

附属資料 4. ワークプラン (活動計画)

IRRIGATION DEPARTMENT

MINISTRY OF AGRICULTURE

WORK PLAN

ON

Technical Cooperation Programme

for

Irrigation Technology Center

September, 1992

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Introduction

The Technical Cooperation Programme on the Irrigation Technology Center Project commenced April 1, 1988. But it had been suspended due to unfortunate political situation in September 1988 and started again in April 1991.

The Japanese Project Consultation Team arrived in Yangon to discuss about the Implementation schedule and management with the Japanese experts and Myanmar counterparts and the team's leader and the Director General of Irrigation Department signed the Tentative Schedule of Implementation (TSI) in November 1991. The team submitted the Report of the Project Consultation for ITC recommending the guide line for work plan of each field activities.

Japanese experts and Myanmar counterparts worked out this Work Plan based on the TSI and the team's recommending. The Work Plan was submitted to the Second Joint Committee Meeting on August 26, 1992 and the the Project has been implementing according to the Work Plan.

Myanmar engineers and Japanese experts who were chiefly involved in the Work Plan are as follows:

- Irrigation Engineering
 - U MD Than Aung Assistant Director, ITC
 - Mr. Nariaki Tamura Team Leader

- Data Analysis
 - U Maung Maung Than Staff Officer, ITC
 - Mr. Manabu Kashiwabara Data Analyst

- Design Criteria
 - U Kyaw Myint Assistant Director, Design Branch
 - Mr. Fumio Ogi Expert in Design Criteria

- Soil and Construction Material Test
 - U Cho Cho Assistant Director, ITC
 - Mr. Mitsuo Takahashi Expert in Construction Material Test and Analysis

- Hydraulic Model Test and Analysis
 - U Cho Cho Assistant Director, ITC
 - Mr. Nariaki Tamura Team Leader

IRRIGATION TECHNOLOGY CENTRE, BAGO

WORK PLAN

FOR

IRRIGATION ENGINEERING

MAY, 1992

IRRIGATION ENGINEERING

1. Background

The Union Of Myanmar is an agriculture-based country with 75% of its population living in rural areas. Its economy depend chiefly on agriculture sector accounting for 40% of the 1989/90 GDP and employed 66% of the labour force. It play 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 is expected to reach 50 million by the end of this century.

The government publication Review of the Financial, Economic and Social Condition for 1991/1992 says that out of the total area 167 million acres, the net area sown is only 20 million acres or 12%. The culturable waste land is about 20.6 million acres and the fallow land is about 4.8 million acres. Total 25.4 million acres which could be reclaimed.

Irrigation in Myanmar is presently applied to 12.3% of 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 for more than six month 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 to 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 country flood protection, are essential for agricultural development.

2. Objectives

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

The objectives of this field's activities is to transfer technical knowhow 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 personals, in turn, will diffuse the technical knowledge to the engineers in the Irrigation Department.

3. Plan of activities

The main activities of this field consists of collection and analysis of relevant data & information on irrigation projects, survey and analysis of field irrigation practice and conduct case study on a model project.

1). Collection and analysis of data & information on irrigation projects

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

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

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

Collection of data/information and field survey will be made in 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

3). Case study on model project

This subject will be carried out in cooperation with all experts and counterparts in ITC. One model project such as Ngamoeyeik Dam project, will be chosen in convenient place near ITC and studied from hydrology, design criteria, soil test and quality control, and other aspects in order to make the counterparts acquire practical technology.

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.

4. Evaluation

The objectives of this field's activities is to contribute for planning and formulating irrigation development and rehabilitation projects in Myanmar. This objectives could be materialized through the counterparts who do the activities with the experts. That is to say, the experts should transfer their technical know how to the counterpart, who will put acquired knowledge into practical application in planning, design and construction work of irrigation projects.

It must be required plenty of time to achieve the final goal of this field. In the end of the project, expected results or impact for upgrading irrigation technology must be still unclear. But the performance of this field activities will have to be evaluated by means of some methods.

Therefore evaluation on the performance of this field will be made by the results of following three items.

- (1) Collection of Project information
- (2) Inspection and study report on irrigation and drainage
- (3) Case study on model project

5. Implementing Plan

1). Japanese Expert

According to the Record of Discussion the field of Irrigation Engineering is covered by the team leader. The coordinator, however took in charge of this field until March 1992.

Short-term experts in irrigation engineering might be dispatch from Japan as occasion demands.

2). Counterpart

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 offices concerned in Myanmar.

TABLE - 1 Long-term expert and counterpart

Name	Duration	Remark
<p>[Long-term Expert]</p> <p>1. Mr. M. Taguchi 2. Mr. N. Tamura</p>	<p>27- 9-1989 to 31- 3-1992 1- 4-1992 to 31- 3-1993</p>	
<p>[Counterpart]</p> <p>1. U MD Than Aung</p>	<p>14- 8-1991 to date</p>	<p>Assistant Director</p>

3). Provision of equipment

Technical books should be supplied to enrich the ITC's library within the budget.

4). Implementing Schedule

The Tentative Schedule of Irrigation Engineering and the Annual Schedule in 1992/93 are shown Table-2, Table-3 respectively.

TABLE - 2 TENTATIVE SCHEDULE OF IRRIGATION ENGINEERING

Fiscal Year	1991.4 - 1992.3	1992.4 - 1993.3	1993.4 - 1994.3	1994.4 - 1995.3
Activities 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 a model project	<div style="display: flex; justify-content: space-around;"> </div>	<div style="display: flex; justify-content: space-around;"> </div>	<div style="display: flex; justify-content: space-around;"> </div>	<div style="display: flex; justify-content: space-around;"> </div>

TABLE - 3 ANNUAL SCHEDULE IN 1992/93

Month	1992												1993			
	A	M	J	J	A	S	O	N	D	J	F	M				
(1). Collection data/Information of the irrigation and drainage project																
(2). Survey and study on practice of field irrigation management																
(3). Preparation for case study																
(4). Field investigations																

WORK PLAN
FOR
DATA ANALYSIS

June, 1992

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.

2. Background

Now-a-days Irrigation Technology such as planning, designing, estimating and constructing are carried out using the computer in order to calculate and analyze on every studies. It is not too much to say that progress of this field is supported by computer technology.

Since computer utilization in Myanmar have been carried out only in a part of field in irrigation and drainage technology, systematization of computer utilization has not yet established up to now. The actual condition is that almost of engineer staff personnel have a little knowledge of computer utilization in their works, because computers have not been spread to the office works 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 consider how to utilize computer for irrigation technology and how to upgrade existing condition. The most important thing is that as computer is only tool for calculation, engineer who can manage the computer for irrigation technology should be trained according to the progress of irrigation and computer technology.

The field of Data Analysis covers many various fields 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 using the computer in order to promote and upgrade irrigation and drainage technology.

