2.2.4 Implementation Plan

2.2.4.1 Implementation Policy

The work for the Project will be inherited by the UNDP and the UNOPS after the basic design and this subsequent work will include the following activities.

(1) The Basic Design Briefing Team will explain the contents of the proposed facility rehabilitation described in the Outline of the Basic Design to the Ministry of Education, Culture, Youth and Sports of the ETTA and the University of East Timor.

(2) The East Timor National University will prepare the project document based on this Outline of the Basic Design and the ETTA will submit a request to the UNDP based on the said project document. The UNDP will subsequently made a request for grant aid to the Government of Japan.

(3) The UNOPS will then prepare the MSA (Draft) for the management of the detailed design and work supervision for the Project. The MSA will conclude between UNOPS and the Government of Japan upon its approval of Cabinet of Government of Japan and ETTA..

(4) Following the signing of the Note Verbal with the UNDP, the Government of Japan will remit funds equivalent to the estimated and evaluated project cost to the UNDP at the UN Head Office.

(5) The UNDP and the UNOPS will select the Japanese Corporate consultant responsible for the detailed design and work supervision. The selected consultant will conclude a detailed design and work supervision agreement with the UNOPS. This agreement will only be concluded after the confirmation of fund remittance.

(6) The selected consultant will conduct the detailed design, estimation of the construction cost and preparation of the tender documents and will obtain approval of their contents by the UNOPS, the Ministry of Education, Culture, Youth and Sports of ETTA and the Faculty of Engineering of the National University of East Timor.

(7) Following the said approval, the UNOPS will organize the tender to select a Japanese construction company (a joint venture with an equipment supplier).

(8) The joint venture between the construction company and equipment supplier of Japanese Nationality which successfully won the tender will conduct the construction of facilities and the procurement as well as installation of equipment. The relevant agreement involving the said joint venture will be concluded with the UNOPS.

During the construction work, the UNDP and UNOPS will monitor the work progress, work quality and problems related to the work via the Consultant and will explain the situation to the DCU, the Ministry of Education, Culture, Youth and Sports of the ETTA and the Faculty of Engineering of the National

University of East Timor at regular meetings.

(1) Project Implementation Body

As the Government of East Timor has not yet taken full shape, deterring direct assistance by the Government of Japan, the body responsible for the implementation of the Project will be the UNDP. The recipient organization within the ETTA will be the Ministry of Education, Culture, Youth and Sports. The Faculty of Engineering of the National University of East Timor will be responsible for the general work during the project implementation period as the recipient of the Project. For the construction of the planned facilities, the establishment of the Project Steering Committee is desirable to co-ordinate the practical work on the East Timor side from the detailed design stage to the completion and handing over stage. It is desirable for members of this committee to consist of representatives of the UNDP, the UNOPS, the Ministry of Education, Culture, Youth and Sports, the DCU, the Faculty of Engineering of the National University of East Timor, the Liaison Office of the Government of Japan.

(2) Consultant

Following the signing of a MSA between the Government of Japan and the UNOPS, the UNOPS usually commence the work to select a consultant through the proposal method. Should this method be used, a work preparation period of seven months, i.e. two months for the selection of a consultant, three months for the detailed design, estimation of the project cost and preparation of the tender documents and two months for the tender and selection of a construction company, will be required. Given the fact that the Project is a grant aid project for urgent rehabilitation and that a strong request has been made by the Faculty of Engineering of the East Timor National University to start using the new facilities from October, 2002, the work must commence in April, 2002 at the latest because of the estimated rehabilitation work period for the target buildings of six months for the renovation of new administration and lecture building and nine months for workshops. Under these circumstances, completion of the rehabilitation work by this time limit will be impossible if the UNDP and the UNOPS follow their standard consultant selection procedure. It is hoped that special consideration will be given to allowing the consultant responsible for the basic design to continue the work, including the detail design, by means of a special private contract. Even in this case, a consultant with Japanese nationality must conclude a consultant agreement for the detailed design and supervision work with the UNOPS and this agreement must be approved by the UNDP Head Office. Following approval of the agreement, the consultant will consult with the UNOPS and the Faculty of Engineering, prepares the detailed design drawings and tender documents based on the Basic Design Study Report and obtain their approval by the Steering Committee.

At the tender and construction stages, the consultant will conduct the tender work and work supervision based on such detailed design documents and tender documents. It will also carry out the supervision of the equipment-related work, ranging from the tender for equipment supply to the installation, trial operation and handing over of the equipment.

(3) Construction Company (Contractor)

A Japanese construction company and a Japanese trading company, both with certain qualifications, will establish a joint venture for its selection as the contractor through the open tender process. The contractor will complete the construction of the planned facilities within the period of the contract in accordance with the detailed design drawings and tender documents prepared by the consultant and will hand them over to the UNOPS. The scope of the work will include the building construction (rehabilitation), air-conditioning/ventilation work, plumbing work, electrical installation work and exterior work and the contractor will complete this work using East Timorese as well as Japanese subcontractors, engineers and workers.

(4) Equipment Supplier

A Japanese trading company with certain qualifications will establish a joint venture with a Japanese construction company for its selection as the equipment supplier (the contractor) through the open tender process. The contractor will conduct the procurement and installation of the planned equipment, which meets the specifications approved by the project implementation body, within the contract period. At the installation stage, expert engineers will be dispatched to supervise the equipment installation work and will explain the equipment operation to the staff members of the Faculty of Engineering.

2.2.4.2 Implementation Conditions

(1) Local Construction Industry

The general conditions of the construction industry in the Dili area of East Timor are described below.

