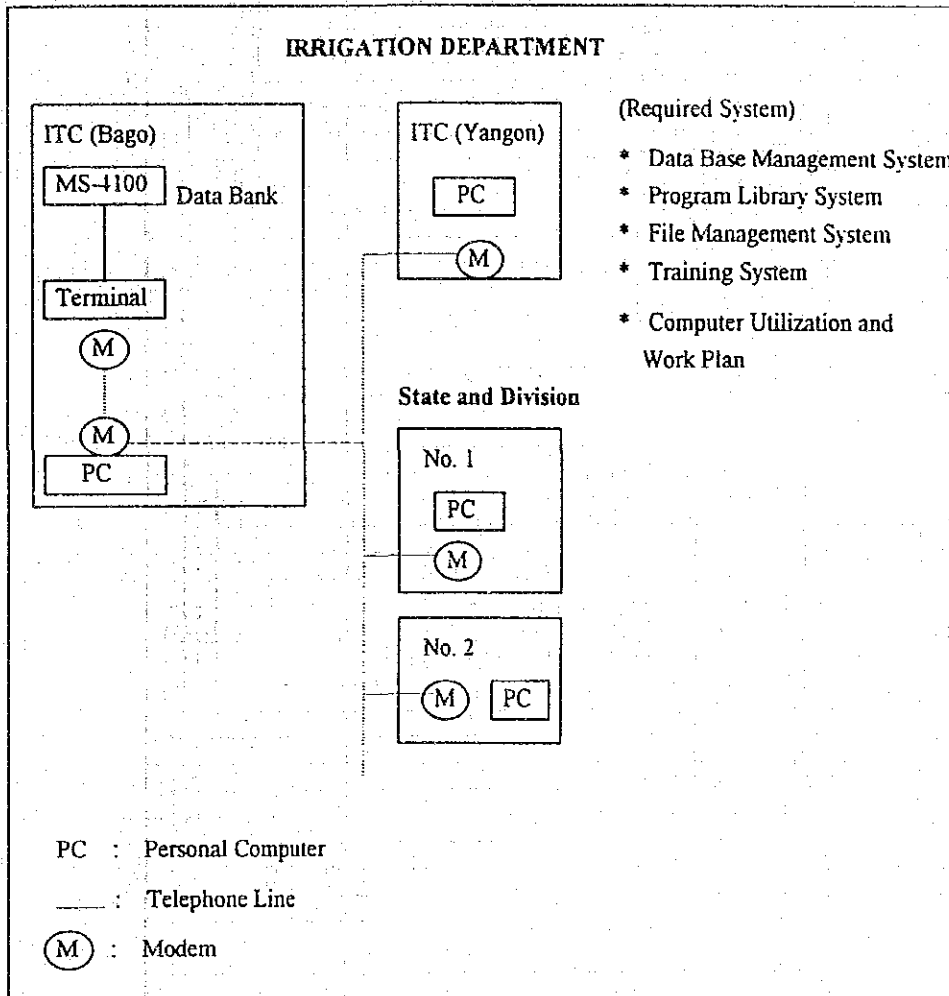
7. Evaluation of Implementation

- * Evaluation of implementation (4/1991 - 7/1993) is shown in ANNEX-4.

ANNEX-1

Concept of Computer System for Irrigation Department

(Proposal future plan)



ANNEX - 2
 Tentative Schedule of Data Analysis (4/1991 - 3/1995)

(1/2)

Item	Fiscal year												Remarks												
	1991/1992				1992/1993				1993/1994					1994/1995											
	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
1) Case Study of System Development for Data Analysis Data Base Management System - Establishment of "Plan of DBMS". - Collection of data for case study. - Creation of file management system and data structure for HYMOS. - Publishing a sample year book for hydrological and meteorological data.																									Actual: _____ Plan: _____ Suspend: _____
B) Analysis on Stored DBMS - Introduction of outline of analysis. - Instruction of basic knowledge of hydrometeorological analysis by short term expert																									
C) Study of Information Exchange on Data Stored DBMS - Investigation of possibility of data communication system - Introduction of basic data communication - Establishing data communication between JTC and Yangon ID Head Office.																									
2) System Development of Technical Calculation Program Library Study of the Existing Technical Programs - Establishment "Program Library System". - Collection of program and making list. - Development sample program manual.																									

ANNEX - 2
Tentative Schedule of Data Analysis (4/1991 - 3/1995)

(2/2)

Item	Fiscal year												1993/1994												1994/1995												Remarks										
	Month																																														
	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3											
3) Study on Other Technical Supporting system - Establishment of "Plan of Computer Utilization" - Supporting for improvement of existing computer system. - To train operating and maintenance. (Switch to Training on Computer Utilization)																																															
4) Training on Computer Utilization - Classification of training course. - Establishment of "Training System". - Elementary Course (Basic Computer Course) - Intermediate Course - Operator Course (by short term expert) - Special Course (OS Training Course) - Special Course (Survey software course)																																															

ANNEX - 3

**Data Analyst
Annual Schedule (1993 / 1994)**

1. Plan of Activity (1993/1994)

Plan of activity for fiscal year (1993/1994) should be decided according to not only the Work Plan but also the result of activities in 1992/1993. Therefore, we always have to review progress of each activity and should revise the plan of activity according to actual progress when necessary.

As a result of technical cooperation activities of past 2 years, it has been found out that the foundation of computer utilization in the Irrigation Department has not been established sufficiently. It is indispensable to accomplish the goal to put computer utilization into practice on irrigation technology without establishing it. In this field, it is the focus of activity to establish the foundation of computer utilization during the technical cooperation term from now on.

Annual Schedule in 1993/1994 is shown in Table - 3.1.

1) Case Study of System Development for Data Analysis

1)-1 Data Base Management System on Technical Data

- To prepare the "Plan of Data Base Management System (DBMS)" by Data Bank System in order to implement DBMS systematically.
- To create file management system and data structure on case study using HYMOS application software.

1)-2 Analysis on Data Stored DBMS

- To introduce outline of analysis of stored Hydrological and Meteorological data on case study.
- To hold Hydrology Training Course by short-term expert

1)-3 Study of Information Exchange on Data Stored DBMS

- To investigate possibility of data communication system by considering existing condition.
- To introduce data communication system by short term expert.

2) System Development of Technical Calculation Program Library

2)-1 Study of the Existing Technical Programs

- To prepare the "Program Library System (Draft)" in order to develop and utilize programs systematically. A manual for Program Library System is to be prepared.
- To develop sample program manuals.

3) Study on Other Technical Supporting System

- To establish "Plan of Computer Utilization in future".
A manual is to be prepared.

4) Training on Computer Utilization

- To hold the following training courses.
- To prepare the "Training System (Draft)" in order to implement computer training systematically. A manual for implementation of training is to be prepared.

TABLE - 3.2 Schedule of Training Course (Tentative)

Course	Date	Participant	Place
Basic Computer Course No. 6	May / 1993 (2 weeks)	10	Bago
No. 7	Nov / 1993 (2 weeks)	10	
No. 8	Mar / 1994 (2 weeks)	10	
Intermediate Computer No. 3	Jun / 1993 (3 weeks)	10	Bago
No. 4	Jan / 1994 (3 weeks)	10	
Computer Operator's Course (NEC MS-4100)	Feb / 1994 (3 weeks)	10	Bago
Special Course * Survey Software Course	Aug / 1993 (1 weeks)	10	[Bago [Yangon

5) Short-term Expert

It is planned that the following short-term experts will be dispatched from Japan.

- Hydrology expert
As part of the training course, technical calculation for Hydrology through computer utilization is to be lectured to personnel staff concerned in December.
- System engineer

As part of the training course, NEC-MS-4100 Operating System, Data Bank System and concept of data communication are to be instructed to computer staff concerned in February 1994.

6) Provision of equipment

It is planned to provide computer equipment for activities. Main equipment is as follows;

- Computer training : 10 personal computers (IBM/AT)
- Technical calculation : 2 personal computers (IBM/AT)

TABLE - 3.1.
Annual Schedule of Data Analysis (93/94)

(1/2)

Activities	Month	4	5	6	7	8	9	10	11	12	1	2	3	Remarks
1) Case Study of System Development for Data Analysis														
1)-1 Data Base Management System														
- Establishment of "Plan of DBMS"														
- Collection of data for case study.														
- Creation of file management system and data structure.														
1)-2 Analysis on Stored DBMS														
- Introduction of basic of data analysis on case study.														
- Hydrology Training Course by short term expert														
1)-3 Study of Information Exchange on Data Stored DBMS														
- Investigation of possibility of data communication system														
- Introduction of data communication system (in Operator Course)														
2) System Development of Technical Calculation Program Library														
2)-1 Study of the Existing Technical Programs														
- Establishment "Program Library System", (Draft)														
- Development sample program manual.														

Actual: _____
Plan: _____
Suspend:

TABLE - 3.1.
Annual Schedule of Data Analysis (93/94)

(2/2)

Activities	Month	4	5	6	7	8	9	10	11	12	1	2	3	Remarks
3) Study on Other Technical Supporting system - Establishment of "Plan of Computer Utilization"														
4) Training on Computer Utilization - Preparation of "Training System (Draft)" - Elementary Course (No. 6,7,8) - Intermediate Course (No. 3,4) - Operator Course (by short term expert) - Special Course (Survey software)														
			6											
				3										
										7				

ANNEX - 4

Data Analysis

Evaluation of Implementation (4/1991 - 7/1993)

1. Activity and Result

ITC Project has carried out the activities according to the Work Plan in order to improve and upgrade computer utilization in the Irrigation Department since a long-term expert for Data Analysis, Mr. M. Kashiwabara, was dispatched in April, 1991. At the same time, as a result of activities, the effects were obtained up to July, 1993.