Main parts of this field to be carried out technical transfer 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

4.1 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 have a site visit for inspection of hydrological and meteorological stations to select 3 (three) case study areas.
- To collect the hydrometeorological data of the case study areas.
- To establish a standardization and systematization of DBMS among the concerned divisions and offices in the Irrigation Department.
- To create file management system and data structure on case study using HYMOS application software.
- To publish yearbook for hydrological and meteorological data on case study.
- To prepare a user's guide for further data entry and analysis using HYMOS.

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 analyze trend and correlation coefficient on probability of rainfall and discharge at different location on case study.
- To analyze a relationship between rainfall and runoff on case study.
- To instruct basic knowledge on hydrometeorological analysis by short term expert.
- To prepare a working report including data and result in each step.

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 establish personal computer communication on 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 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 collect computer programs being used at Design Branch Office, Hydrology Office, ITC and other Irrigation Offices using computers.
- To review each computer program on personal computer and categorization in each subject such as Hydraulics, Hydrology, Soil Mechanics, Project planning etc.
- To prepare for documentations on each program.
- To compile final documentation and to publish some program manuals every year.
- To distribute these user's manual to computer sections concerned.

4.2.2 Cooperation on Computer Utilization

This item aims to establish cooperation system on computer utilization.

- To cooperate and assist in computer utilization on the request of other technical sections to use the advanced technology such as Hydraulic design, Hydraulic simulation, structural design, Irrigation project planning and so on.
- To assist the HID/UNDP Project in installation of Data Bank at ITC computer center.

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 project. Accordingly computer utilization in future should be studied through considering case study and other fields of technical cooperation.

- To study the plan of computer utilization in future.
- To prepare for introduction of new data entry terminal and file transfer facility software to be used for data communication between MS-4100 and IBM PC/AT using HYMOS.

- 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 engineer and staff personnel to build up skilled engineer in this field according to the schedule. In addition, know-how of giving instructions for training should be studied.

- Classification of computer training courses.
- To prepare teaching materials and lecture notes for each course.
- To prepare review reports at the end of each training and submitting to authority concerned.

4.4.1 Computer Training Course

1) Elementary Course

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

2) Intermediate Course

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

5. Evaluation

Performance of this field can be evaluated whether systematization of data analysis is established for irrigation technology and how much spread effect of computer utilization in irrigation technology. Therefore following items are to be evaluated at the end of this project.

5.1 Case Study of System Development for Data Analysis

- Whether the counterpart personnel master know-how of DBMS and publish year books.
- Whether the counterpart personnel master know-how of data analysis system and prepare reports.
- Whether study on data communication system of personal computer accomplished.

5.2 System Development of Technical Calculation Program Library

- Whether the counterpart personnel master know-how of development of program library and publish program library.
- Whether establishment of cooperation system on computer utilization carried out.

5.3 Study on Other Technical Supporting System

- Whether establishment of the plan for computer utilization in future are done.
- Whether existing computer system has been studied and improved for computer utilization in future.
- Whether the counterpart personnel master know-how of operating and maintain system on the computer system.

5.4 Training on Computer Utilization

- Whether the counterpart personnel master know-how of teaching techniques and carry out training.

6. Implementing Plan

6.1 Assignment of work

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

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

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, 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 such as 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. Long-term Expert and Counterpart

Name	Duration	Remarks
Long-term Expert		
1. Mr. M. Kashiwabara	1 - 4 - 91 to 31 - 3 - 93	
Counterpart		
	From	
1. U Cho Cho	1 - 6 - 92	
2. U Maung Maung Than	1 - 4 - 91	
3. U Soe Min	1 - 4 - 91	
4. Daw Thwe Thwe	7 - 11 - 91	
5. Daw Htay Htay Win	7 - 11 - 91	
6. Daw Than Than Oo	21 - 5 - 92	
7. Daw Aye Aye Hlaing	6 - 7 - 92	
8. Daw Toe Toe Maw	6 - 7 - 92	

6.2 Provision of Equipment

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

6.3 Implementing Schedule

The Tentative Schedule of Data Analysis and Annual Schedule in 1992/93 are shown in Table - 2 and Table - 3 respectively.

TABLE-2 Tentative Schedule of Data Analysis (92 / 95)

ACTIVITIES	92 / 93	93 / 94	94 / 95	Remarks
1) <u>Case Study of System Development for Data Analysis</u>				
A) Data Base Management System				
B) Analysis on Stored DBMS				
C) Study of Information Exchange on Data Stored				
2) <u>System Development of Technical Calculation Program Library</u>				
A) Study of the Existing Technical Programs				
B) Cooperation on Computer Utilization				
3) <u>Study on Other Technical Supporting system</u>				
4) <u>Training on Computer Utilization</u>				

TABLE-3 Annual Schedule of Data Analysis (12 33)

ACTIVITIES	MONTH												Remarks		
	4	5	6	7	8	9	10	11	12	1	2	3			
1) <u>Case Study of System Development for Data Analysis</u>															
A) <u>Data Base Management System</u> -Investigation of case study areas. -Collection of hydrometeorological data and check manually. -Standardization and systematization of DBMS. -Creation of file management system and data structure. -Publishing a sample yearbook for hydrological and meteorological data. -Preparation of a user's guide for using HYMOS															
B) <u>Analysis on Stored DBMS</u> -Analysis of trend and correlation coefficient on probability of rainfall and discharge. -Analysis of a relationship between rainfall and runoff. -Instruction of basic knowledge of hydrometeorological analysis by short term expert. -Preparation of a working report.															From next year.
C) <u>Study of Information Exchange on Data Stored DBMS</u> -Investigation of possibility of data communication system. -Establishing PC communication between ITC and Yangon ID Head Office.															From next year.
2) <u>System Development of Technical Calculation Program Library</u>															
A) <u>Study of the Existing Technical Programs</u> -Collecting programs using at ID etc. -Review of each program and categorization. -Documentation of each program. -Publishing a program library.															
B) <u>Cooperation on Computer Utilization</u> -Teaching and assisting for other technical section. -Assisting the MID/UNDP Project in installation of Data Bank.															
3) <u>Study on Other Technical Supporting system</u> -Supporting for improvement of existing computer system.															
4) <u>Training on Computer Utilization</u> -Classification of training course. -Holding Elementary Course. -Holding Intermediate Course. -Holding Operator Course. (by short term expert															

**WORK PLAN
FOR
DESIGN CRITERIA**

July, 1992

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. To achieve this plan as one of the purposes, 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 on 23 Dec. 1987 and 27 Sep. 1991.

This WORK PLAN stipulates the detail of whole duty in this field and activities should be proceeded following 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 stipulated as the work plan (Framework) in Tentative Schedule of Implementation, Nov. 1991. The report prepared by leader of Survey 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 planning and design, this item has been added. And this field is closely related with data analysis. Therefore, this will be proceeded in cooperation with computer section in ITC.

2. OBJECTIVES

The Design Criteria is various or wide field, and its content is complicated. And it takes long time and needs intensive analysis / examinations to establish the Design Criteria completely.

Therefore, some of subjects will be chosen according to the importance and priority as urgent subjects. These subjects will direct toward the solution through the introduction on procedure of standardization of Design Criteria. The Draft Design Criteria will be prepared as a final result.