① There are several local subsidiaries of Australian, Portuguese and Singaporean construction companies in Dili. Much of the large-scale work is conducted by Australian subsidiaries and, therefore, these companies employ many skilled workers. Indigenous construction companies are not specialized in certain fields and their business scale is small.

② Based on the average productivity of local carpenters, plasters, reinforcing bar workers and finishers, the required labor input appears to be three or four times larger than that in Japan. As this figure is based on interview results with local construction companies, the actual input required may well be higher than this.

③ Skilled workers for the jobs mentioned above are difficult to recruit locally and their recruitment in such neighboring countries as Singapore, the Philippines and Malaysia, etc. will be necessary.

④ With the growing volume of construction work in recent years, there has been an increase of the

cost of construction materials and of the labor cost. As such key construction materials as cement and reinforcing bars are entirely imported, their prices are likely to be influenced by the market situation in neighboring countries.

(2) Important Points for Construction Work

① Although the period from December to April is considered to be the rainy season in Dili, there is relatively little difference between the rainfall in the rainy season and the dry season and, therefore, no problems are anticipated for the earth work and foundation work in terms of the season.

② Power supply in Dili is provided by diesel generators of Power Plant. Because of the small capacity and aging of the generating facilities, the generating capacity of the power station is insufficient to meet the demand and regular power cuts lasting some 3 hours/day are implemented even in Dili. There was an accident in power station in Dili by breaking crankcase by crankshaft and one of the generator is under over all maintenance in September 2001. Because of the absence of two sets out of five generator sets become more power situation worse and there were more blackout happened frequently.

As the Hera area where the project site is located is some 16 km away from the generating facilities, a substantial voltage drop is likely. Accordingly, the installation of an on-site generator to supply power for the work will be required. Given the prospect of likely frequent power cuts due to insufficient of the generating capacity and voltage dropdown, it is needs to use generator set during construction for operation of construction equipment and over time work in the night.

③ The target buildings are made of RC and reinforced concrete blocks. Although these are common construction methods, the quality and speed of work tend to be determined by the skills of construction workers. Accordingly, proper attention must be paid to quality as well as schedule control.

④ As the river sand pit in Dili is located near the coast, the river sand has a high salt and mud content, making strict quality control for concrete mixing necessary.

⑤ In regard to the installation and test operation of the building service equipment, proper guidance should be provided for the maintenance staff for the rehabilitated facilities in regard to operation, regular inspection and parts replacement methods, etc.

⑥ It is difficult for East Timor people to find job all over the country, therefore the consultant accept to use the local construction method and grade for this project and instruct the contractor to give chance for the job opportunity to East Timor peopole.

(3) Supervising Engineers of the Contractor

For the punctual completion of the facilities meeting the specifications set forth in the detailed

drawings/documents within the planned completion period, the Japanese contractor must be capable of smoothly conducting the joint work with local construction companies while providing appropriate technical guidance and implementing strict schedule control. It is, therefore, desirable for the contractor to appoint supervising engineers conversant with the local conditions to achieve the high quality of the facilities based on a precise understanding of the nature of the planned facilities. Given the contents and scale of the facilities planned under the Project, the following full-time work staff will be necessary.

< Building Work >

・Field Representative : one person
General management and coordination
・Service Engineer (short-term) : one person
Mechanical/electrical equipment installation and test operation and technical guidance
・Administrator : one person
Administrative work, labours controls and import procedure

< Equipment Work >

・Explanation of and technical guidance on the installation, test operation and inspection of the equipment

・Listing of those sections of the main equipment where breakdown is more likely to occur than other sections and submission of the list to the University at the time of the handing over of the equipment

2.2.4.3 Demarcation of the Work

The following general demarcation of the work between Japanese side and East Timor side is judged to be appropriate for the Project.

(1) Work to be undertaken by Government of Japan

1) Facilities

・New administration and lecturer building:
Introduction of various administrative rooms, library, computer room, classrooms and toilets, etc. with the rehabilitation of the existing physics and chemistry laboratory building

・New electrical and mechanical engineering workshops building:
Introduction of teachers' rooms, drawing room, classrooms, workshops and toilets, etc. with the rehabilitation of the existing mechanical work shop

・New civil engineering workshop building:
Introduction of teachers' room, classrooms, workshop and storage room, etc. with the rehabilitation of the existing civil workshop.

・Canteen building:
Introduction of toilets and kitchen, etc. with the rehabilitation of the existing canteen building

・Gate house：
Rebuilding of the gate house and repair of steel gate

・Construction of infrastructure, including water supply, sewage, drainage and power supply facilities

・Demolition of the existing administration building

2) Equipment (Systems)

・Equipment and spare parts, etc. required for practical training in the electrical, mechanical and civil engineering courses

・General office furniture and fixtures, etc. required for the new administration and classroom building and the new workshop buildings

・Removal of existing heavy equipment in the existing workshops

(2) Work to be Undertaken by the ETTA

1) Removal of trees, etc. which will obstruct the work on the campus and teaching after the opening of the campus

2) Repair work for external work (eg. damaged brick paved corridor, damaged bridge)

3) Removal of lightweight equipment remaining in the existing workshops which can be moved by approximately four workers

4) Arrangements for the procurement of consumables and spare parts for the maintenance of the new facilities and equipment

5) Payment of handling charge on imported equipment and materials

6) Auxiliary work not included in the scope of work under the Project

2.2.4.4 Consultant Supervision

In accordance with the urgent rehabilitation grant aid policy of the Government of Japan, the consultant will organize a project implementation team to conduct the detailed design and supervision services in line with the basic design policies. At the construction stage, the consultant will dispatch full-time supervisors with ample technical capability to provide instructions for the contractor in order to ensure the smooth progress of the work. The consultant will also assign technical experts on a short-term basis in accordance with the work progress to conduct inspection and to provide guidance on execution.