1.1. General Activity and Result

Activity : Implementing according to the Work Plan.

Result : The general progress except for Study on Other Technical Supporting System and Training on Computer Utilization is behind.

In the beginning stage, it was expected that counterparts staff personnel who had fundamental knowledge of computer utilization were assigned to each part. At present, assigned counterparts are selected from persons who have finished our computer training courses.

Therefore, they have to master fundamental knowledge of computer utilization at the moment so that they can get advanced technology in future. It takes a little long time to become skilled person for computer utilization. They also have to take charge of lecturer at training time.

1.2. Case Study of System Development for Data Analysis

Progress of activity, counterpart, equipment and short-term expert are shown in Table -

4.1. Summary of activities are as follows;

- 1) Activity : Plan for Data Base Management System is being studied.
Result : Draft of it is to be prepared in future.

The key is that counterpart has general knowledge of computer utilization

- 2) Activity : Introduction of basic knowledge on Hydrology by a short-term expert, Dr. Y. Hayase.
Result : It seemed a little difficult for trainees to understand it.

1.3. System Development of Technical Calculation Program Library

Progress of activity, counterpart, equipment and short-term expert are shown in Table -

4.2. Summary of activities are as follows;

- 1) Activity : Example of program manual is being studied.
Result : Program Library System is to be established in future.

As counterparts were assigned to this task alternate weeks, they could not concentrate to carry out their tasks according the Work Plan.

1.4. Study on Other Technical Supporting System

Progress of activity, counterpart, equipment and short-term expert are shown in Table -

4.3. Summary of activities are as follows;

- 1) Activity : Provision of personal computers for each TCP field.
Result : Computer utilization in daily office work has now become more in friendly-use than before.

Furthermore, it has been recognized deeply how useful the computer is. Enough numbers of skilled persons are to be posted for efficient computer utilization.

- 2) Activity : Improvement of NEC MS-4100 Super Mini Computer by short-term experts, Mr. S. Homma, Mr. S. Shinpuku and Mr. K. Ebina.
Result : NEC MS-4100 System has the function as Data Bank System.

Data Base Management System is to be organized using this function. The key is to establish Data Base Management System for irrigation data in future.

- 3) Activity : Training on NEC MS-4100 Operating System and Data Bank System by a short-term expert, Mr. S. Shinpuku.
Result : Trained computer staffs have gained knowledge to be able to operate and maintain NEC MS-4100.

The key is that trained persons utilize and review it.

1.5. Training on Computer Utilization

Progress of activity, counterpart, equipment and short-term expert are shown in Table -

4.4. Summary of activities are as follows;

- 1) Activity : The following training courses were held. (Table -4.5)
Result : The foundation of Computer Training System has been established.

As computer training is one of the most important subjects in the Work Plan, all computer staff personnel were engaged in it during computer training courses.

TABLE - 4.5 Held Computer Training Courses

Course	Date	Participant	Place
Basic Computer Course			
No. 1	4 /Nov /1991 - 8 /Nov /1991	20	Bago
No. 2	18/May /1992 -23 /May /1992	18	
No. 3	28/Sep /1992 - 9 /Oct /1992	9	
No. 4	26/Oct /1992 - 6 /Nov /1992	10	
No. 5	23/Nov /1992 - 4 /Dec /1992	11	
No. 6	26/Apr /1993 - 7 /May /1993	10	
Intermediate Computer			
No. 1	20/Jul /1992 - 7 /Aug /1992	10	Bago
No. 2	18/Jan /1993 - 5 /Feb /1993	12	
No. 3	21/Jun /1993 - 9 /Jul /1993	10	
Computer Operator's Course (NEC MS-4100)			
	2 /Mar /1992 - 9 /Jul /1993	5	Bago
	1 /Mar /1993 - 16 /Mar /1993	9	
Special Course			
* OS Training Course	16/Nov /1992 -21 /Nov /1992	12	Bago
* Survey Software Course	29/Dec /1992 - 8 /Jan /1993	10	Yangon

2. For further Progress

As a result of activities of past 2 fiscal years (1991, 1992), it is recommended to establish the following points;

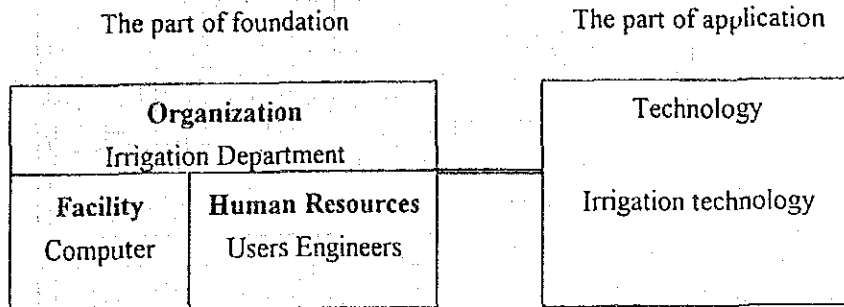
1) Systematic implementation of computer utilization in irrigation technology.

There are four essential elements, Facilities, Human resources, Organization and Technology to establish computer utilization in irrigation technology. The relation of them is shown in Figure - 4.1. It is indispensable that the part of foundation is established so that the part of application could progress efficiently in future.

It is recommended that to establish the part of foundation, it is given the first priority in the technical cooperation remaining project term, and at the same time the only outline of irrigation technology is introduced in the part of application.

Therefore, it is desirable that the practice of the part of application will be implemented after establishing the part of foundation.

Figure - 4.1



2) The organization for utilization of computer in the Irrigation Department

It is essential to establish the organization for making good use of computer in daily office work not only for the present but also for the future 10 years.

It is recommended to prepare the following systems:

- Computer Utilization and Work Plan in Irrigation Department
- Plan of Data Base Management System for irrigation data
- Program Library System
- Training System for computer utilization

3) Leader for computer utilization

It is essential to build up skilled personnel who can manage and maintain computer system and instruct younger generation in know-how of computer utilization on Irrigation technology.

It is recommended that the person assigned for computer utilization will be engaged in the same work continuously for at least 5 years.

TABLE - 4.1.
Case Study of System Development for Data Analysis

Item	Fiscal year												Remark											
	Month																							
	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1) Case Study of System Development for Data Analysis	* The TSI and Work Plan (Frame work) were formulated on Nov 20, 1991 between Japan Myanmar side.																							
A) Data Base Management System																								
- Establishment of "Plan of DBMS".																								
- Collection of data for Case study.																								
- Creation of file management system and data structure for HYNMOS.																								
- Publishing a sample year book for hydrological and meteorological data.																								
- Preparation of a user's guide for using HYNMOS																								
B) Analysis on Stored DBMS																								
- Introduction of outline of analysis on case study																								
- Instruction of basic knowledge of hydrometeorological analysis by short term expert																								
C) Study of Information Exchange on Data Stored DBMS																								
- Investigation of possibility of data communication system																								
- Introduction of Basic knowledge on data communication (Operator Course)																								
- Establishing data communication between FTC and Yungon ID Head Office.																								
Counterpart																								
• U Maing Maing Thin 3/91-4/91																								
(Counterpart Training Japan 10/90 - 4/91)																								
• Daw Aye Aye Hlaing (Chief) 7/92																								

TABLE - 4.1.
Case Study of System Development for Data Analysis

Item	Fiscal year												Remark												
	1991/1992			1992/1993			1993/1994			1994/1995															
	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
Provision of Equipment																									
• Personal Computer 1 set 3/92-																									
• HYMOS 1 set 7/92-																									
(DBMS for Hydro-meteorology)																									
(Appraisal software)																									
• Personal Computer 1 set 12/92-																									
• Personal Computer 1 set 9/93-																									
Short Term Expert																									
• Dr. Y. Nayak (Hydrology)																									
25/93-8/4/93																									
• (Hydrology) 1 Month 12/93																									
• (Hydrology) 1 Month 12/94																									

(2/2)

TABLE - 4.2.
System Development of Technical Calculation Program Library

Item	Fiscal year												Remarks											
	1991/1992			1992/1993			1993/1994			1994/1995														
Month	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
2) System Development of Technical Calculation Program Library																								
A) Study of the Existing Technical Programs																								
- Establishment "Program Library System".																								
- Collection of program using at ID etc.																								
- Development sample program manual.																								
- Publishing a program library.																								
B) Cooperation on Computer Utilization																								
- Cooperation and assistance for other technical section.																								
- Assistance the IHD/UNDP Project in installation of Data Bank.																								
Counterpart																								
• Daw Hlay Hlay Win (Chief) 11/91-																								
(Training in Japan 8/90 - 11/90)																								
• Daw Thwe Thwe 11/91 - 4/93																								
Provision of Equipment																								
• Personal computer 1 set 3/92-																								

* The TSI and Work Plan (frame work) were formulated on Nov 20, 1991 between Japan Myanmar side.