For the item of computer utilization, the examination of existing technical calculation programs and arrangement of program library will be proceeded in cooperation with computer section of ITC.

3. PLAN OF ACTIVITIES

3-1 Subjects

3-1-1 Design Criteria

Expected kinds of works are,

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

The contents of each subject will be as follows:

1) Fill Dam

- 1)-1 Basic Considerations and procedure in Planning and Design
- 1)-2 Design Conditions of Dambody and Foundation
- 1)-3 Design of appurtenant Structures

2) Canal

- 2)-1 Basic Considerations and procedure in Planning and Design
- 2)-2 Design Conditions of Open Channel

3) Headworks

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

3-1-2 Computer Utilization

Technical calculation programs and survey program which concern with the subjects of Design Criteria would be proceeded.

3-2 Form of Design Criteria

This will be prepared as the Japanese Criteria style. The Criteria should show the standard on the design so that this would be safe and rational under all conditions. Therefore, in the Criteria, description should be the basic rule which must be followed at least and should suggest the expected direction at design. Furthermore, this will show alternatives all which may be examined for each examination item and explanation.

Title	Items that should be examined.
Criteria	The provision of definition of terms or basic concept which must be followed. This part consists of one or two sentences and within around 5 lines.
Explanation and Reference	The content of Criteria will be described in detail or practically. The ground of Criteria, method of design and construction which is formulated at present and matters to be attended will be listed. This part should not be a practical use for the specified project. Typical samples can be also introduced for the reference.

3-3 Study Procedure

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

3-3-1 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 Introduce Criteria

Counterparts will examine whether introduced Criteria is adaptable or not. If this 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 skillful engineer concerning each field and in cooperation with YANGON INSTITUTE OF TECHNOLOGY. The draft design criteria will be prepared as a first study.

3-3-2 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 programs and how to use.

3) Arrangement of Program Library

Counterparts will try to utilize through arrangement, improvement and adaptation of the existing and introduced programs.

4. 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 for three fields mentioned in 3-1 Subjects .

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

5. IMPLEMENTATION PLAN

5-1 Japanese Expert

The Japanese Experts have been dispatched by the Government of Japan.

Name	From	To
Mr. Y. FURUYAMA	2 June, 1988	10 September, 1988
Mr. F. OGI	16 November, 1991	15 November, 1993

Following is a tentative schedule for short-term expert.

1992/93 - two man-month
1993/94 - two man-month
1994/95 - two man-month

5-2 Counterparts

The Irrigation Department would assign counterpart personnel needed to proceed the task of this field together. They shall also make all necessary arrangement concerned.

5-3 Provision of Equipment

Technical equipment needed , mainly books, will be handed over for ID within JICA budget.

5-4 Implementation Schedule

The Tentative Schedule on Design Criteria and Annual Schedule in 1992/93 are shown Table-1, Table-2 respectively.

Table - 1 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					=====

Table - 1 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					=====

TABLE - 2 ANNUAL SCHEDULE IN 1992/93

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

IRRIGATION TECHNOLOGY CENTER, BAGO

WORK PLAN
FOR
CONSTRUCTION MATERIAL TEST
AND
ANALYSIS

JULY, 1992

CONSTRUCTION MATERIAL TEST AND ANALYSIS

1. Background

To the engineer engaged in design and construction of irrigation structures, the properties of construction material such as cement, aggregate, concrete, reinforcing steel, rock, soil and water that is used in his works are very important. To enable testing of the construction material, a laboratory for soil and construction material had included in establishing Irrigation Technology Centre of Irrigation Department.

2. Objectives

To Myanmar counterpart personnels engaged at Irrigation Technology Centre in the field of construction material testing, it will be given technical guidance by JICA experts. The activities to be carried out in the corresponding field will be planned to get good development.

3. Plan of Activities

3.1 Construction material test

3.1.1 Material testing and handling of equipment

The know how on systematic operation of equipment of the material testing laboratory would be transferred. The procedure of material testing according to JIS will be fulfilled so that the counterpart would have gained confidence on the results obtained from his tests.

The tests would include:

- a. Physical tests of cement
- b. Aggregate tests
- c. Fresh concrete tests
- d. Hard concrete tests
- and e. Steel and rock tests

3.1.2 Quality tests and mix design of concrete

Technology on tests in finding out the quality of material would be transferred. To make the most economical use of available material that will produce concrete of the required specification, concrete mix design will be carried out.

3.1.3 Concrete manufacturing and quality control

The know how for production of uniform and economical concrete will be transferred

3.1.4 Reinforcing steel and concrete in construction works

The technology transfer on construction control of concrete and reinforcing steel will be made.

3.2 Soil Test

3.2.1 Geological survey

This activity aims at technology transfer on geological survey and will include method of exploration, boring, sounding and sampling.

3.2.2 Field survey and sampling

Principles of investigation, surface and subsurface exploration and methods of explorations will be included.

3.2.3 Method of soil tests and handling of equipment

Technology transfer on method of soil tests according to JIS and operation know how of test machinery will be carried out. It will cover following tests:

- a. Tests for discrimination and classification of soil
- b. Tests for dynamic quality of soil
- c. Tests for construction control
- d. In-situ tests.

3.2.4 Tests on foundations, subgrade, soil used in construction and quality control

It will cover soil tests on foundation of different type of structures and tests on soil used as a construction material. Quality control for earth construction will also be covered.

3.3 Water Quality Test

3.3.1 Water quality testing method and handling of equipment

It is to be acquainted with test procedure and handling of water quality equipment.

3.3.2 Survey of water quality

Standard of water quality for irrigation will be specified and survey of water quality of irrigation water will be performed.

3.4 Case Study on Irrigation Projects

Study on construction material and soil of Irrigation Projects in Myanmar will be carried out.

4. Implementing Plan

4.1 JICA Experts

JICA dispatches one long-term expert and necessary short term experts for this field. For 1992-93, short-term expert for geological survey would be dispatched for one month duration. Tentative schedule of visit of Experts is shown in Table - 2.

4.2 Counterparts

10 counterpart personae are assigned to this field and will work together with JICA experts in all planned activities. They will make all necessary arrangements for the activities of the field under the guidance of the expert. The counterpart personnels will carry out necessary coordination with other government offices.

The expert and counterpart list is shown in Table -1.

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 the engineering and laboratory personnels of Myittha laboratory and construction circles.

4.5 Implementing schedule

The tentative schedule and schedule of activities in 1992 - 93 are shown in Table - 2 and 3.