(1) Basic Supervision Principles

1) The punctual completion of the facilities based on the construction schedule should be aimed at through close communication with and reporting to the related organizations and those in charge in Japan and East Timor.

2) Prompt and appropriate advice and guidance will be provided for those involved in the work to ensure that the constructed facilities meet the specifications set forth by the design documents.

3) Priority will be given to the use of local construction methods using local materials as much as possible.

4) Appropriate guidance will be provided on the operation and maintenance of the building service equipment and systems.

5) Appropriate advice and guidance will be provided in regard to post-handing over maintenance to facilitate the smooth operation of the facilities.

(2) Work Supervision Contents

1) Assistance for the signing of the construction contract
Selection of the contractor by means of tender (determination of the contracting method, preparation of the draft agreement, confirmation of the contents of the specifications and witnessing of the work contract, etc.)

2) Inspection and approval of shop drawings, etc.
Approval of the shop drawings, samples and materials, etc. submitted by the contractor and their inspection, if necessary

3) Work guidance
Examination of the schedule plan and work outline, etc., provision of guidance for the contractor and reporting of the work progress to the owner

4) Assistance for payment authorization procedure
Assistance for the payment authorization procedure through examination of the contents of

invoices and the work progress in regard to the construction cost to be paid during the construction work and upon completion of the said work

5) Inspection and approval

According to the necessity, implementation of the inspection of each work in terms of quality and workmanship and the provision of guidance for the contractor during the construction period

The consultant shall confirm the completion of the work in accordance with the conditions of the contract, attend the handing over of the completed work and obtain the acceptance of the owner. It shall also report to the Government of Japan any important matters related to the progress of the construction work, payment procedures and handing over of the completed work.

2.2.4.5 Quality Control Plan

Given the climate of East Timor which is characterized by high temperatures and high relative humidity, strict quality control of the planned construction work is required to maintain pleasant living conditions and a safe environment for equipment by shutting out strong solar radiation and humidity.

Particularly important will be the preservation of the concrete quality in the face of high temperatures by carefully measuring the ambient temperature as well as the concrete temperature at the time of the concrete placing work. While past meteorological data suggests that the mean monthly temperature does not exceed 35°C throughout the year, the application of appropriate measures for proper concrete placing under a high temperature may be necessary depending on the weather conditions.

Aggregate will be obtained from an inland quarry. The absence of mud and foreign matters should be confirmed prior to the mixing of aggregate with cement. The amount of chloride in the post-mixing fresh concrete should also be checked. Quality control of the finishing work will focus on the preservation of the exterior appearance of the existing buildings in view of the main work being the rehabilitation of these buildings and adaptation of the finish to high temperatures and high humidity.

The contents of the quality control plan for each type of work are outlined below.

Table 2-23 Quality Control Plan

Work Category	Type of Work	Control Item	Method	Remarks
Structural Work	- Concrete work	- Fresh concrete	- Slump, air volume, temperature and chloride tests	Due to the absence of public organizations in East Timor, the necessary equipment will be brought in Australia
		- Concrete strength	- Comprehensive strength test	
		- Reinforcing bars		
	-Reinforcing work	-Arrangement of reinforcing bars	- Tensile test; mill sheet check - Reinforcing bar arrangement check (dimensions) -Mill sheet and delivery note check	
	-Steel frame work	- Structural steel	- Mill sheet and delivery note check -	

Finishing Work	- Roof work	- Workmanship and leakage	- Visual inspection; water spray test	
	- Tile work	- Workmanship	- Visual inspection	
	- Plastering work	- Workmanship	- Visual inspection	
	-Door and window work	- Products	- Check of factory inspection report	
		-Installation accuracy	- Visual inspection and check of dimensions	
		- Workmanship		
	- Painting work	- Products/ workmanship	- Visual inspection	
	- Interior work	- Products/ workmanship	- Visual inspection	
Electrical Work	- Power receiving and transformer equipment	-Check of performance level and operation/ installation conditions	-Thorough pre-shipment inspection; withstand voltage; megar and operating test; visual inspection	
	- Conduit work	- Check of bends; support distance	- Visual inspection; check of dimensions	
		- Damage to sheath	- Check of performance reports; clearing before laying work	
	- Wiring and cabling work	- Loose connection	- Marking after fastening of bolts	
	- Lightning rod work	- Resistance value; support for conductor	- Measuring of resistance; visual inspection; check of dimensions	
	- Lighting work	-Check of performance level and operation/ installation conditions	- Check of performance reports; illumination test; visual inspection	
Plumbing Work	- Water pipe laying work	- Support distance and leakage	- Visual inspection; leakage and water feed test	
	- Drainage pipe laying work	- Gradient, support distance and leakage	- Visual inspection; leakage and water feed test	
	-Pump installation work	-Check of performance level and operation/ installation conditions	- Check of performance reports; flow rate test	
	Air-conditioning work	- Checking of performance level and operation/ installation conditions	- Check of performance reports; flow rate test	
	- Water tank and elevated water tank work	- Water leakage	- Water filling test	
	- Sanitary ware installation work	- Check of operation, installation and leakage conditions	- Visual inspection and water feed test	

2.2.4.6 Procurement Plan

1. Building Work

The following items should be taken into consideration for the procurement of the construction materials and equipment to be used for the construction of the facilities under the Project.

(1) Procurement Policy

Most of the construction materials can be locally procured. The procurement policy is, therefore, the procurement of suitable materials taking the supply capacity and quality vis-à-vis local manufacturers and suppliers into consideration. The materials to be procured from Japan should be kept to a minimum and should be restricted to items which cannot be procured locally because of the cost, special specifications, poor performance or simply insufficient local supply capacity.