TABLE - 4.3.
Study On Other Technical Supporting System

Item	Fiscal year												Remark														
	1991/1992			1992/1993			1993/1994			1994/1995																	
Month	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3			
3) Study on Other Technical Supporting system - Supporting for improvement of existing computer system. - Establishment of "Plan of Computer Utilization" - To train operating and maintenance. (Switch to Training on Computer Utilization)																									Actual: _____ Plan: _____		
	(Training in Japan)																										
	Counterpart																										
	• U Maung Maung Than 5/91-4/93 (Counterpart Training Japan 10/90 - 4/91)																										
	• (Chief counterpart is not available.)																										
• U Win Myint Hlaing 4/92 - Provision of Equipment																											
• Data Bank System for NEC MIS-4100 1 set 93/3																											
• Terminal for NEC MIS-4100 (Powermate) 2 set 93/12																											
Short Term Expert																											
• Mr. S. Honma (System) 26/10/91 - 2/11/91																											
• Mr. S. Shinpuku (System) 24/ 2/92 - 14/ 3/92																											
• Mr. S. Shinpuku (System) 27/ 2/93 - 18/ 3/93																											
• Mr. K. Ebisu (System) 27/2/93 - 11/ 3/93																											
• (Software) 1 month 10/93/-																											
• (Software) 1 month 10/94/-																											

TABLE - 4.4
Training on Computer Utilization

Item	Fiscal year												Remark
	Month												
4) Training on Computer Utilization													Actual
- Classification of training course.													
- Establishment of "Training System".													
- Elementary Course													
(Basic Computer Course)													
- Intermediate Course													
- Operator Course (by short term expert)													
- Special Course (OS Training Course)													
- Special Course (Survey software)													
Counterpart													Plan
• U Maung Maung Than (Lecturer) (Training in Japan 10/90 - 4/91)													
• Daw Toe Toe Myaw (Chief) 5/91 - 7/92													
• Daw Thwe Thwe (Lecturer) 11/91 - 4/93													
• Daw Htay Htay Win (Lecturer) 11/91 - 7/92													
• Daw Aye Aye Hlaing (Lecturer) 7/92 - 4/92													
• U Win Myint Hlaing (Lecturer) 4/92 -													
Provision of Equipment													
• Terminal (NEC MS-1100) 10 sets 3-88 - 8/93													
• Personal Computer (PC) 10 sets 9/93 -													

WORK PLAN
FOR
DESIGN CRITERIA

Irrigation Technology Center Project
Irrigation Department

by

Mr. F. Ogi
and
Counterparts on Design Criteria

August 26, 1993

1. INTRODUCTION

The projects in MYANMAR have been executed under the criteria of foreign countries. Irrigation Department, Ministry of Agriculture, MYANMAR, has intended to unify and adapt these criteria, and make them suitable for site conditions in MYANMAR standing on the sufficient experience. Needless to say, design criteria is the grand total of its' technology or constitution for engineer and indicates the level of engineering. To achieve this program, the Government of the Union of MYANMAR and Japan International Cooperation Agency (JICA) signed Record of Discussion (R/D) for the Irrigation Technology Center (ITC) Project, which includes a function of design criteria preparation, on 23 Dec. 1987 and 27 Sep. 1991.

This WORK PLAN stipulates the detail of whole activities in this field and it should be proceeded according to this WORK PLAN.

According to R/D, the Government of JAPAN dispatched a long term expert Jun. 1988, and Nov. 1991 to carry out the technical assistance. The MASTER PLAN was agreed to recommend in this discussions, such as,

"In the Program, the Japanese Technical Cooperation will give technical guidance and advice to prepare of design standards and criteria for irrigation facilities."

For the detail, the performance of this field has been proposed as the work plan (Framework) in Tentative Schedule of Implementation, Nov. 1991. The report prepared by leader of Survey Consulting Team has also submitted at the same time. In this report, the guideline of detailed work plan has been recommended as follows:

- 1) Reviews and findings report will be prepared through collection and study on present design criteria.
- 2) Japanese Design Criteria and design procedure will be introduced.
- 3) The introduced criteria will be adapted and modified according to the condition of MYANMAR. The result will be prepared as a draft design criteria.
- 4) Technical calculation programme will be introduced through computer utilization in cooperation with computer section, ITC.

Because Computer Utilization is useful for the rationalization of planning and design, this item has been stipulated. And this field is closely related with data analysis. Therefore, this will be proceeded in cooperation with computer section in ITC.

2. OBJECTIVES

Program on ITC project has been implemented for the purpose of upgrading irrigation technology, thus contributing to the development of agriculture in Myanmar. As the one of practical approach to this purpose, the field of design criteria was stipulated.

The detail objectives of this field have been made clear in Work Plan in 1992/93. That is, preparation of the first draft design criteria on Fill dam, Canal works and Head works, and introduction of computer utilization for planning and design.

3. PROGRESS

Summary of activities up to now is as follows;

3-1 Fill dam

1) Introduction of Japanese design criteria and standard

- Basic concept
- Main features of dam body and foundation
- Design of fill dam
 - Materials
 - Seepage
 - Introduction of Finite Element Method

2) Adaptation of Myanmar design criteria

- | | |
|--|--|
| <ul style="list-style-type: none"> - General - Main features | <ul style="list-style-type: none"> • General description • Design Flood • Reservoir capacity • Sedimentation • Free board |
|--|--|

- Outlet works and intake facilities
- Installation
- Spillway

3-2 Canal Works

1) Introduction of Japanese design criteria and standard

- General description
- Investigations
- Design concepts

2) Adaptation of Myanmar design criteria

The first draft throughout the whole items submitted to working group.
This draft is under typing.

3-3 Computer utilization

- Discussion for establishment of master plan on computer utilization in Design branch, Irrigation Department
- Installation of two numbers of computer, auto-cad system and software.
- Special training course for a survey software.

4. EVALUATION

About the arrangement of design criteria, the counterparts group has constituted so called project team and functioned for preparation of Myanmar criteria. Practical concepts for design criteria have been grasped and the procedure of arrangement has been fixed among counterparts. However, the progress in the field of Fill dam is not so enough to complete on schedule planned last year. The strength of function of working group and revision of planning schedule should be recommended, so that the objectives will be accomplished as total schedule.

As to the computer utilization, it is need to be reflected the idea of engineers as a user. This means the program development has to be done by the staff of computer section in Irrigation Department with cooperation of staff of Design branch. Also it should be kept in close cooperation with computer section in ITC.

Table - 1 ANNUAL SCHEDULE IN 1992/93 AND IMPLEMENTATION

Activities	Month											
	1992						1993					
	A	M	J	J	A	S	O	N	D	J	F	M
Design Criteria												
1) Preparation												
2) Introduction of Japanese Criteria - Fill dam												
3) Adaptation of Introduced Criteria - Fill dam												
4) Field Survey												
Computer Utilization												
1) Planning on Program Library												
2) Introduction of Program												
3) Arrangement of Program Library												

Legend :  Plan  Actual Implementation

5. PLAN OF ACTIVITIES in 1993/94

5-1 Subjects

5-1-1 Design Criteria

Expected kinds of work are,

- 1) Fill Dam
- 2) Canal
- 3) Headworks

The contents of each subject will be as follows:

1) Fill Dam

- 1)-1 Dambody and foundation
- 1)-2 Outlet works and intake facilities
- 1)-3 Instrumentation
- 1)-4 Reservoir Investigation

2) Canal

- 2)-1 General description
- 2)-2 Investigation
- 2)-3 Canal design
- 2)-4 Hydraulic design
- 2)-5 Structural design

3) Headworks

- 3)-1 Basic Considerations and procedure in Planning and Design
- 3)-2 Design Conditions of Weir

5-1-2 Computer Utilization

Expected kinds of utilization are,

- 1) Project Planning
- 2) Survey
- 3) Hydrology
- 4) Hydraulics
- 5) Structural Analysis

5-2 Study Procedure

The study of some subjects will be proceeded at the same time. The main activities will be divided into 2 parts, that is, Design Criteria and Computer Utilization.

5-2-1 Design Criteria

The process will be divided into 4 stages practically.

1) Preparation

This stage is for selection of subjects. The scope of works will be decided in this stage. Study tour, data collection and discussions are included.

2) Introduction of Japanese Criteria

A long term expert will introduce the Japanese Criteria about each subject.

3) Adaptation of Introduced Criteria

Counterparts will examine through deep discussion whether introduced Criteria is adaptable or not. If it is impossible to adapt, the examination will be done by using the design of existing projects with consultation of a long term expert.

4) Review of the Result

The result will be checked again at the final stage with a group of experienced engineer concerning each field. The draft design criteria will be prepared as a first study.

5-2-2 Computer Utilization

This process will be divided into 3 stages practically.

- 1) Planning on Program Library
Counterparts will make a plan on program library with consultation of long term experts.
- 2) Introduction of program
A long term expert will introduce some technical calculation programs.
- 3) Arrangement of Program Library
Counterparts will try to utilize through development, improvement and adaptation of the existing and introduced programs.

6. FINAL EVALUATION

Activities on this field would be evaluated by the results. Following will be the visible check item for evaluation:

- Number and content of items fulfilled for three fields mentioned in 4-1 Subjects .
- Number of programs introduced and developed.

The technical transfer of the procedure of standardization for Design Criteria should also be evaluated.

6. IMPLEMENTATION PLAN

The tentative schedule on Design Criteria and annual schedule in 1993/94 are shown in Table-2 and Table-3 respectively.