Table - 1 Experts and counterparts for soil and Construction Material Testing

No.	Name	Designation	Remark
1	Mr. M. Takahashi	JICA Expert	Long-term expert
2			Short-term expert
3	U Cho Cho	Assistant Director	Chief counterpart
4	U Zaw Htut Oo	Staff Officer	Staff counterpart (Material testing Lab)
5	U Oo Hla Myaing	"	"
6	U Tin Shwe	Supervisor	"
7	Daw Mu Mu Myint	Staff Officer	Staff counterpart (Soil Laboratory)
8	U Thein Win	"	"
9	U Soe Tint	"	"
10	U Ye Win	Supervisor	"
11	U Tin Aung	"	"
12	U Oo Myint	"	"

Table - 2 TENTATIVE SCHEDULE OF CONSTRUCTION MATERIAL TEST AND ANALYSIS

Activities	Fiscal Year			1991.4 - 1992.3			1992.4 - 1993.3			1993.4 - 1994.3			1994.4 - 1995.3			
	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM
1. CONSTRUCTION MATERIAL TEST																
1) Method of testing and handling of equipment																
2) Quality test and concrete mix design																
3) Concrete manufacturing and quality control																
4) Concrete in construction works																
2. SOIL TEST																
1) Geological Survey																
2) Field Survey and Sampling																
3) Method of Soil tests and handling of equipment																
4) Tests on foundation, subgrade and soil used in construction and quality control																
3. WATER QUALITY TEST																
1) Method of testing and handling of equipment																
2) Survey of water quality of irrigation																

Table - 2 TENTATIVE SCHEDULE OF CONSTRUCTION MATERIAL TEST AND ANALYSIS

Activities	1991.4 - 1992.3			1992.4 - 1993.3			1993.4 - 1994.3			1994.4 - 1995.3		
	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM
4. CASE STUDY ON IRRIGATION PROJECT												
5. TRAINING												
6. VISIT OF EXPERTS												
a) Long term expert												
b) Short term expert												

TABLE - 3 SCHEDULE OF ACTIVITIES CONSTRUCTION MATERIAL TEST AND ANALYSIS FOR 1992-93

	ACTIVITIES	1992						1993					
		A	M	J	J	A	S	O	N	D	J	F	M
1	CONSTRUCTION MATERIAL TESTS 1. Method of testing and handling of equipment 2. Quality test and concrete mix design 3. Concrete manufacturing and quality control 4. Reinforcing steel and concrete in construction works												
2	SOIL TEST 1. Geological survey 2. Field survey and sampling 3. Method of soil tests and handling of equipment 4. Tests on foundations and sub-grade and soil used in construction and quality control of earth construction												
3	WATER QUALITY TEST 1. Method of testing and handling of equipment 2. Survey of water quality												
4	CASE STUDY ON IRRIGATION PROJECT												
5	TRAINING												
6	VISIT OF EXPERTS 1. Long term expert 2. short term												

IRRIGATION TECHNOLOGY CENTRE, BAGO

WORK PLAN
FOR
HYDRAULIC MODEL TEST
AND
ANALYSIS

June, 1992

WORK PLAN FOR HYDRAULIC MODEL TEST AND ANALYSIS

1. The Background

The Irrigation Department is the sole department for carrying out all the water resources projects related to irrigation, flood control and river conservancy works of the country. ID undertakes planning, investigation, design and implementation of the above projects, and also operation and maintenance after their completion.

For optimizing the designs and predication of performance behavior of hydraulic structures, model investigation is very useful. Thus a hydraulic laboratory was introduced at the Irrigation Technology Center. Since the laboratory is the first of its kind in the Department, ID required to train staff for conducting effective model investigation.

2. The Objectives

Hydraulic engineering works are in many cases so complex that their design requires much care. Before the work is carried out it has to be sure that the effects anticipated will indeed be reached and that negative effects on the environment are reduced as much as possible. So the behavior of a hydraulic structure itself and its influence on the environment has to be forecasted.

The prediction is carried out by means of models of various sorts. The application of models, both physical (scale) models and mathematical models, would be introduced through hydraulic laboratory of ITC. The technology of both type of models would be transferred from Japanese experts to counterparts so that by using the facilities of ITC hydraulic laboratory and computers, the use of hydraulic models can be carried out for hydraulic design works.

3. Plan of activities

3.1. Physical (scale) models

Law of hydraulic similarity, principle of modelling and principle of scaling would be introduced. The design and construction of some models, and instrumentation would also be included in the technology transfer.

3.1.1. Case study on Dam spillway

Model of Spillway of Yin dam and Sadon dam will be constructed and studies so that the above technology could be transferred by the on the job training.

In particular the following will be conducted in Spillway model studies:

- (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 discharges;
- (g) investigation with alternative shapes of the flip bucket, such as with alternate bucket radius, lip shape, lip angle etc.; and
- (h) investigation for the invert level and required dimensions of the plunge pool, and qualitative study of scour at plunge pool and outfall channel.

3.1.2. Case study on Yin Weir

Yin Weir model will be constructed and model study will be carried out on that model. The use of mobile bed model will be introduced. Studies on flow pattern, sediment distribution, sediment movement, pond level will be included in the Yin Weir model studies. The configuration of the weir such as alignment, crest level of both weir and head regulators, offtake water-way width, geometry of upstream and downstream guide bunds, the length and geometry of divide wall will also be studied.

3.2. Mathematical models

Computer technology, nowadays, is well developed and is utilized in every field. In hydraulic problems the use of mathematical model become wider as the development of digital computers make mathematical models more powerful. ITC had equipped with computer facilities and it will be introduced the use of mathematical models (computer simulation models).

In some hydraulic problems, mathematical models are more economical and have more advantages, and in some cases these type of models are superior. The know-how, technology and utilization of mathematical models will be transferred to Irrigation Department (ID) personals through ITC hydraulic laboratory. The short term expert for ITC hydraulic laboratory will introduce the ID personals about the general overview of mathematical models, the use of mathematical models in hydraulic and irrigation engineering problems, what type of data and how they should be collected for the model, the calibration of the model etc.

The well-known mathematical models developed by well established hydraulic laboratories would be used. The ID personals would be made familiar with the use of mathematical models so that they can consider mathematical modelling for the future works of the Department whenever necessary.

4. **Implementing Plan**

1) **Japanese expert**

JICA dispatchs short-term experts for this field according to the Record of Discussion. Following is a tentative schedule of the short-term experts.

1991/92	One man month
1992/93	Two man month
1993/94	Two man month
1994/95	Two man month

2) **Counterpart**

ID assigns counterpart personal who carry out the hydraulic and mathematical model test consulting with the short-term experts.

3) **Provision of equipment**

Measring instruments and equipments for hydraulic model tests will be provided within JICA budget.

4) **Implementing schedule**

The Tentative Schedule of Hydraulic Model Test and Analysis and the Schedule of Activities of Hydraulic Laboratory for 1992-93 are attached Table-2,3 respectively.

Table - 1 **EXPERT AND COUNTERPART**

Name	Duration	Remark
[Short-term Expert]		
1. Mr. Y. Matsumoto	15. 6.91 to 11. 7.91	
[Counterpart]		
1. U Nu Maung	22. 4.91 to 27. 9.91	Assistant Director
2. U Cho Cho	15. 5.89 to date	Assistant Director
3. U Myo Myint Aung	20. 4.90 to 3.12.91	Staff Officer
4. U Hla Baw	6.12.91 to date	Staff Officer

5. Evaluation

Since this is the ID's first experience in establishing and conducting the hydraulic laboratory, it is the aim of ID to build up engineers in this field. Therefore evaluation is conducted to assess whether the activities has achieved the targets, that is: the counterpart engineers could do the simple model tests and prepare reports of the study, and have ability to improve their technology of conducting verification or predication of hydraulic works by model investigation in the near future.