(2) Procurement in Japan

In regard to equipment and materials of which the local procurement is difficult, procurement in Japan will be considered. In the case of building service equipment and electrical equipment which will require a special order, timely order placement in accordance with the work progress will be necessary as a long time is required to complete the process from initial order placement to design approval, manufacture and shipment by the manufacturer.

(3) Local Procurement

Imported materials from such neighboring countries as Indonesia, Singapore and Australia are widely available in the market and these materials will be regarded as local materials for the purpose of the Project. Even though the procurement cost for some of these items is relatively high, materials imported from neighboring countries will be actively used because of the easy maintenance of the new facilities using these materials after their completion. In the case of Indonesian products, the quality and grade of some materials may well be inferior to those of comparable products made in other countries.

(4) Cost Comparison

Japanese products will be procured when their prices are found to be substantially lower than the prices of locally available products. In the case of products procured in Japan, the cost of these products will reflect the packaging, transportation and insurance costs and exemption of local taxes.

(5) Procurement Plan

Based on the procurement principles described above, the equipment and materials to be used for the construction (rehabilitation) of the planned facilities under the Project will be procured in the following manner.

1) Structural Work

The main structural materials, including sand, gravel, cement, reinforcing bars and structural steel (including foreign products), are available locally and in neighbouring countries. As far as

concrete blocks are concerned, those made by a foreign subsidiary construction company appear to be usable.

2) Interior and Exterior Finishing Work

Almost all of the materials required for the buildings, i.e. timber, aluminum fittings, plastering materials, tiles, roof tiles, metal roofing materials, paint and glass, including imported materials are available in the local market.

3) Air-Conditioning and Sanitary Work

As high quality imported air-conditioning equipment, fans and sanitary ware, etc. are available in the local market, these will, in principle, be procured from the viewpoint of their maintenance.

4) Electrical Work

Imported lamps, electrical wires and cables and PVC pipes are available in the local market. These items will, in principle, be procured locally or from neighbouring countries from the viewpoint of their maintenance. The procurement sources for such custom-made products as distribution panels, transformers, automatic voltage regulators and control panels will be decided based on their cost analysis. Procurement from third countries will also be considered.

5) Equipment Work

As some of the equipment to be procured under the Project is difficult to procure locally, procurement from Indonesia, Singapore, Australia and/or Japan will be considered.

6) Transportation Plan

In principle, maritime transportation will be used for the transportation of the equipment and materials procured in Japan to Port Dili. The transportation requirements in East Timor are outlined below. When the cargo is insufficient to fill a cargo ship, there is no direct service from Japan or Singapore to Port Dili, making transfer at Jakarta or Surabaya necessary. In other words, should the ship from Japan or Singapore be full, transfer at Jakarta or Surabaya will be unnecessary. The planned transportation time should allow some margin.

① From Japan to the project site: approximately one month

- From Japan to Singapore: one week (transfer at Singapore unless a chartered vessel is used)
- From Singapore to the project site: biweekly service

② From Darwin, Australia to Port Dili: approximately 10 days

- From Port Darwin to Port Dili: weekly service at present
  Departure on a Monday provided that customs clearance by Friday morning has been conducted and arrival at Port Dili on the following Wednesday

③ From Singapore to the project site: approximately three weeks

- From Singapore to Port Dili: one to two weeks
  Weekly service: one week to Port Dili by direct service provided that the vessel is full of cargo for East Timor or two weeks if the vessel has mixed cargo making it necessary for the vessel to call at Jakarta or Surabaya

④ From Surabaya to the project site: approximately three weeks

- From Surabaya to Port Dili: five days to two weeks
  Weekly service: the allocation of extra days is required as departure may be delayed until the vessel is fully loaded or if it is necessary for the vessel to call at Port Kupang

7) Customs clearance and inland transportation

Customs clearance and inland transportation from Port Dili to the project site require two days each. If a weekend is involved, arrival will be the following week.

The results of the findings of the field survey in accordance with the above-described procurement plan are shown in Table 2-24

Table 2-24 Study of Major Construction Materials and Procurement Plan

(1) Building materials

Works	Materials	Place of procurement			Remarks
		Local	Japan	Others	
Concrete work	Portland Cement	○			Available at local market.
	Anti-Sulfate Cement	○			Ditto
	Sand/Crushed Stone	○			Ditto
	Reinforcement bars	○			Imported material available at local market
	Wooden forms	○			Ditto
Steel work	Structural Steel	○			Need time to processing
	Sheet Metal	○			Ditto
Masonry work	Concrete block	○			Local procurement available 190mm×390mm×90,150,200mm 3 sizes available
Water-proof Work	Sealing material	○			Imported material available at local market
Tile work	Ceramic tile	○			Imported material is available at local market.
Wooden work	Wood	○			Imported material is available at local market
	Plywood	○			
Roof work	Color metal sheet	○			Imported material is available at local market
	ALM metal sheet	○			Ditto
	Galuvalium metal Sheet			○	Import from Singapore
Metal work	Steel ladder	○			Local procurement available
Metal Sash Work	Alum window frame	○			Imported material available at local market
	Steel jarogee	○			
	Alum window	○			
Wooden Sash Work	Wooden door	○			Imported material available at local market
	Wooden door frame	○			
Ironmongery	Door handle, lock	○			Imported material available at local market
	Door closer	○			Ditto