Table - 3 ANNUAL SCHEDULE IN 1993/94

Activities	1993												1994			
	A	M	J	J	A	S	O	N	D	J	F	M				
Design Criteria																
1) Introduction of Japanese Criteria																
- Fill dam																
- Canal																
- Headworks																
2) Adaptation of Introduced Criteria																
- Fill dam																
- Canal																
- Headworks																
3) Field Survey																
Computer Utilization																
1) Planning on Program Library																
2) Introduction of Program																
3) Arrangement of Program Library																

Table - 2 TENTATIVE SCHEDULE OF DESIGN CRITERIA

Activities	Fiscal Year				
	1991.4 - 1992.3	1992.4 - 1993.3	1993.4 - 1994.3	1994.4 - 1995.3	
Design Criteria					
1) Preparation					
2) Introduction of Japanese Criteria					
- Fill dam					
- Canal					
- Headworks					
3) Adaptation of Introduced Criteria					
- Fill dam					
- Canal					
- Headworks					
4) Review of the Result					
- Fill dam					
- Canal					
- Headworks					
Computer Utilization					
(1) Planning on Program Library					
(2) Introduction of Program					
(3) Arrangement of Program Library					

Legend :  Prolongation
 Previous Schedule

WORK PLAN
FOR
CONSTRUCTION MATERIAL
TEST AND ANALYSIS

Irrigation Technology Center Project
Irrigation Department

by

Mr. M. Takahashi
and
Counterparts

August 26, 1993

1. Background

The Irrigation Technology Center (ITC) was established with the aim of achieving overall technical advancement in Irrigation Technology. The activities of construction material test and analysis take important role in construction of irrigation facilities. Thus, transferring technical knowledge of construction material test and analysis to staff and engineers as well as obtaining field experiences is regarded as one of the most important element of ITC project.

2. Summary of Activities in 1992/93

After an inauguration of JICA long-term expert, Mr. M. Takahashi, in May 1992, various testing procedures and handling of equipment for which a former expert could not complete were taught. The testing manuals such as Japanese Industrial Standard (JIS) was introduced to eliminate any individual modification or alteration of testing methods and procedures. Field survey was conducted to instruct the important relationship of testing and its contribution to construction sites. Reporting methods were introduced for giving advice and comments on data obtained by testing.

Technology transfer was primarily objected to train the counterparts assigned to the experts. However, for the purpose of diffusing technical skill and knowledge more widely, the counterparts taught by the expert were trained to demonstrate obtained technique precisely and correctly to other laboratory members. The progress of the activities is shown in Table 1.

2-1. Material Testing and Handling of Equipment

The several types of testing methods and analysis together with handling of equipment were introduced. Some of tests conducted will be listed in below.

a) Soil Test and Analysis

- ① Physical test
- ② Large scale permeability test
- ③ Unconfined compression test
- ④ Direct shear test
- ⑤ Compacting test

Physical soil testing methods and its application were taught. Bulk density of lateritic soils varies with its weathering conditions.

b) Concrete Test and Analysis

- ① Specific gravity of cement
- ② Physical test of aggregate
- ③ Concrete mix design by volume
- ④ Test of tensile strength of bar

Effects of concrete weathering on its bulk density with different packing were studied. The importance of concrete mix design by volume was explained. Some methods for fresh concrete analysis to test its characteristics, mixing, and quality control was conducted. Tensile and flexural tests for hard concrete were demonstrated.

For field surveying, the Shumitt hammer test was introduced in connection with its relationship of test piece strength and curing.

c) Others

- ① Reporting of test results
- ② Data sheet making
- ③ Training of concrete mix design

2-2. Training Activity

Training of soil exploration methods was conducted *in situ* to obtain operative skill and knowledge of which were studied in the laboratory. Principles of investigation, surface and subsurface exploration and methods of explorations were included. Sampling methods using equipment like hand augers and its related points to be reminded were demonstrated. Case study on test of an irrigation canal was taken place *in situ*.

In service training course on soil and concrete testing was held for nineteen days and sixteen participants attended. Geological and Soil Exploration training was held when the short-term expert visited. To support training activities, several technical manuals and books were prepared and handed over to the laboratory.

2-3. Quality Control Program

Since Quality Control (QC) activities became important in construction, some of the laboratory staff was asked to work in the construction sites. The importance of QC and its concepts were introduced in the connection with routine testing and analysis. The text book of QC was prepared.

3. Plan of Activities in 1993/94

The scheduled activities in 1993/94 are shown in Table 2. The main activities of Construction Material Test and Analysis in the year of 1993/93 would be continuing to transfer the technique of testing and analyzing. In addition, advising to the test data obtained from analysis of samples that were given from the construction sites would be made. Activities of QC will be emphasized further.

3-1. Material Testing and Handling of Equipment

The knowledge transfer of systematic operation of equipment for the material testing laboratory would be continued. The procedures would be followed with JIS to make data obtained more standard and reliable to be used.

3-2. Quality Control

To introduce new concepts of QC program, problems in present QC systems should be solved. To fulfill the objective, seminars and case study of constructions would be held. The short-term expert will introduce systematic knowledge of QC.

3-3. Water Quality Test

It is needed to augment facilities as well as testing capacity of water quality testing laboratory. Thus, implementation of equipment will be requested. Standard of water quality for irrigation will be specified and survey of water quality of irrigation water will be performed.

4. Plan of Implementation

4-1. JICA Experts

JICA has been dispatching one long-term expert, Mr. M. Takahashi, and necessary short term experts in this field will be dispatched. In 1993/94 implementation schedule, a short-term expert on Quality Control will be dispatched for the period of one month.

4-2. Counterparts

About twenty counterpart personnel are assigned to this field. The counterpart personnel will carry out necessary coordination with other government offices. The counterparts will make all necessary arrangements for the activities under the guidance of the expert. The counterpart personnel will carry out necessary coordination with other government offices. The expert and counterpart list are shown in Table 3.

4-3. Provision of Equipment

Some more equipment for field tests and chemicals for water quality test would be supplied. Manuals and technical books related to this field would also be provided by JICA.

4-4. Training

Training on construction material, soil and water quality tests will be carried out. The technology relating to this field will be transferred to engineers and laboratory personnel.

Table 3. Experts and Counterparts for Construction Material Test and Analysis

No	Name	Designation	Remark
1	Mr. M. Takahashi	JICA Expert	Long-term expert
2	(Mr. T. Oono)	JICA Expert	Short-term expert (Quality Control)
3	Daw Mu Mu Myint	Staff Officer	Staff counterpart (Material testing Lab)
4	U Tin Shwe	Supervisor	Staff counterpart (Material testing Lab)
5	U Maung Aye	Assist. Supervisor	Staff counterpart (Material testing Lab)
6	U Than Soe	Sub-assist. Supervisor	Staff counterpart (Material testing Lab)
7	U Thein Zan	Sub-assist. Supervisor	Staff counterpart (Material testing Lab)
8	Daw Than Than Oo	Sub-assist. Supervisor	Staff counterpart (Material testing Lab)
9	U Kyaw Min Nyunt	Sub-assist. Supervisor	Staff counterpart (Material testing Lab)
10	U Win Kyi	Staff Officer	Chief counterpart
11	U Soe Tint	Staff Officer	Staff counterpart (Soil Laboratory)
12	U Hla Win	Supervisor	Staff counterpart (Soil Laboratory)
13	U Tin Aung	Supervisor	Staff counterpart (Soil Laboratory)
14	U Oo Myint	Supervisor	Staff counterpart (Soil Laboratory)
15	U Ye Win	Supervisor	Staff counterpart (Soil Laboratory)
16	U Kyi Aye	Supervisor	Staff counterpart (Soil Laboratory)
17	U Kyaw Wa	Assist. Supervisor	Staff counterpart (Soil Laboratory)
18	U Maung Hla	Assist. Supervisor	Staff counterpart (Soil Laboratory)
19	U Thein Sint	Assist. Supervisor	Staff counterpart (Soil Laboratory)
20	U Ko Ko Oo	Sub-assist. Supervisor	Staff counterpart (Soil Laboratory)
21	Daw Theingi Lwin	Sub-assist. Supervisor	Staff counterpart (Soil Laboratory)
22	U Kyaw Lin	Sub-assist. Supervisor	Staff counterpart (Soil Laboratory)
23	U Htin Kyaw	Sub-assist. Supervisor	Staff counterpart (Soil Laboratory)
24	Daw Khin Mar Win	Sub-assist. Supervisor	Staff counterpart (Soil Laboratory)

5. Comments

The main activities of Construction Material Test and Analysis are to transfer knowledge of testing and analysis by using equipment, to analyze samples brought in from construction sites, to assist QC program, and to train staff and engineers. During working seasons, dry seasons, the priority is given to construction site; thus, some counterparts are invested into QC program at sites. Moreover, the number of requested samples to analyze as a routine work of the laboratory is increasing. Hence, we are facing the problem of the shortage of the counterparts to transfer the technology even though some new supporting staffs were recruited. Consequently, we need to keep requesting the Irrigation Department to assign suited counterparts.