The evaluation should consider the likelihood of the sustainability of the hydraulic laboratory and suggest measures to intensify activities, if necessary.

Table - 2 - TENTATIVE SCHEDULE OF HYDRAULIC MODEL TESTS AND ANALYSIS

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

Table - 3 SCHEDULE OF ACTIVITIES OF HYDRAULIC LABORATORY (ITC) FOR 1992-93

No.	Job Description	1992												1993			
		A	M	J	J	A	S	O	N	D	J	F	M				
1.	Preparation of interim and final report on Yin spillway model study																
2.	Seminar on Yin Spillway model study																
2.	Design and preparation of estimate for Sadon Spillway Model																
4.	Construction of Sadon Spillway Model																
5.	Test on Sadon Model (a) Original design (b) Alternative design																
6.	Report on Sadon Spillway Model																
7.	Introduction to mathematical models																
8.	Visit of Short term expert																

IRRIGATION TECHNOLOGY CENTRE, BAGO

**WORK PLAN
FOR
IRRIGATION ENGINEERING**

BY

**U M. D. Than Aung
&
Mr. Nariaki TAMURA**

MAY, 1992

IRRIGATION ENGINEERING

1. Background

The Union Of Myanmar is an agriculture-based country with 75% of its population living in rural areas. Its economy depend chiefly on agriculture sector accounting for 40% of the 1989/90 GDP and employed 66% of the labour force. It play 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 is expected to reach 50 million by the end of this century.

The government publication Review of the Financial, Economic and Social Condition for 1991/1992 says that out of the total area 167 million acres, the net area sown is only 20 million acres or 12%. The culturable waste land is about 20.6 million acres and the fallow land is about 4.8 million acres. Total 25.4 million acres which could be reclaimed.

Irrigation in Myanmar is presently applied to 12.3% of 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 for more than six month 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 to 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 country flood protection, are essential for agricultural development.

2. Objectives

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

The objectives of this field's activities is to transfer technical knowhow 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 personals, in turn, will diffuse the technical knowledge to the engineers in the Irrigation Department.

3. Plan of activities

The main activities of this field consists of collection and analysis of relevant data & information on irrigation projects, survey and analysis of field irrigation practice and conduct case study on a model project.

1). Collection and analysis of data & information on irrigation projects

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

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

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

Collection of data/information and field survey will be made in 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

3). Case study on model project

This subject will be carried out in cooperation with all experts and counterparts in ITC. One model project such as Ngamoeyeik Dam project, will be chosen in convenient place near ITC and studied from hydrology, design criteria, soil test and quality control, and other aspects in order to make the counterparts acquire practical technology.

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.

4. Evaluation

The objectives of this field's activities is to contribute for planning and formulating irrigation development and rehabilitation projects in Myanmar. This objectives could be materialized through the counterparts who do the activities with the experts. That is to say, the experts should transfer their technical know how to the counterpart, who will put acquired knowledge into practical application in planning, design and construction work of irrigation projects.

It must be required plenty of time to achieve the final goal of this field. In the end of the project, expected results or impact for upgrading irrigation technology must be still unclear. But the performance of this field activities will have to be evaluated by means of some methods.

Therefore evaluation on the performance of this field will be made by the results of following three items.

- (1) Collection of Project information
- (2) Inspection and study report on irrigation and drainage
- (3) Case study on model project

5. Implementing Plan

1). Japanese Expert

According to the Record of Discussion the field of Irrigation Engineering is covered by the team leader. The coordinator, however took in charge of this field until March 1992.

Short-term experts in irrigation engineering might be dispatch from Japan as occasion demands.

2). Counterpart

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 offices concerned in Myanmar.

TABLE - 1 Long-term expert and counterpart

Name	Duration	Remark
[Long-term Expert] 1. Mr. M. Taguchi 2. Mr. N. Tamura	27- 9-1989 to 31- 3-1992 1- 4-1992 to 31- 3-1993	
[Counterpart] 1. U MD Than Aung	14- 8-1991 to date	Assistant Director

3). Provision of equipment

Technical books should be supplied to enrich the ITC's library within the budget.

4). Implementing Schedule

The Tentative Schedule of Irrigation Engineering and the Annual Schedule in 1992/93 are shown Table-2, Table-3 respectively.

TABLE - 2 TENTATIVE SCHEDULE OF IRRIGATION ENGINEERING

Fiscal Year	1991.4 - 1992.3	1992.4 - 1993.3	1993.4 - 1994.3	1994.4 - 1995.3
Activities - 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 a model project				

TABLE - 3 ANNUAL SCHEDULE IN 1992/93

Activities	Month											
	1992						1993					
	A	M	J	J	A	S	O	N	D	J	F	M
(1). Collection data/Information of the irrigation and drainage project												
(2). Survey and study on practice of field irrigation management												
(3). Preparation for case study												
(4). Field investigations												

WORK PLAN
FOR
DATA ANALYSIS

By

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&
Mr. Manabu KASHIWABARA

June, 1992

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.

2. Background

Now-a-days Irrigation Technology such as planning, designing, estimating and constructing are carried out using the computer in order to calculate and analyze on every studies. It is not too much to say that progress of this field is supported by computer technology.

Since computer utilization in Myanmar have been carried out only in a part of field in irrigation and drainage technology, systematization of computer utilization has not yet established up to now. The actual condition is that almost of engineer staff personnel have a little knowledge of computer utilization in their works, because computers have not been spread to the office works 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 consider how to utilize computer for irrigation technology and how to upgrade existing condition. The most important thing is that as computer is only tool for calculation, engineer who can manage the computer for irrigation technology should be trained according to the progress of irrigation and computer technology.

The field of Data Analysis covers many various fields 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 using the computer in order to promote and upgrade irrigation and drainage technology.

Main parts of this field to be carried out technical transfer 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

4.1 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 have a site visit for inspection of hydrological and meteorological stations to select 3 (three) case study areas.
- To collect the hydrometeorological data of the case study areas.
- To establish a standardization and systematization of DBMS among the concerned divisions and offices in the Irrigation Department.
- To create file management system and data structure on case study using HYMOS application software.
- To publish yearbook for hydrological and meteorological data on case study.
- To prepare a user's guide for further data entry and analysis using HYMOS.

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 analyze trend and correlation coefficient on probability of rainfall and discharge at different location on case study.
- To analyze a relationship between rainfall and runoff on case study.
- To instruct basic knowledge on hydrometeorological analysis by short term expert.
- To prepare a working report including data and result in each step.