Glass work	Plane glass	○			Imported material available at local market
Paint work	Interior paint Exterior paint	○ ○			Imported material is available. Ditto
Interior work	Rockwool Acc. Board Gypsum Board Cement Board	○ ○ ○			Imported material available at local market Ditto Ditto
Furniture work	Kitchen sink	○			Imported material is available.
External work	Pavement block	○			Imported material available at local market

(2) Mechanical work

Works	Materials/Equipment	Place of procurement			Remarks
		Local	Japan	Others	
A/C & Fan work	Separate type A/C Exhaust Fan Insulation Material	○ ○ ○			Imported material is available at local market Ditto Ditto
Sanitary work	Pump & Tank Sanitary Ware Pipe (Steel) Pipe (PVC)	○ ○ ○ ○			Imported material is available at local market. Ditto Ditto Ditto

(3) Electric equipment work

Works	Materials/Equipment	Place of procurement			Remarks
		Local	Japan	Others	
Lighting & Cabling work	Lighting Fixtures Wire/Cables Panel Transformer AVR	○ ○ ○ ○ ○			Imported material is available at local market. Ditto. Ditto Ditto Ditto

2. Equipment

The following issues must be considered for the procurement of educational equipment.

(1) Procurement Principles

As all of the main equipment is not produced locally, it must be procured in Japan or a third country (such as Australia or Indonesia). The basic principle for procurement is the purchase of products of those manufacturers which have an agent or a trading partner in East Timor if possible or from Australia and/or Indonesia to ensure (i) an adequate supply of spare parts and expendables after the initial delivery of the equipment and (ii) the availability of technical services to enable the continuous use of the procured equipment. While a generator to support practical training equipment can be locally procured, the procurement decision must be made after careful consideration of a reliable maintenance service, price and specifications.

(2) Procurement Plan

As procurement from Japan or a third country takes a much longer time than local procurement, the order placement, manufacture, shipment and transportation in East Timor must be carefully coordinated with the progress of the facility construction work. Efficient procurement, storage and installation must be aimed at by classifying the procurement items by supplier and placing a blanket order to each supplier.

(3) Incidental Care of Procured Equipment

The following incidental care should be provided for the educational equipment to ensure its educational effects after procurement and installation and the continuity of its quality and functions.

1) Explanation of the safe and appropriate handling and operation to staff members of the East Timor National University

2) Provision of operation and maintenance manuals written in a language which can be understood by East Timorese

3) Use of a language which can be understood by East Timorese for operation-related markings on equipment and monitor displays, etc.

4) Provision of suitable plugs for different types of receptacles used in different places for mobile equipment.

(4) Transportation Plan

1) Maritime Transportation Plan

In principle, the equipment procured in Japan will be transported by sea from Port Yokohama to Port Dili via Singapore. If a cargo ship from Singapore to Port Dili is fully booked, it travels directly to Port Dili. Otherwise, it calls at Jakarta or Slabaya, taking a longer time to reach Port Dili. Accordingly, the transportation schedule for equipment procured in Japan should allow for such extra transportation time. See the transportation plan described earlier for the planned schedule.

2) Road Transportation in East Timor

The equipment transported by sea will be unloaded at Port Dili. Road transportation from Port Dili to the campus or equipment storage yard will be conducted by truck for each equipment or each shipload consignment, paying special attention to the following points.

・The possibility of delayed delivery should be considered as the road conditions in the mountainous area and around Hera are poor during the rainy season.

・The transportation plan should take security and safety into proper consideration to prevent the theft of the equipment, etc.

(5) Site Management and Installation Work Plan

It is estimated that approximately 4 – 6 months will be required from the placement of order at the equipment manufacturer to the arrival of the equipment at the Project Site. A number of deliveries should be determined in line with the schedule for the building rehabilitation work. Special attention should be paid to the following points in regard to the storage of the equipment.

- Prevention of rainwater leakage onto the equipment
- Security at the storage yard (deployment of security guards and other measures)
- Confirmation of the availability of incidental facilities at the equipment installation locations
- Presence of a specialist engineer and an assistant(s) for the installation of the equipment

Table 3-25 shows the procurement sources for the educational equipment.

Table 2-25 Procurement Sources for Equipment

Category	Main Equipment	Procurement Source		
		Japan	Third Country	East Timor
1.Electrical Engineering Equipment	Various measuring instruments; electronic circuit experiment equipment; load device for single phase and three phase measurement; motor for practical training; logic circuit experiment equipment	○	○	
2.Mechanical Engineering Equipment	Various measuring instruments; various tools; lathe; vertical milling machine; grinding machine; welding machine; bending machine; shearing machine	○	○	
3.Civil Engineering Equipment	Concrete compaction tester; soil tester; ceodorite; Marshall compaction tester	○	○	
4.Drawing Equipment	Drawing board with parallel ruler; drawing table; drawing tools	○	○	
5.Computer and AV Equipment	PC; network server; printer; UPS; LAN connection parts and tools; TV/video system; OHP system	○	○	
6.Physics Laboratory Equipment	Drop tester; momentum observation tester; columnar resonance tester; metallic specific heat tester; circuit grid tester	○	○	
7.Common Fixtures	Desks, chairs, lockers and cabinets, etc.		○	
8.Generator for practical Training Equipment	9 KVA single phase/three phase and 20 KVA single phase generators			○

2.2.4.7 Soft Component

The planned range of the basic equipment for laboratory experiments and practical training under the Project represents the minimum requirement to fulfil the curriculum.

Although some teachers have experience of operating this or similar equipment, their teaching experience is mainly at the polytechnic level (D2 level) of teaching the relevant skills. Hardly any

teacher has teaching experience using a curriculum designed for a faculty of engineering at the university level.