Table 2. Schedule of Construction Material Test and Analysis for 1993/94

Sr.	Contents	1993					1994						
		A	M	J	J	A	S	O	N	D	J	F	M
I	Technical Transfer												
	1.1 Soil Test												
	(a) pH and Slaking Test of Soil												
	(b) Chemical Test												
	- pH test of soil												
	- Organic Matter Content Test												
	- Salty Test (Concentration Salts)												
	- Sulphate Content												
	- Carbonate Content												
	- Chloride Content												
	- Total dissolved solids.												
	(c) Dynamics Test												
	- C.B.R Test												
	- Large Scale Triaxial Test												
	- Direct Shear Test												
	1.2. Water Quality Test												
	(a) pH value												
	(b) E.C Test												
	(c) Turbidity												
	(d) Chemical												
	1.3. Quality Control Test												
	(a) Moisture Content of Infrared method												
	(b) Field Permeability												
	1.4. In - situ Test												
	(a) Field C.B.R Test												
	(b) Test for Plate Bearing of Road												
	(c) Vane Shear Test												
	(d) Penetration test of Dutch Cone												
	(e) Sampling for Undisturbed Soil of thin wall sampler of Stationary Piston Type												
	(f) Drilling Machine												
	(g) Speed Moisture Test												
	1.5 Case Study												
	(a) Analysis of Density												
	(b) To compare the settlement of soft soil												
	(c) Survey of water quality												

Table 2. Schedule of Construction Material Test and Analysis for 1993/94

Sr.	Contents	1993					1994						
		A	M	J	J	A	S	O	N	D	J	F	M
	1.6 Short Term Expert (a) Quality Control (b) Concrete Engineering												
II	Routine Laboratory Test for I. D - Physical Test - Permeability Test - Unconfined Compression Test - Direct Shear Test - Compaction Test - Consolidation Test - Triaxial Test												
III	Quality Control (a) Ngamoeyeik Dam Project (b) Waba Dam Project												
IV	Training Program (a) Basic Training Course (b) Intermediate Training Course												

Table 2. Schedule of Construction Material Test and Analysis for 1993/94

Sr.	Contents	1993										1994				
		A	M	J	J	A	S	O	N	D	J	F	M			
I	Technical Transfer															
	1.1 Cement Test															
	(a) Flexural (Bending Strength) Test															
	(b) Heat of Hydration Test															
	1.2 Aggregate Test															
	(a) Test for Content of Surface Moisture															
	(b) Test for Salt Content to Sand															
	1.3. Fresh Concrete Test															
	(a) Washing Analysis Test															
	(b) Bleeding Test															
	(c) Mix Design Trial Test															
	1.4. Hard Concrete Test															
	(a) Flexural Strength Test															
	(b) Test for compressive strength of concrete using portion of beams in flexure															
	(c) Tensile Strength Test															
	(d) Test for cutting of core and beam out of concrete															
	(e) Test for boring, sampling, cutting the core from concrete with portable core drilling machine															
	(f) Test for length changed on dry and wetting of mortor or concrete specimen															
	(g) Poisson's Ratio Test															
	(h) Creep Test															
	(i) Bending Strength Test															
	1.5 Steel Material Test															
	(a) Bending T.P of steel material															
	1.6 Rock Test															
	(a) Preparation for specimen and sampling of compressive strength															
	(b) Compressive Strength															
	(c) Tensile Strength Test															
	(d) Polishing of rocks															
	(e) Crystallization of rocks															
	(f) Boring of rocks															

Table 2. Schedule of Construction Material Test and Analysis for 1993/94

Sr.	Contents	1993											1994				
		A	M	J	J	A	S	O	N	D	J	F	M				
	1.7 Case Study (a) Ngamoeyeik Dam concrete works																
	1.8 Short Term Experts (a) Quality Control (b) Concrete Engineering																
II	Routine Laboratory Test - Sieve Analysis of Fine & Coarse Aggregate - Specific Gravity Test for Cement, Fine & Coarse Aggregate - Tensile Strength test for steel bars																
III	Quality Control (a) Ngamoeyeik Dam Project (b) Waba Dam Project																
IV	Training Program (a) Basic Training Course (b) Intermediate Training Course																

**WORK PLAN
FOR
HYDRAULIC MODEL TEST**

**Irrigation Technology Center Project
Irrigation Department**

by

**Mr. C. Kajiwara
and
Counterparts**

August 26, 1993

1. Background

Irrigation Technology Center (ITC) for the Irrigation Department (ID) was established at Bago and included one hydraulic laboratory for testing and studying of hydraulic phenomena. Some hydraulic phenomena are so complex and cannot be solved only by analytic means. Then simulation of hydraulic phenomena in the laboratory is to be carried out by using scale models or mathematical models or both.

2. The Objective

The main objectives are to upgrade the knowledge of technology by introducing the technique of modeling both physical and mathematical models through Hydraulic Laboratory of ITC, and to transfer the technology to the engineers and ID personnel by means of on job training on testing of physical models and mathematical models, moreover to check the design of hydraulic structures by studying the hydraulic phenomena around the structures by testing physical models before construction.

3. Activities in 1993/94

3-1. Study of Sadon Spillway model

After finished of the testing of Yin Spillway model, preparation of estimate and design of Sadon Spillway model was started. Construction works of Sadon model was carried out up to the end of March 1993. Studies on Sadon Spillway model have to be worked out up to the end of December. At the same time analyzing of data and calculation works are carried out for preparation of technical report for Yin Spillway model testing.

The following tests were already completed for the original design of Sadon Spillway up to now.

- a) Calibration of weir discharge at the upstream and downstream of spillway model.
- b) Determination of the spillway rating curve and compares with design H-Q curve.

3-2. Training

Training given by short-term experts was carried out for staff officers of ID in March and July 1993. The subjects of training were as follows.

Table 1. List of training

No.	Training	Short-term Expert	Period	No. of trainees
1.	Unsteady flow simulation	Mr. Masahiko Shimazaki	29 -3 -93 - 6 -4 -93	8
2.	Hydraulic Model Testing	Dr. Masaaki Ueda	12 -7 -93 -23 -7 -93	14

During the training not only lectures for theory but also demonstrations of instrumentation and measuring systems were carried out in the laboratory as practical works.

4. Plan of activities

4-1. Plan of physical (scale) models

The main plan is to introduce advanced technology for ID personnel and to transfer technical knowledge about testing of physical model by the experts. At the same time law of hydraulic similarity, principle of modeling and principle of scaling would be introduced. The design and construction of some models and testing of models would also be included in the technology transfer.

4-1-1. Case study on Dam Spillway

Some case study on Dam Spillway will be carried out by the testing of physical model for checking and confirming of design before construction. By this way, technology of scale modeling could be transferred by the on job training moreover if necessary it could be changed the original design of structures by more appropriate design and it could be saved amount of expenditures also.

At present, model of spillway for Sadon Dam is constructed and will be studied the following items of tests.

- (a) flow conditions in the approach channel.
- (b) pressure distribution along spillway crest and flip bucket.
- (c) water surface profile along crest, chute and flip bucket.

- (d) determination of the spillway rating curve.
- (e) investigation of the alternative battering of floor downstream of ogee crest.
- (f) confirmation of the shape and landing position of the trajectory for design and other discharge.
- (g) Investigation with alternative shapes of the flip bucket, such as with alternate bucket radius, lip shape, lip angle and
- (h) investigation for the invert level and required dimensions of the plunge pool, and qualitative study of scour at plunge pool and out fall channel.

4-1-2. Case study on Weir

The use of mobile bed model will be introduced by studying of weir model such as Yin Weir model. The following tests will be carried out for the mobile bed model.

- (a) flow pattern.
- (b) sediment movement.
- (c) sediment distribution.
- (d) The configurations of the weir such as alignment, crest level of both weir and head regulators, off take water-way width.
- (e) Geometry of upstream and down stream guide bounds.
- (f) The length and geometry of divide wall and
- (g) pond level of weir.

4-2. Mathematical Simulation

Nowadays most of the design and prediction concerning with hydraulic engineering works are carried out by means of mathematical models. At present, development of digital computers makes a mathematical model more powerful. Increasingly mathematical models are being used in Hydraulic engineering problems. In some Hydraulic problems, mathematical models are more economical and have more advantage and some case these types of models are superior.

ITC Hydraulic Laboratory had equipped with one personnel computer with laser jet printer and it will be introduced the use of mathematical models. The plans for the use of mathematical models are as follows.

- (a) to transfer the know-how, technology and utilization of mathematical models to ID personnel through ITC Hydraulic Laboratory.
- (b) to introduce the ID personnel about the general overview of mathematical models, the use of models in hydraulic and irrigation engineering problems, collecting of data for the model and the calibration of the model etc.
- (c) to give training by the short-term experts.
- (d) to use the well-known mathematical models (software) developed by well established hydraulic laboratories.
- (e) to develop some mathematical models for solving of hydraulic and irrigation engineering problems.

The ID personnel would be made familiar with the use of mathematical models so that they can consider mathematical modeling for the future works of the Department whenever necessary.

5. Implementing Plan

5-1. Japanese Expert

JICA dispatches short-term experts for training and gives lectures on mathematical simulation and hydraulic model testing. Following is a schedule of the short-term experts for the hydraulic laboratory during the period of project.

Table 2. List of short-term experts.

Year.	Short-term Expert	Duration	Training
1991/92	Mr. Y. Matsumoto	15 -6 -91 - 11 -7 -91	Instrumentation and given lectures
1992/93	Mr. M. Shimazaki	25 -3 -93 - 8 -4 -93	Un steady flow simulation
1993/94	Dr. M. Ueda	3 -7 -93 - 29 -7 -93	Hydraulic Model Testing
1994/95	-	Planned for 2m-months	

5-2. Counterpart

ID assigns counterpart personnel for the hydraulic laboratory to carry out the hydraulic model tests and mathematical simulation works, and consulting with the short-term experts for upgrading of technical knowledge. The lists of counterparts during the period up to now are shown as follows.

Table 2. List of short-term experts.