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 establish personal computer communication on 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 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 collect computer programs being used at Design Branch Office, Hydrology Office, ITC and other Irrigation Offices using computers.
- To review each computer program on personal computer and categorization in each subject such as Hydraulics, Hydrology, Soil Mechanics, Project planning etc.
- To prepare for documentations on each program.
- To compile final documentation and to publish some program manuals every year.
- To distribute these user's manual to computer sections concerned.

4.2.2 Cooperation on Computer Utilization

This item aims to establish cooperation system on computer utilization.

- To cooperate and assist in computer utilization on the request of other technical sections to use the advanced technology such as Hydraulic design, Hydraulic simulation, structural design, Irrigation project planning and so on.
- To assist the HID/UNDP Project in installation of Data Bank at ITC computer center.

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 project. Accordingly computer utilization in future should be studied through considering case study and other fields of technical cooperation.

- To study the plan of computer utilization in future.
- To prepare for introduction of new data entry terminal and file transfer facility software to be used for data communication between MS-4100 and IBM PC?AT using HYMOS.

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 engineer and staff personnel to build up skilled engineer in this field according to the schedule. In addition, know-how of giving instructions for training should be studied.

- Classification of computer training courses.
- To prepare teaching materials and lecture notes for each course.
- To prepare review reports at the end of each training and submitting to authority concerned.

4.4.1 Computer Training Course

1) Elementary Course

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

2) Intermediate Course

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

5. Evaluation

Performance of this field can be evaluated whether systematization of data analysis is established for irrigation technology and how much spread effect of computer utilization in irrigation technology. Therefore following items are to be evaluated at the end of this project.

5.1 Case Study of System Development for Data Analysis

- Whether the counterpart personnel master know-how of DBMS and publish year books.
- Whether the counterpart personnel master know-how of data analysis system and prepare reports.
- Whether study on data communication system of personal computer accomplished.

5.2 System Development of Technical Calculation Program Library

- Whether the counterpart personnel master know-how of development of program library and publish program library.
- Whether establishment of cooperation system on computer utilization carried out.

5.3 Study on Other Technical Supporting System

- Whether establishment of the plan for computer utilization in future are done.
- Whether existing computer system has been studied and improved for computer utilization in future.
- Whether the counterpart personnel master know-how of operating and maintain system on the computer system.

5.4 Training on Computer Utilization

- Whether the counterpart personnel master know-how of teaching techniques and carry out training.

6. Implementing Plan

6.1 Assignment of work

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

The expert and counterpart list is shown in Table - 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, 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 such as 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 Long-term Expert and Counterpart

Name	Duration	Remarks
Long-term Expert		
1. Mr. M. Kashiwabara	1 - 4 - 91 to 31 - 3 - 93	
Counterpart		
	From	
1. U Cho Cho	1 - 6 - 92	
2. U Maung Maung Than	1 - 4 - 91	
3. U Soe Min	1 - 4 - 91	
4. Daw Thwe Thwe	7 - 11 - 91	
5. Daw Htay Htay Win	7 - 11 - 91	
6. Daw Than Than Oo	21 - 5 - 92	
7. Daw Aye Aye Hlaing	6 - 7 - 92	
8. Daw Toe Toe Maw	6 - 7 - 92	

6.2 Provision of Equipment

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

6.3 Implementing Schedule

The Tentative Schedule of Data Analysis and Annual Schedule in 1992/93 are shown in Table - 2 and Table - 3 respectively.

TABLE-2 Tentative Schedule of Data Analysis (92 / 95)

A C T I V I T I E S	92 / 93	93 / 94	94 / 95	Remarks
1) <u>Case Study of System Development for Data Analysis</u>				
A) Data Base Management System				
B) Analysis on Stored DBMS				
C) Study of Information Exchange on Data Stored				
2) <u>System Development of Technical Calculation Program Library</u>				
A) Study of the Existing Technical Programs				
B) Cooperation on Computer Utilization				
3) <u>Study on Other Technical Supporting system</u>				
4) <u>Training on Computer Utilization</u>				

TABLE-3 ANNUAL SCHEDULE OF DATA ACTIVITY

ACTIVITIES	MONTH												REMARKS	
	4	5	6	7	8	9	10	11	12	1	2	3		
<p>1) <u>Case Study of System Development for Data Analysis</u></p> <p>A) <u>Data Base Management System</u> -Investigation of case study areas. -Collection of hydrometeorological data and check manually -Standardization and systematization of DMS. -Creation of file management system and data structure. -Publishing a sample yearbook for hydrological and meteorological data -Preparation of a user's guide for using HYMOS</p> <p>B) <u>Analysis on Stored DMS</u> -Analysis of trend and correlation coefficient on probability of rainfall and discharge -Analysis of a relationship between rainfall and runoff. -Instruction of basic knowledge of hydrometeorological analysis by short term expert. -Preparation of a working report.</p> <p>C) <u>Study of Information Exchange on Data Stored DMS</u> -Investigation of possibility of data communication system -Establishing PC communication between ITC and Yangon ID Head Office.</p>													From next year.	
<p>2) <u>System Development of Technical Calculation Program Library</u></p> <p>A) <u>Study of the Existing Technical Programs</u> -Collecting programs using at ID etc -Review of each program and categorization. -Documentation of each program. -Publishing a program library.</p> <p>B) <u>Cooperation on Computer Utilization</u> -Teaching and assisting for other technical section. -Assisting the HID/UNDP Project in installation of Data Bank.</p> <p>3) <u>Study on Other Technical Supporting system</u> -Supporting for improvement of existing computer system.</p>														From next year.
<p>4) <u>Training on Computer Utilization</u></p> <p>-Classification of training course. -Holding Elementary Course. -Holding Intermediate Course. -Holding Operator Course. (by short term expert</p>														

**WORK PLAN
FOR
DESIGN CRITERIA**

BY

**U Kyaw Myint
&
Mr. Fumio OGI**

July, 1992

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. To achieve this plan as one of the purposes, 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 on 23 Dec. 1987 and 27 Sep. 1991.

This WORK PLAN stipulates the detail of whole duty in this field and activities should be proceeded following 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 stipulated as the work plan (Framework) in Tentative Schedule of Implementation, Nov. 1991. The report prepared by leader of Survey 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 planning and design, this item has been added. And this field is closely related with data analysis. Therefore, this will be proceeded in cooperation with computer section in ITC.

2. OBJECTIVES

The Design Criteria is various or wide field, and its content is complicated. And it takes long time and needs intensive analysis / examinations to establish the Design Criteria completely.

Therefore, some of subjects will be chosen according to the importance and priority as urgent subjects. These subjects will direct toward the solution through the introduction on procedure of standardization of Design Criteria. The Draft Design Criteria will be prepared as a final result.

For the item of computer utilization, the examination of existing technical calculation programs and arrangement of program library will be proceeded in cooperation with computer section of ITC.