For the education at the Faculty of Engineering of the East Timor National University using the D3 level new curriculum to be truly effective, wide-ranging and long-term cooperation will be required in relation to the management of the faculty, finalization of the syllabus, maintenance of equipment and education/training of teachers to improve their teaching level in terms of theory and practical training in their specialist subjects. Having considered the length and scale of the required cooperation, it is believed that continuous technical cooperation rather than the use of the soft component of the present Project will be much more effective to realize the general effects of the cooperation and to ensure the continuity of such effects.

2.2.4.8 Implementation Schedule

Following the completion of the Basic Design Study, the Government of Japan and the UNDP will conclude the MSA and the Project will be placed under the control of the UNDP and the UNOPS. Following the signing of the MSA, the Government of Japan will remit the entire project funds to the UNDP Head Office for project implementation under the control of the UNDP and the UNOPS. Because of this, the selection of the consultant to be responsible for the detailed design and supervising work will be made by the proposal method. The consultant thus selected will undergo the selection approval procedure at the UNDP Head Office and will conclude a detailed design and supervising work agreement with the UNOPS, which is the project implementation body. The construction work will subsequently commenced after such stages as the preparation of the detailed design documents, preparation of tender documents, tender and signing of the construction agreement.

(1) Detailed Design Stage

The tender documents will be prepared based on the basic design and these will consist of the detailed design drawings, specifications, estimations, budget statements and tender guidelines, etc. Close discussions will be held with the Steering Committee at the initial and final stages of the detailed design preparation stage. The detailed design stage will be completed when the final results are approved by the Steering Committee.

(2) Tender Stage

After the detailed design work is completed, the prequalification (preliminary review of the qualifications of applying contractors) will be announced and carried out in Japan. In accordance with the review, the UNDP as the implementation body will invite tenders for the Project and the tender will be conducted in Japan and will be witnessed by the concerned parties. The bidder that offers the lowest price will become the successful bidder if the contents of the tender are judged to be appropriate and will sign a construction agreement with the UNDP.

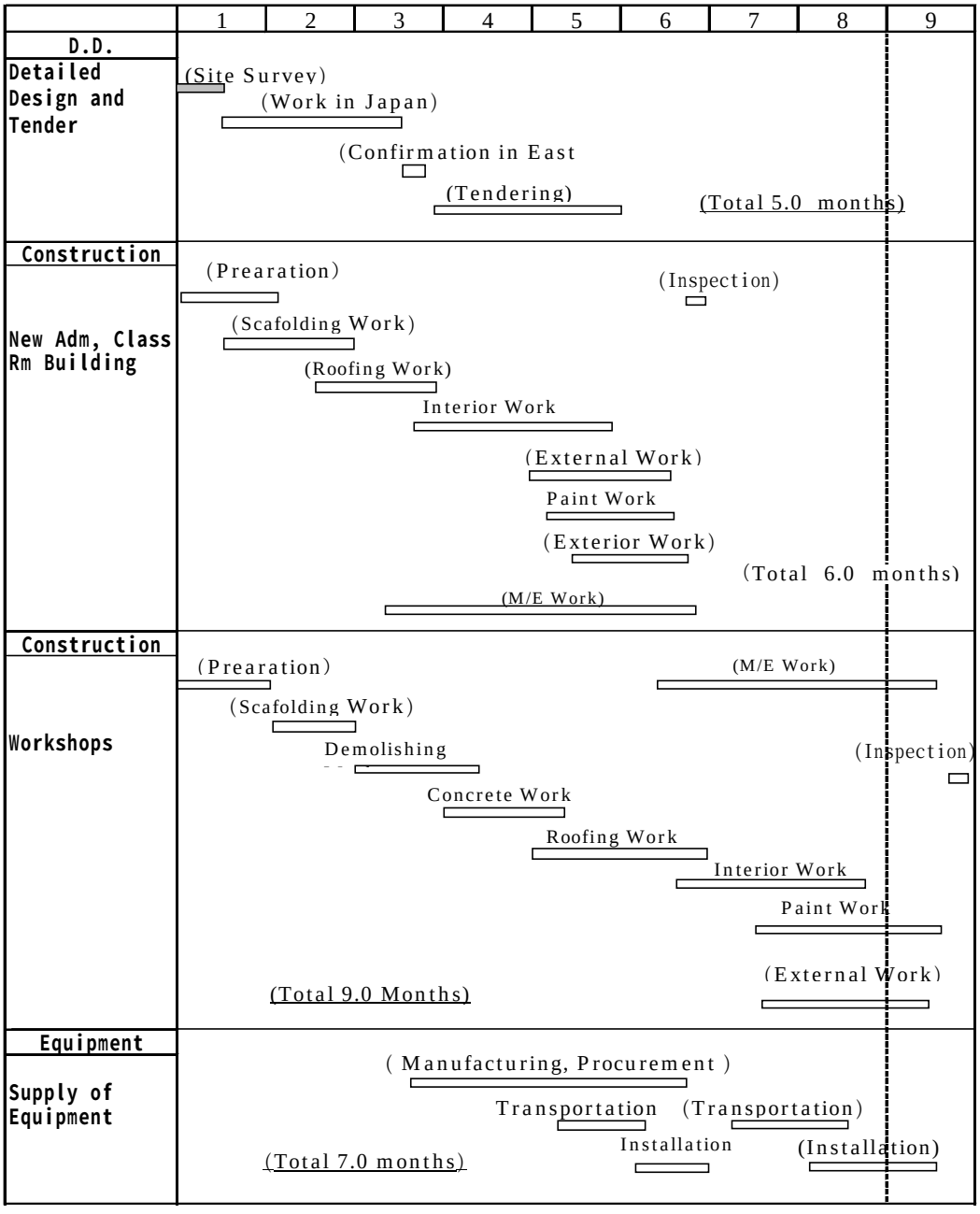
(3) Construction Stage

Following the signing of the construction agreement, the Contractor will commence the construction work with its verification by the Government of Japan. Based on the scale and contents of the project

facilities and the conditions of the local construction industry, the construction period, including equipment procurement and installation, is expected to be approximately 10 months. However, this presupposes the smooth procurement of equipment, the swift completion of all necessary procedures and review by the East Timorese side and the successful completion of the work to be undertaken by the East Timorese side.