No.	Name	Duration	Remark
1.	U Nu Maung	22 -4 -91 - 27 - 9 -91	Assistant Director
2.	U Cho Cho	15 -5 -89 - 20 - 4 -93	Assistant Director
3.	U Myo Myint Aung	20 -4 -90 - 3 -12 -91	Staff Officer
4.	U Hla Baw	6 -12 -91 - to Date	Staff Officer
5.	Daw Than Than Oo	1 -5 - 93 - to Date	Staff Officer

5-3. Provision of equipment

Measuring instruments and equipment for hydraulic model tests, some software and publications those will be useful in development of ITC Hydraulic Laboratory will be provided with JICA budget.

5-4. Implementing schedule

The tentative schedule and activities of Hydraulic Laboratory for 1993/94 are attached on table 4 and 5 respectively.

6. Evaluation

The subject of model testing (Both physical model and mathematical model) is one of the most advanced technology in hydraulic engineering field. Therefore we need more trained personnel for this field and it is essential to transfer technology and knowledge to the ID personnel. At present condition, the progress of hydraulic laboratory is not so much satisfactory due to the shortage of trained engineers and experienced personnel. Even Yin spillway model and Sadon spillway model were tested, it is necessary to get more idea, knowledge and experience for testing of weir model since movable models are more complicated and many problems for simulation of prototype occur.

Since the main aim of ID is to build up engineers in this field, that are the counterparts' engineers could do the simple model tests and prepare report of the study, and have ability to improve their technology of conducting verification of prediction of hydraulic works by model investigation soon. Therefore the evaluation should consider whether the activities have achieved the targets.

Table 3. Tentative Schedule of Hydraulic Model Tests and Analysis

Activities	Fiscal Year				
	1991.4 - 1992.3	1992.4 - 1993.3	1993.4 - 1994.3	1994.4 - 1995.3	
- Hydraulic model tests and simulation model tests of designed structures including analysis					
1. Hydraulic Model Tests					
1). Yin Dam Spillway					
2). Sadon Dam Spillway					
3). Yin Wier					
2. Simulation Analysis Through Computer Utilization					
1). Introduction of simulation analysis					

Previous Plan
 Implemented Plan
 Present Plan

Table 4. Schedule of Activities of Hydraulic Laboratory (ITC) for 1993/94

JOB DESCRIPTION	1993												1994		
	A	M	J	J	A	S	O	N	D	J	F	M			
1. Test on Sadon Spillway (scale) model															
(a) Original Design															
(b) Alternate Design															
2. Report on Sadon Spillway model															
(a) Draft report															
(b) Final report															
3. Introduction to mathematical models (Computer Simulation)															
4. Data collection and application of mathematical model															
5. Design and construction of Yin Weir (physical) model															
6. Visit of Short-term expert															
(a) Physical (scale) model															
(b) Mathematical model															

附属資料 7. 供与機材リスト

附属資料 7-1 1990年度供与機材リスト (Annual Report 1991/1992)

TABLE - 6 Provision of Equipment (Budget in fiscal year 1990/91)

Nos.	Description of Goods	Quantity	Unit Price	Amount
1	"HARUTO" Swedish Sounding Apparatus S-64, JIS A 1221, S, P1 1p Weights: 10kg-2p. 25kg-3p	1 set		Y350,000.-
2	"HARUTO" Rod Puller SH-588 Capacity: 300 kg, φ19mm	1 set		250,000.-
3	"HARUTO" Mechanical Soil Compactor SO-17, JIS A 1210, A 1211 Drop Height: 30 or 45cm Motor: 380V, 50Hz, 0.75KW	1 unit		2,870,000.-
4	"HARUTO" Hold & Accessories for CRB Test	(3 sets)		
	1) CBR Hold 503-10	3 pcs	8Y31,000.-	93,000.-
	2) Spacer Disc 503-6	3 pcs	16,000.-	48,000.-
	3) Swell Plate 503-7	3 pcs	15,000.-	45,000.-
	4) " 503-7	3 pcs	27,000.-	81,000.-
	5) Surcharge Weight 503-9	3 sets	10,400.-	31,200.-
5	"HARUTO" Sand Density Apparatus S29A-4, JIS A 1214, ASTM Plastic Capacity: 4L	2 sets	85,000.-	170,000.-
6	"HARUTO" Recorder for Unconfined Compression Test Recording System Set for SO-2038A Recorder: 25x18cm(A4) RE-10-02 Transducer Amplifier RE-300V-4 Elastic Ring Load Transducer RE-AK50W Dial Type Displacement Transducer RE-D20W Transformer and Colum	1 set (1 set) (1 set) (1 set) (1 set)		1,929,000.-
7	"A & D" Electronic Precision Balance 1) Capacity: 6,100g (0.1g) FA-6000 2) Capacity: 2,100g (0.01g) FA-2000	1 unit 1 unit		137,500.- 137,500.-
8	"SHARP" Word Processor WD-A730	1 unit		298,000.-
9	"HARUTO" Recording System for Triaxial Compression Test Load Cell LCW-500 Load Cell LCW-5T	1 set (1 set) (1 set)		5,398,000.-

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Nos.	Description of Goods	Quantity	Unit Price	Amount
(9)	Dial Type Displacement Transducer RE-D50W	(1 set)		
	Pore Pressure Measuring App.	(1 set)		
	Volume Change Measuring App. SC-432-01	(1 set)		
	Transducer Amplifier RE-200	(1 set)		
	X-Y Recorder RE-13T	(1 set)		
	Transducer	(1 unit)		
10	"HARUTO" Recording System for Consolidation Test RE-34S-01	2 sets	650,000.-	¥3,300,000.-
	Transducer	1 unit		210,000.-
11	"HARUTO" Water Bath Thermo-Regulator Apparatus CE-1011B Bath Dimen: 1 x 5 x 0.5m Temperature: 20±2°C Electric: 380V, 50Hz	1 set		1,230,000.-
12	"HARUTO" Spherically Seated Bending Test Equipment CO3-2A JIS A 1106 B.S:15 x 15 x 53-55cm	1 set		300,000.-
13	"A & D" Electronic Precision Balance EP-22KA Capacity: 2kg/20kg 0.1g/1g	1 set		220,000.-
14	"HARUTO" Aggregate Soundness Test Set 1) C117-1 (∅12cm, ∅5cm) 4 pcs/set 2) C117-2 (∅21cm, ∅10cm) 4 pcs/set 3) C117-3 (∅36cm, ∅20cm) 4 pcs/set	4 sets		492,800.-
15	"HARUTO" Washington Type Air Meter LC1013X JIS A 1128, 1119 Lucite Material, 7L	1 set		160,000.-
16	"KOKUYO" Steel Cabinet (for Electronic Precision Equipment) 1760 x 515 x 880 S-D6355 1760 x 515 x 880 S-D6355G 1760 x 500 x 60 S-615B	2 sets	124,000.-	248,000.-

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Nos.	Description of Goods	Quantity	Unit Price	Amount
17	"KOKUYO" Data Sheet Saelves 540 x 332 x 880 (A4-2 x 16) SK-A22 540 x 332 x 880 (A4-2 x 10) SK-A32	2 sets	¥104,000.-	¥208,000.-
18	"HARUI" Ultrasonic Non-Destructive Tester Type MIN-005-1 Digital Indication Standard Vib: 50KHz Optional Accessories 1) Vibrator 2) Transformer & Sliding Transformer	1 set		2,978,000.-
19	"SAKATADENNKI" Earthpressure Cells EEP-5305D 5kgf/cm2 φ300mm	1 unit		130,000.-
20	"SAKATADENNKI" Earth Pore Pressure Cells EPP-5805 5kgf/cm2	1 unit		85,000.-
21	"SAKATADENNKI" Cable for LVDT SC-DT 100m	1 set		50,000.-
22	"SAKATADENNKI" Indicator EM-51	1 unit		400,000.-
23	"KATSUSHIHA" Servo-type Seismometer SD-240H SD-240V	1 set		900,000.-
SUB TOTAL :				¥22,750,000.-
OTHER CHARGE :				682,500.-
Total :				¥23,432,500.-

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Nos.	Description of Goods	Quantity	Unit Price	Amount
	1. TOYOTA CRESSIDA STATION WAGON CODE : RX72LG-XMINS <u>C/NO.</u> <u>FRAME NO.</u> <u>ENGINE NO.</u> <u>KEY NO.</u> T-5 6010524 3220979 5781	1		¥1,427,000.-
	2. TOYOTA LAND CRUISER STATION WAGON 4WD CODE : FJ80L-GCKRS <u>C/NO.</u> <u>FRAME NO.</u> <u>ENGINE NO.</u> <u>KEY NO.</u> T-1 0028357 0321782 W1656 T-2 0028465 0322066 W0145 T-3 0028570 0322348 W0346 T-4 0028566 0322336 W0035	4		8,072,000.-
	3. TOYOTA AUTO PARTS (CRESSIDA WAGON)	1		143,000.-
	4. TOYOTA AUTO PARTS (LAND CRUISER WAGON)	1		808,000.-
SUB TOTAL				¥10,450,000.-
OTHER CHARGE				598,470.-
TOTAL				¥11,048,470.-
	G. TOTAL :			¥34,480,970.-