3. PLAN OF ACTIVITIES

3-1 Subjects

3-1-1 Design Criteria

Expected kinds of works are,

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

The contents of each subject will be as follows:

1) Fill Dam

- 1)-1 Basic Considerations and procedure in Planning and Design
- 1)-2 Design Conditions of Dambody and Foundation
- 1)-3 Design of appurtenant Structures

2) Canal

- 2)-1 Basic Considerations and procedure in Planning and Design
- 2)-2 Design Conditions of Open Channel

3) Headworks

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

3-1-2 Computer Utilization

Technical calculation programs and survey program which concern with the subjects of Design Criteria would be proceeded.

3-2 Form of Design Criteria

This will be prepared as the Japanese Criteria style. The Criteria should show the standard on the design so that this would be safe and rational under all conditions. Therefore, in the Criteria, description should be the basic rule which must be followed at least and should suggest the expected direction at design. Furthermore, this will show alternatives all which may be examined for each examination item and explanation.

Title	Items that should be examined.
Criteria	The provision of definition of terms or basic concept which must be followed. This part consists of one or two sentences and within around 5 lines.
Explanation and Reference	The content of Criteria will be described in detail or practically. The ground of Criteria, method of design and construction which is formulated at present and matters to be attended will be listed. This part should not be a practical use for the specified project. Typical samples can be also introduced for the reference.

3-3 Study Procedure

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

3-3-1 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 Introduce Criteria

Counterparts will examine whether introduced Criteria is adaptable or not. If this 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 skillful engineer concerning each field and in cooperation with YANGON INSTITUTE OF TECHNOLOGY. The draft design criteria will be prepared as a first study.

3-3-2 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 programs and how to use.

3) Arrangement of Program Library

Counterparts will try to utilize through arrangement, improvement and adaptation of the existing and introduced programs.

4. 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 for three fields mentioned in 3-1 Subjects .

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

5. IMPLEMENTATION PLAN

5-1 Japanese Expert

The Japanese Experts have been dispatched by the Government of Japan.

Name	From	To
Mr. Y. FURUYAMA	2 June, 1988	10 September, 1988
Mr. F. OGI	16 November, 1991	15 November, 1993

Following is a tentative schedule for short-term expert.

1992/93 - two man-month
1993/94 - two man-month
1994/95 - two man-month

5-2 Counterparts

The Irrigation Department would assign counterpart personnel needed to proceed the task of this field together. They shall also make all necessary arrangement concerned.

5-3 Provision of Equipment

Technical equipment needed , mainly books, will be handed over for ID within JICA budget.

5-4 Implementation Schedule

The Tentative Schedule on Design Criteria and Annual Schedule in 1992/93 are shown Table-1, Table-2 respectively.

Table - 1 TENTATIVE SCHEDULE OF DESIGN CRITERIA

Activities	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				

TABLE - 2 ANNUAL SCHEDULE IN 1992/93

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

WORK PLAN
FOR
CONSTRUCTION MATERIAL TEST
AND
ANALYSIS

BY
U Cho Cho
&
Mr. Mitsuo TAKAHASHI

JULY, 1992

CONSTRUCTION MATERIAL TEST AND ANALYSIS

1. Background

To the engineer engaged in design and construction of irrigation structures, the properties of construction material such as cement, aggregate, concrete, reinforcing steel, rock, soil and water that is used in his works are very important. To enable testing of the construction material, a laboratory for soil and construction material had included in establishing Irrigation Technology Centre of Irrigation Department.

2. Objectives

To Myanmar counterpart personnels engaged at Irrigation Technology Centre in the field of construction material testing, it will be given technical guidance by JICA experts. The activities to be carried out in the corresponding field will be planned to get good development.

3. Plan of Activities

3.1 Construction material test

3.1.1 Material testing and handling of equipment

The know how on systematic operation of equipment of the material testing laboratory would be transferred. The procedure of material testing according to JIS will be fulfilled so that the counterpart would have gained confidence on the results obtained from his tests.

The tests would include:

- a. Physical tests of cement
 - b. Aggregate tests
 - c. Fresh concrete tests
 - d. Hard concrete tests
- and
- e. Steel and rock tests

3.1.2 Quality tests and mix design of concrete

Technology on tests in finding out the quality of material would be transferred. To make the most economical use of available material that will produce concrete of the required specification, concrete mix design will be carried out.

3.1.3 Concrete manufacturing and quality control

The know how for production of uniform and economical concrete will be transferred .

3.1.4 Reinforcing steel and concrete in construction works

The technology transfer on construction control of concrete and reinforcing steel will be made.

3.2 Soil Test

3.2.1 Geological survey

This activity aims at technology transfer on geological survey and will include method of exploration, boring, sounding and sampling.

3.2.2 Field survey and sampling

Principles of investigation, surface and subsurface exploration and methods of explorations will be included.

3.2.3 Method of soil tests and handling of equipment

Technology transfer on method of soil tests according to JIS and operation know how of test machinery will be carried out. It will cover following tests:

- a. Tests for discrimination and classification of soil
- b. Tests for dynamic quality of soil
- c. Tests for construction control
- d. In-situ tests.

3.2.4 Tests on foundations, subgrade, soil used in construction and quality control

It will cover soil tests on foundation of different type of structures and tests on soil used as a construction material. Quality control for earth construction will also be covered.

3.3 Water Quality Test

3.3.1 Water quality testing method and handling of equipment

It is to be acquainted with test procedure and handling of water quality equipment.

3.3.2 Survey of water quality

Standard of water quality for irrigation will be specified and survey of water quality of irrigation water will be performed.

3.4 Case Study on Irrigation Projects

Study on construction material and soil of Irrigation Projects in Myanmar will be carried out.

4. Implementing Plan

4.1 JICA Experts

JICA dispatches one long-term expert and necessary short term experts for this field. For 1992-93, short-term expert for geological survey would be dispatched for one month duration. Tentative schedule of visit of Experts is shown in Table - 2.

4.2 Counterparts

10 counterpart personae are assigned to this field and will work together with JICA experts in all planned activities. They will make all necessary arrangements for the activities of the field under the guidance of the expert. The counterpart personae will carry out necessary coordination with other government offices.

The expert and counterpart list is shown in Table -1.

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 the engineering and laboratory personae of Myittha laboratory and construction circles.

4.5 Implementing schedule

The tentative schedule and schedule of activities in 1992 - 93 are shown in Table - 2 and 3.