The implementation schedule of the Project is shown in Fig. 2-26.

Table 2-26 Implementation schedule



2.3 Obligation of Recipient Country

The East Timorese side is required to undertake the following for the implementation of the Project under the grant aid scheme of the Government of Japan.

(1) Felling and disposal of trees from the construction site

(2) Arrangements for consumables and spare parts, etc. which will be required for the maintenance of the new facilities and equipment

(3) Tax exemption and customs clearance of the equipment and materials to be procured and imported to East Timor within the scope of the grant aid cooperation

(4) Exemption of Japanese companies and Japanese nationals involved in the Project from duties, taxes and levies imposed in East Timor

(5) Provision of all conveniences required for the entry and stay therein of the Japanese nationals referred to in (4) above in East Timor to perform their work under the Project

(6) Appropriate and effective utilisation and maintenance of the rehabilitated facilities and supplied equipment under Japan's grant aid cooperation

(7) Smooth relocationing of the existing equipment and bearing of the necessary expenses

(8) Bearing of all expenses which are necessary for the implementation of the Project but which are not included in the scope of Japan's grant aid cooperation

2.4 Project Operation Plan

2.4.1 Buildings and Facilities

(1) Detailed Design Stage

The tender documents will be prepared based on the basic design and these will consist of the detailed design drawings, specifications, estimations, budget statements and tender guidelines, etc. Close discussions will be held with the Steering Committee at the initial and final stages of the detailed design preparation stage. The detailed design stage will be completed when the final results are approved by the Steering Committee.

(1) Key Issues for Building Maintenance

There are three key issues for building maintenance as listed below.

① Daily cleaning
② Repair of worn, damaged or aged items
③ Security arrangements to ensure safety and crime prevention

The implementation of daily cleaning has a positive influence on the attitude of building users and these users will start to use the facilities and equipment more carefully than before. Daily cleaning is important to preserve the performance level of the equipment used for practical training and also leads to the early detection of damage or breakdown so that the life of the equipment can be prolonged with early repair. Repair work mainly consists of the mending and replacement of interior and exterior materials which protect the building structure. According to examples in Japan, remodeling, renovation and/or extension due to changes of the nature of activities and/or an increase of personnel is necessary every 10 years.

The details of regular inspections and repair which determine the life of a building are submitted at the time of the handing over of a building by the contractor in the form of a “maintenance manual”. At the same time, the inspection methods and regular cleaning methods are also explained by the contractor. These regular inspections (checks) are outlined in Table 2-27.

Table 2-27 Outline of Regular Building Inspections

	Inspection Item	Frequency
Exterior	- Repair or repainting of exterior finishes	- every 5 years
	- Inspection or repair of metal roof	- inspection: every year
	- Periodical cleaning of downspouts and drains, etc.	- every month
	- Inspection and repair of sealing of doors/windows	- every year
	- Periodical inspection and cleaning of drainage	- every year
Interior	- Changes in interior finishes	- as required
	- Repair and repainting of interior walls	- as required
	- Repairing of ceiling	- as required
	- Retightening or changing of fittings	- every year

(2) Building Service Equipment

In regard to building service equipment, daily “preventive maintenance” is essential before the stage requiring breakdown repair or parts replacement is reached. While the lives of building service equipment can definitely be prolonged by normal operation, daily checks, oiling, adjustment, cleaning and minor repair, they are also determined by the length of operation. Daily checks can prevent the occurrence of breakdowns and accidents and can also prevent extensive accidents even if an accident does take place. During regular checks/inspections, consumables should be replaced and filters should be cleaned, among other things, in accordance with the maintenance manual. Even though a complicated building service system will not be introduced under the Project, the establishment of a reliable maintenance system, including the entrustment of regular checks/maintenance work to local agents of the manufacturers, is essential in addition to the employment of maintenance staff to conduct daily maintenance. The standard lives of the main equipment are listed in Table 2-28.

Table 2-28 Lives of Major Building Service Equipment

	Type of Equipment	Standard Life
Electrical equipment	- Generator - Panel boards - Fluorescent lamps - Incandescent lamps	- 15 to 20 years - 20 to 30 years - 5,000 to 10,000 hours - 1,000 to 1,500 hours
Plumbing equipment	- Pumps, Pipes and valves - Tanks - Sanitary fixtures - Infiltration pit	- 10 to 15 years - 15 to 20 years - 20 years - 10 to 20 years
Air-conditioning and ventilation	- Pipes - Fans - Air conditioners	- 10 to 15 years 10 to 15 years 10 years

2.4.2 Maintenance of Equipment

The maintenance of the planned equipment is crucial for the effective and sustainable functioning of the planned facilities under the Project. Hera, where the new campus of the Faculty of Engineering of the University of East Timor is located and where the planned equipment will be installed, is not far from Dili, the capital of East Timor, and has frequent rain because of its location in the tropical monsoon zone. Under the conditions of high temperatures and high relative humidity together with frequent lightning, equipment maintenance must be carefully conducted.