LOCAL PROCUREMENT

NO.	ITEM	SPEC	QUANTITY	DATE OF RECEIVED	MAINTENANCE BY	REMARKS
	In 1990/91					
1.	Constant Humidity Cabinet	National NRB 33	1 set	25.3.91	Laboratory	
2.	"	National NRB 22	1 set		Expert Room	
3.	Microwave Oven	National NN 5550	1 set		Laboratory	
4.	"	National NN 6508	1 set		Laboratory	
5.	Room Air Conditioner	National CW 1802 QH	6 sets		Laboratory	
	"		2 sets		Expert Room (ID)	
	"		1 set		Computer Room	
	"		1 set		"	
6.	Copier with Accessories & etc.	Ricoh FT 4490	1 set		Expert Room (ID)	
7.	Copier with Accessories & etc.	Ricoh FT 2260	1 set		Expert Room	
	In 1991/92					
1.	Uninterruptible Power Supply	UPS 2075	6 sets		Computer Room	
2.	Computer	486/33 MHZ	2 sets		"	
3.	Air Conditioner	National 1802 QH	2 sets		"	
	"	"	6 sets		Laboratory	
	"	"	2 sets		Expert Room	

1991/92 Grand-Aid Equipment List (Domestic)

1.	Computer	2 sets	US\$ 8,600.00
2.	HP Laser Jet Printer	2 sets	US\$ 7,000.00
3.	Toner Cartridge	10 sets	US\$ 1,300.00
4.	Roland DXY Plotter	1 set	US\$ 1,358.00
5.	Mouse	4 sets	US\$ 200.00
6.	Data Switch	7 sets	US\$ 434.00
7.	Softwares	9 sets	US\$ 4,250.00
8.	Accessories	2 sets	US\$ 448.00
9.	Plotter Pen	1 set	US\$ 240.00
10.	Air Conditioner	8 sets	US\$ 5,600.00
11.	UPS(Uninterrupted Power Supply)	6 sets	US\$ 6,630.00
12.	Copier	2 sets	US\$12,573.45
13.	HYMOS Software Package	2 sets	US\$20,000.00

TOTAL **US\$68,633.45**

1991/92 Grand-Aid Equipment List (Japan)

1.	Toyota Land Cruiser	1 set	2,609,772 yen
2.	Toyota Hi-Lux Pick Up Truck	1 set	1,615,658 yen
3.	Water Level Gauge	1 set	618,000 yen
4.	Analogue Recorder	1 set	1,709,800 yen
5.	Digital Point Gauge	1 set	690,100 yen
6.	Battery for Digital Point Gauge	50 sets	56,650yen
7.	Sand Level Gauge	1 set	673,620 yen
8.	Current Meter	1 set	110,210 yen
9.	Current Meter Counter	1 set	160,680 yen
10.	Volume Type Tide Meter	2 sets	580,920 yen
11.	Acrylic Board	30 sets	1,102,512 yen
12.	Personal Computer 386/25	2 sets	2,106,144 yen
13.	Color Monitor, VGA	2 sets	244,110 yen
14.	Network Interface Board	2 sets	143,582 yen
15.	Data Binder	300 sets	329,600 yen
16.	Corn Penetrometer	1 set	180,250 yen
17.	Soil Test Equipment	1set	597,400 yen
18.	Material & Concrete Test Equipment	1 set	165,212 yen
19.	Black Board	1 set	71,070 yen
20.	OHP	2 set	473,800 yen
21.	OHP Screen	2 sets	113,300 yen
22.	Slide Projector	1 set	195,700 yen
23.	Camera	4 sets	193,640 yen
24.	Video Camera	1 set	164,800 yen
25.	Books	1 set	2,809,840 yen
TOTAL			17,716,370 yen

Technical Cooperation Equipment in 1992/1993

Construction Materials Testing

Item	Specification	Origin	No.	Location
Analogue Recorder		Japan	1	Soil Lab.
Balance	UO-311	Japan	2	Soil Lab.
BS Sand Cylinder	MARUTO S29A-1	Japan	2	Soil Lab.
Cone Penetrometer	MARUTO S44	Japan	1	Soil Lab.
Crucible 100 ml	MARUTO S33-2	Japan	50	Soil Lab.
Crucible 50 ml	MARUTO S33-2	Japan	50	Soil Lab.
Cubic Permeameter	MARUI MIS-227-5-01	Japan	1	Soil Lab.
Dial Gauge		Japan	2	Soil Lab.
Driving Tube Sampler	MARUTO SD17-A	Japan	1	Soil Lab.
Evaporation Dish	MARUTO S33-1b	Japan	25	Soil Lab.
Field Permeameter	MARUTO S12-F	Japan	1	Soil Lab.
Hydrogen Peroxide 500g	MARUTO H2O2	Japan	20	Soil Lab.
Hygrometer		Japan	3	Soil Lab.
Le Chatelier Flask	MARUTO C33-1	Japan	2	Soil Lab.
Manometer Fluid	MARUTO	Japan	1	Soil Lab.
Max. Min. Thermometer		Japan	3	Soil Lab.
Miter Box	MARUI MIS-208-1-10	Japan	1	Soil Lab.
Moisture Meter	MARUI	Japan	2	Soil Lab.
Multi Recorder		Japan	1	Concrete Lab.
Schmit Hammer Anvil		Japan	1	Concrete Lab.
Sodium Silicate 500g	MARUTO Na ₂ SiO ₃	Japan	10	Soil Lab.
Thermo Couple Cable		Japan	1	Soil Lab.
Thermometer		Japan	20	Soil Lab.
Tube Sampler 75 x 250 mm		Japan	20	Soil Lab.
Tube Sampler 75 x 70 mm		Japan	20	Soil Lab.
Ultra Red Ray Moisture Meter	F-2B	Japan	1	Soil Lab.
Personal Computer	Memory 486/50DX	Myanmar	1	Soil & Conc
Printer	HP Laser Jet Printer IIP	Myanmar	1	Soil & Conc
UPS	PK Electronic US2050	Myanmar	1	Soil & Conc
Memory for printer	2 MB Pacific	Myanmar	1	Soil & Conc
Printer Cable		Myanmar	1	Soil & Conc
Mouse Pad		Myanmar	1	Soil & Conc

Item	Specification	Origin	No.	Location
Geocomp Myanmar Font	Geocomp	Myanmar	1	Soil & Conc
Air Conditioner	National CW 1802	Myanmar	2	Library, ITC
Dehumidifier	Westinghouse ED-305K	Myanmar	1	Soil & Conc

Data Analysis

Item	Specification	Origin	No.	Location
Data Cabinet	KOKUYO SF-B4-04-AY	Japan	4	Computer
Data Safe	KOKUYO ES-54MDN	Japan	1	Computer
Steel Cabinet	KOKUYO S-D3605-AY	Japan	6	Computer
Steel Cabinet	KOKUYO S-D4355-GAY	Japan	4	Computer
Steel Cabinet	KOKUYO S-D4355-AY	Japan	4	Computer
Steel Cabinet	KOKUYO S415B	Japan	4	Computer
UPS	MATSUNAGA	Japan	1	Computer
Computer Table	KOKUYO ECT-B118FMM	Japan	10	Computer
OA Chair	KOKUYO CRGP151	Japan	10	Computer
Map Case	KOKUYO MC-DA0-AY	Japan	4	Computer
Map Case Base	KOKUYO MCB-DFL	Japan	4	Computer
Personal Computer	Memory 486/50DX	Myanmar	3	Computer
Personal Computer	Memory 386/33DX	Myanmar	9	Computer
Personal Computer	Memory 386/33DX	Myanmar	1	Admin, ITC
Monitor 17"	EIZO 550i	Myanmar	1	Computer
Printer	HP Laser Jet Printer IV	Myanmar	1	Computer
Printer	EPSON LQ 1170 PS-2	Myanmar	1	Computer
Plotter	HP Draft Master SX	Myanmar	1	Computer
Plotter	ROLAND DXY-1200	Myanmar	1	Computer
Digitizer	Microgrid III	Myanmar	1	Computer
UPS	PK Electronic US2050	Myanmar	1	Computer
UPS	PK Electronic US2120	Myanmar	3	Computer
Memory for printer	2 MB Pacific	Myanmar	3	Computer
Fax modem	Hedaka	Myanmar	1	Computer
Data Switch	4 switches	Myanmar	2	Computer
Printer Cable		Myanmar	11	Computer
Mouse Pad		Myanmar	13	Computer

Item	Specification	Origin	No.	Location
Toner Cartridge	Toner Cartridge for HP4	Myanmar	7	Computer
Toner Cartridge	Toner Cartridge for HP3P	Myanmar	4	Computer
Geocomp Myanmar Font	Geocomp	Myanmar	1	Computer
Microsoft Word	(Windows)	Myanmar	1	Computer
Excel	Ver. 3.0	Myanmar	1	Computer
Windows 3.1		Myanmar	1	Computer
Dehumidifier	Westinghouse ED-305K	Myanmar	6	Computer
Vaccume Cleaner	Philips TC 535	Myanmar	1	Computer
Air Conditioner	National CW 1802	Myanmar	1	Admin, ITC