Table - 1 Experts and counterparts for soil and Construction Material Testing

No.	Name	Designation	Remark
1	Mr. M. Takahashi	JICA Expert	Long-term expert
2			Short-term expert
3	U Cho Cho	Assistant Director	Chief counterpart
4	U Zaw Htut Oo	Staff Officer	Staff counterpart (Material testing Lab)
5	U Oo Hla Myaing	"	"
6	U Tin Shwe	Supervisor	"
7	Daw Mu Mu Myint	Staff Officer	Staff counterpart (Soil Laboratory)
8	U Thein Win	"	"
9	U Soe Tint	"	"
10	U Ye Win	Supervisor	"
11	U Tin Aung	"	"
12	U Oo Myint	"	"

Table - 2 TENTATIVE SCHEDULE OF CONSTRUCTION MATERIAL TEST AND ANALYSIS

Activities	Fiscal Year		1991.4 - 1992.3		1992.4 - 1993.3		1993.4 - 1994.3		1994.4 - 1995.3			
	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM
1. CONSTRUCTION MATERIAL TEST												
1) Method of testing and handling of equipment												
2) Quality test and concrete mix design												
3) Concrete manufacturing and quality control												
4) Concrete in construction works												
2. SOIL TEST												
1) Geological Survey												
2) Field Survey and Sampling												
3) Method of Soil tests and handling of equipment												
4) Tests on foundation, subgrade and soil used in construction and quality control												
3. WATER QUALITY TEST												
1) Method of testing and handling of equipment												
2) Survey of water quality of irrigation												

Table - 2 TENTATIVE SCHEDULE OF CONSTRUCTION MATERIAL TEST AND ANALYSIS

Activities	1991.4 - 1992.3			1992.4 - 1993.3			1993.4 - 1994.3			1994.4 - 1995.3		
	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM
4. CASE STUDY ON IRRIGATION PROJECT												
5. TRAINING												
6. VISIT OF EXPERTS												
a) Long term expert												
b) Short term expert												

IRRIGATION TECHNOLOGY CENTRE, BAGO

**WORK PLAN
FOR
HYDRAULIC MODEL TEST
AND
ANALYSIS**

BY

**U Cho Cho
&
Mr. Nariaki TAMURA**

June, 1992

WORK PLAN FOR HYDRAULIC MODEL TEST AND ANALYSIS

1. The Background

The Irrigation Department is the sole department for carrying out all the water resources projects related to irrigation, flood control and river conservancy works of the country. ID undertakes planning, investigation, design and implementation of the above projects, and also operation and maintenance after their completion.

For optimizing the designs and predication of performance behavior of hydraulic structures, model investigation is very useful. Thus a hydraulic laboratory was introduced at the Irrigation Technology Center. Since the laboratory is the first of its kind in the Department, ID required to train staff for conducting effective model investigation.

2. The Objectives

Hydraulic engineering works are in many cases so complex that their design requires much care. Before the work is carried out it has to be sure that the effects anticipated will indeed be reached and that negative effects on the environment are reduced as much as possible. So the behavior of a hydraulic structure itself and its influence on the environment has to be forecasted.

The prediction is carried out by means of models of various sorts. The application of models, both physical (scale) models and mathematical models, would be introduced through hydraulic laboratory of ITC. The technology of both type of models would be transferred from Japanese experts to counterparts so that by using the facilities of ITC hydraulic laboratory and computers, the use of hydraulic models can be carried out for hydraulic design works.

3. Plan of activities

3.1. Physical (scale) models

Law of hydraulic similarity, principle of modelling and principle of scaling would be introduced. The design and construction of some models, and instrumentation would also be included in the technology transfer.

3.1.1. Case study on Dam spillway

Model of Spillway of Yin dam and Sadon dam will be constructed and studies so that the above technology could be transferred by the on the job training.

In particular the following will be conducted in Spillway model studies:

- (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 discharges;
- (g) investigation with alternative shapes of the flip bucket, such as with alternate bucket radius, lip shape, lip angle etc.; and
- (h) investigation for the invert level and required dimensions of the plunge pool, and qualitative study of scour at plunge pool and outfall channel.

3.1.2. Case study on Yin Weir

Yin Weir model will be constructed and model study will be carried out on that model. The use of mobile bed model will be introduced. Studies on flow pattern, sediment distribution, sediment movement, pond level will be included in the Yin Weir model studies. The configuration of the weir such as alignment, crest level of both weir and head regulators, offtake water-way width, geometry of upstream and downstream guide bunds, the length and geometry of divide wall will also be studied.

3.2. Mathematical models

Computer technology, nowadays, is well developed and is utilized in every field. In hydraulic problems the use of mathematical model become wider as the development of digital computers make mathematical models more powerful. ITC had equipped with computer facilities and it will be introduced the use of mathematical models (computer simulation models).

In some hydraulic problems, mathematical models are more economical and have more advantages, and in some cases these type of models are superior. The know-how, technology and utilization of mathematical models will be transferred to Irrigation Department (ID) personals through ITC hydraulic laboratory. The short term expert for ITC hydraulic laboratory will introduce the ID personals about the general overview of mathematical models, the use of mathematical models in hydraulic and irrigation engineering problems, what type of data and how they should be collected for the model, the calibration of the model etc.

The well-known mathematical models developed by well established hydraulic laboratories would be used. The ID personals would be made familiar with the use of mathematical models so that they can consider mathematical modelling for the future works of the Department whenever necessary.

4. Implementing Plan

1) Japanese expert

JICA dispatchs short-term experts for this field according to the Record of Discussion. Following is a tentative schedule of the short-term experts.

1991/92 One man month
1992/93 Two man month
1993/94 Two man month
1994/95 Two man month

2) Counterpart

ID assigns counterpart personal who carry out the hydraulic and mathematical model test consulting with the short-term experts.

3) Provision of equipment

Measuring instruments and equipments for hydraulic model tests will be provided within JICA budget.

4) Implementing schedule

The Tentative Schedule of Hydraulic Model Test and Analysis and the Schedule of Activities of Hydraulic Laboratory for 1992-93 are attached Table-2,3 respectively.

Table - 1

EXPERT AND COUNTERPART

Name	Duration	Remark
[Short-term Expert]		
1. Mr. Y. Matsumoto	15. 6.91 to 11. 7.91	
[Counterpart]		
1. U Nu Maung	22. 4.91 to 27. 9.91	Assistant Director
2. U Cho Cho	15. 5.89 to date	Assistant Director
3. U Myo Myint Aung	20. 4.90 to 3.12.91	Staff Officer
4. U Hla Baw	6.12.91 to date	Staff Officer

5. Evaluation

Since this is the ID's first experience in establishing and conducting the hydraulic laboratory, it is the aim of ID to build up engineers in this field. Therefore evaluation is conducted to assess whether the activities has achieved the targets, that is: the counterpart engineers could do the simple model tests and prepare reports of the study, and have ability to improve their technology of conducting verification or predication of hydraulic works by model investigation in the near future.

The evaluation should consider the likelihood of the sustainability of the hydraulic laboratory and suggest measures to intensify activities, if necessary.

TENTATIVE SCHEDULE OF HYDRAULIC MODEL TESTS AND ANALYSIS

Table - 2

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					

Table - 3 SCHEDULE OF ACTIVITIES OF HYDRAULIC LABORATORY (ITC) FOR 1992-93

No.	Job Description	1992							1993				
		A	M	J	J	A	S	O	N	D	J	F	M
1.	Preparation of interim and final report on Yin spillway model study												
2.	Seminar on Yin Spillway model study												
3.	Design and preparation of estimate for Sadon Spillway Model												
4.	Construction of Sadon Spillway Model												
5.	Test on Sadon Model												
	(a) Original design												
	(b) Alternative design												
6.	Report on Sadon Spillway Model												
7.	Introduction to mathematical models												
8.	Visit of Short term expert												