Design Criteria

Item	Specification	Origin	No.	Location
Map Case	KOKUYO DA0-AY	Japan	6	Design, Ygn
Map Case Base	KOKUYO MCB-DA0	Japan	3	Design, Ygn
Map Case Stand	KOKUYO MCB-DFH	Japan	3	Design, Ygn
Storage Box	KOKUYO S365-AY	Japan	1	Design, Ygn
Black Board	KOKUYO	Japan	1	Design, Ygn
Personal Computer	Memory 486/50DX	Myanmar	2	Design, Ygn
Monitor 17"	EIZO 550i	Myanmar	1	Design, Ygn
Printer	HP Laser Jet Printer IV	Myanmar	2	Design, Ygn
Plotter	HP Draft Master SX	Myanmar	1	Design, Ygn
Plotter	ROLAND DXY-1200	Myanmar	1	Design, Ygn
Digitizer	Microgrid III	Myanmar	1	Design, Ygn
UPS	PK Electronic US2120	Myanmar	2	Design, Ygn
Fax modem	Hedaka	Myanmar	1	Design, Ygn
Data Switch	4 switches	Myanmar	2	Design, Ygn
Printer Cable		Myanmar	6	Design, Ygn
Mouse Pad		Myanmar	2	Design, Ygn
Ribbon	LQ-1170	Myanmar	10	Computer, Bago
Plotter Pen	HP 0.25 (Black)	Myanmar	4	Design, Ygn
Plotter Pen	HP 0.25 (Color)	Myanmar	1	Design, Ygn
Plotter Pen	HP 0.35 (Black)	Myanmar	4	Design, Ygn
Plotter Pen	HP 0.35 (Color)	Myanmar	1	Design, Ygn

Item	Specification	Origin	No.	Location
Plotter Pen	HP 0.50 (Black)	Myanmar	4	Design, Ygn
Plotter Pen	HP 0.50 (Color)	Myanmar	1	Design, Ygn
Drafting Paper	A1 (125 Sheets)	Myanmar	2	Design, Ygn
Drafting Paper	A0 (125 Sheets)	Myanmar	2	Design, Ygn
Geocomp	Ver. 7.0	Myanmar	1	Design, Ygn
dBase IV	Ver. 1.1	Myanmar	1	Design, Ygn
Geocomp Myanmar Font	Geocomp	Myanmar	1	Design, Ygn
Microsoft WORD	Windows	Myanmar	1	Design, Ygn
Excel	Ver. 3.0	Myanmar	1	Design, Ygn
Windows	Ver. 3.1	Myanmar	1	Design, Ygn
Dehumidifier	Westinghouse ED-305K	Myanmar	4	Design, Ygn
Vacuum Cleaner	Phillips TC 535	Myanmar	1	Design, Ygn
Air Conditioner	National CW 1802	Myanmar	1	Library, ITC

Hydraulic Model Testing

Item	Specification	Origin	No.	Location
Electro-Maganetic Current Meter	TOKYO SF-5212	Japan	1	Hydraulic Lab.
Wave Height gauge	TOKYO	Japan	1	Hydraulic Lab.
Personal Computer	Memory 486/50DX	Myanmar	1	Hydraulic Lab.
Printer	HP Laser Jet Printer IIP	Myanmar	1	Hydraulic Lab.
UPS	PK Electronic US2050	Myanmar	1	Hydraulic Lab.
Memory for Printer	2 MB Pacific	Myanmar	1	Hydraulic Lab.
Printer Cable		Myanmar	1	Hydraulic Lab.
Mouse Pad		Myanmar	1	Hydraulic Lab.
Geocomp Myanmar Font	Geocomp	Myanmar	1	Hydraulic Lab.
Dehumidifier	Westinghouse ED-305K	Myanmar	1	Hydraulic Lab.
Vaccume Cleaner	National	Myanmar	1	Hydraulic Lab.
Air Conditioner	National CW 1802	Myanmar	1	Library, ITC

Irrigation and Drainage

Item	Specification	Origin	No.	Location
Contact Sand Level Gauge	TOKYO KEISOKU	Japan	1	Hydraulic Lab.
Current Meter	TOKYO	Japan	1	Hydraulic Lab.
Current Meter Counter	TOKYO	Japan	1	Hydraulic Lab.
Water Level Gauge	TOKYO	Japan	1	Hydraulic Lab.
Personal Computer	Memory 486/50DX	Myanmar	1	Plan. & Stat. M.O.A.
Printer	HP Laser Jet PrinterIII	Myanmar	1	Plan. & Stat. M.O.A.
UPS	PK Electronic US2050	Myanmar	1	Design Criteria
Data Switch	4 Switches	Myanmar	1	Design Criteria
Printer Cable		Myanmar	1	Design Criteria
Mouse Pad		Myanmar	1	Design Criteria
Dehumidifier	Westinghouse ED-305K	Myanmar	1	Design Criteria
Air Conditioner	National CW 1802	Myanmar	1	Library, ITC

Training

Item	Specification	Origin	No.	Location
Text Book		Japan	1	ITC Library
Text Book		Japan	195	Library
Evaporimeter		Japan	1	ITC
Hydrograph		Japan	1	ITC
Recording Rain Gauge		Japan	1	ITC
Thermograph		Japan	1	ITC
Wind Sensor		Japan	1	ITC

Proposed Technical Equipment In 1993/1994

1. Irrigation and Drainage

1. Pickup Truck	Toyota Hi-lux 4WD	1
2. Analogue Recorder	Yokogawa	1
3. Personal Computer	PC 486 Compatible	1
4. Printer	Laser Jet	1
5. UPS	500VA	1
6. Application Software		2
7. Computer accessories		1
8. Vacuum Cleaner		1
TOTAL		¥ 4,400,000

2. Data Analysis

1. Personal Computer	PC 486 Compatible	1
2. Personal Computer	PC 386 Compatible	10
3. Printer	Laser Jet	1
4. Printer	Line printer	3
5. UPS	500VA	1
6. UPS	1200VA	3
7. Application Softwares		4
8. Computer accessories		6
9. Vacuum Cleaner		2
TOTAL		¥ 7,000,000

3. Design Criteria

1. Map Case	A-0 size	4
2. Drawing Board		5
3. Altimeter		3
4. Planimeter		6
5. Cabinet		10
6. Closet		4
7. White Board		1
8. Drawing File Box		50
9. Software	Engineering Mathematics	1
10. Calculator		10
11. Copier		1
12. Conference Table		6
13. AVR		3
14. Vacuum Cleaner		1
TOTAL		¥ 6,000,000

4. Construction Materials Testing

1. Shumit Hammer		1
2. Data Logger		1
3. BS Mortar Vibrator		1
4. Cement Mortar Cube		6
5. Concrete Mixer		1
6. Proving Ring		1
7. BS Cube Mold		6
8. Constant Head Permeameter		1
9. Infrared Moisture Meter		1
10. Desiccator	D 360 mm	1
12. Picno Meter	250 ml, 500 ml	50
13. Poreous Stone	For Shearing Test Apparatus	10
14. Tri Axial Membrane		100
15. Bouyoucos Hydrometer		5
16. Hydrometer Jar		20
17. Graduated Volumetric Cylinder		40
18. Grooving Tool for Cohesionless Soil		5
19. Wash Bottle		10
20. Mortar		3
21. Sieve		3
22. Platform Scale		1
TOTAL		¥12,700,000

5. Hydraulic Model Testing

1. Contact Sand Level Gauge		2
2. Wave Height Gauge		1
3. Multi Recorder		2
4. Survey Equipment	Level, Staff, Measure	2
5. Current Meter		1
6. Tools		5
TOTAL		¥5,200,000

6. Training

1. Air Conditioner		9
2. Dehumidifier		4
3. Book Shelf		10
4. Library Table		10
5. Library Chair		60
6. Magazine Rack		5

7. Desk	10
8. Black Board	3
9. Book	1

TOTAL **¥ 4,700,000**

GRAND TOTAL **¥ 40,000,000**

附属資料 8. 参考資料一覧

1. 南西アジア（ビルマ）農林業協力プロジェクトファイナディング調査報告書
昭和60年7月、国際協力事業団
2. ビルマ連邦社会主義共和国かんがい技術センター計画事前調査報告書
昭和61年2月、国際協力事業団
3. ビルマ国かんがい技術センター設立計画基本設計調査報告書
昭和61年6月、国際協力事業団
4. ビルマ灌漑技術センター計画実施協議調査団報告書
昭和63年1月、国際協力事業団
5. ビルマ灌漑技術センター計画巡回指導調査団報告書
平成元年2月、国際協力事業団
6. ミャンマー灌漑技術センター計画巡回指導調査団報告書
平成3年3月、国際協力事業団
7. ミャンマーかんがい技術センター計画計画打合せ調査団報告書
平成4年年2月、国際協力事業団
8. 1st JOINT COMMITTEE MEETING
1991年10月9日、ITC
9. 2nd JOINT COMMITTEE MEETING
1992年8月26日、ITC
10. (1)THIRD JOINT COMMITTEE MEETING
1993年8月26日、(IRRIGATION TECHNOLOGY CENTER)
(2)THIRD JOINT COMMITTEE MEETING、APPENDIXES
1993年8月26日、(IRRIGATION TECHNOLOGY CENTER)
(3)STATUS REPORT OF IRRIGATION TECHNOLOGY CENTER
1993年8月、(IRRIGATION TECHNOLOGY CENTER)
11. ANNUAL REPORT FOR 1991/1992
1992年3月31日、(IRRIGATION TECHNOLOGY CENTER)
12. ANNUAL REPORT FOR 1992/1993
1993年3月25日、(IRRIGATION TECHNOLOGY CENTER)
13. WORK PLAN
1992年9月、(IRRIGATION TECHNOLOGY CENTER)
14. MONTHLY REPORT FROM SEPTEMBER 1991 TO FEBRUARY 1993
(1993年、IRRIGATION TECHNOLOGY CENTER)
15. ITC MEETING FROM MAY 1992 TO FEBRUARY 1993
(1993年、IRRIGATION TECHNOLOGY CENTER)

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