For the proper maintenance of the planned equipment, “daily checks” involving the checking of the equipment before and after operation and “regular inspections” involving repair and thorough maintenance once a year are necessary. While daily checks can be conducted by those using the equipment in each engineering department, it is recommended that regular inspections be conducted by specialist maintenance staff. In regard to the machine tools to be installed in the mechanical engineering workshop, any error of the machining precision should be reported to the manufacturer or supplier for their maintenance to ensure safe operation as well as the machining precision. Similar actions must be taken in the case of any error of a measuring instrument in order to maintain the measurement error within the tolerance. If “emergency inspection” is necessary because of the breaking down of equipment or it becoming inoperable due to an unforeseen event, the specialist maintenance staff should contact the manufacturer or supplier with a view to parts replacement or equipment repair. The necessary maintenance work for various types of equipment is outlined in Table 2-29.

Table 2-29 Maintenance Work

Major Equipment	Daily check	Subcontracted Work
Electrical Engineering Equipment All of devices, etc. **Mechanical Engineering Equipment** Lathe Vertical milling machine Shaper Sawing machine Bending machine Shearing machine Universal tester Welding machine Double-ended grinder, etc. **Civil Engineering Equipment** Concrete compression tester Soil tester Marshall compression tester, etc	Before/After Use	Annual Inspection and Repair
Various Measuring Equipment Soil tester Oscilloscope Theodolite and other surveying equipment Physics laboratory equipment, etc.	Before/After Use	Annual inspection and calibration/repair
Tools and Other Equipment Drawing table PC set Furniture and fixtures, etc.	Before/After Use	Not Required

2.5. Estimated Project Cost

2.5.1 Apportioning of Estimated Project Cost

In the case of the Project's implementation with grant aid of the Government of Japan, the total project cost is estimated to be approximately ¥ 574 million (¥ 574 million to be borne by the Government of Japan and ¥ 0.37 million to be borne by the ETTA). The cost breakdown for each side and the estimation conditions are described below.

(1) Cost to be Borne by Government of Japan

Items	Cost (¥)
(1) Construction Cost	365.2 million
1) Direct Construction Cost	(255.2)
2) Site Expenses	(63.9)
3) Cost of Common Temporary Facilities	(18.4)
4) General Management Service Charge	(27.7)
(2) Equipment Cost and Installation	110 .1million
(3) Design and Supervision Cost	66.3million
(4) Management Service Charge	32.5million
Total	574.1 million

(2) Cost to be Borne by ETTA

1) Construction Work-Related Cost

①	Felling and Disposal of Trees (volunteer work by students)		
②	Exterior Development Cost	US $2,000.0	¥ 250,000
③	Customs Clearance Charge (US$ 180 x 5 times)	US $ 900.0	¥ 110,000

2) Development of Infrastructure

①	Electricity Meter Installation Cost	US$ 100.0	¥ 10,000

3) Others

None

Total	US$ 3,000.0	¥ 370,000

(3) Estimation Conditions

1)Time of Estimation : August, 2001

2)Exchange Rate : US$ 1 = ¥123.5

3)Construction Period : As the work from the detailed design stage onwards will be conducted by the UNOPS, the exact time for the commencement of the construction work has not yet been decided. The required period will be six months for the completion of the new classroom building and nine months for the completion of the new workshop buildings.

4)Others : Up to the basic design stage of the Project will be implemented under Japan's grant aid scheme and all work from the detailed design stage onwards will be managed by the UNOPS.

2.5.2 Estimation of Operation and Maintenance Cost

The annual operating cost and maintenance cost of the facilities on becoming operational are estimated as described below.

The operating cost is divided into the ① electricity cost, ② water supply cost, ③ sewerage cost and ④ diesel oil, ⑤ oxygen and acetylene gas cost while the maintenance cost is divided into the ① building maintenance cost, ② building service equipment maintenance cost and ③ equipment maintenance cost and ④consumable procurement (see Table 2-30). The electricity cost is estimated based on the quantity and hours of use shown in Table 2-31.

Table 2-30 Operation and Maintenance Cost

	Operation cost without blackout Annual Total (US$/year)	Operation cost with 3hours blackout everyday Annual Total (US$/year)
1) Operating Expenses	35,000.00	25,000.00
① Electricity Cost	33,973.00	20,000.00
② Water Cost	0.00	0.00
③ Sewerage Cost	0.00	0.00
④ Diesel oil Cost	13.80	3,700.00
⑤ Oxygen, acetylene	1,170.00	1,170.00
2) Maintenance Cost	7,000.00	7,000.00
① Buildings	2000.00	2000.00
② Building Service Equip.	730.00	730.00
③ Equipment	1400.00	1400.00
④Consumables Proc. Cost	3000.00	3000.00
Total Cost	42,000.00	32,000.00

Table 2-31 Breakdown of use of Electricity

	Semester Period		Off-Semester Period	
	Electricity Load (kVA)	Electric Energy (Kwh/year)	Electricity Load (kVA)	Electric Energy (Kwh/year)
Lighting	58	17.4	58	5.8
Receptacles	16	3.2	16	1.6
Air-conditioning	109	42.1	109	21.3
Equipment to Make Teaching Aids	90	18	90	0.0
Total	—	80.7	—	28.7

Total Operation Cost estimated as US$42,000 in a year for the Faculty of Engineering, and this amount is equal to 3.2% of 2001/02 year's annual budget (US$1.320,000) of East Timor National University(ETNU). ETNU requested 20% additional budget for the year 2001/02 for employment additional teachers, but this request was rejected and same amount of budget as 2000/01 was approved. Because of restricted budget, operation of ETNU suppose to be difficult.

Total number of students will become 450, and if we presume to share this operation cost by all of students, the amount is US$93 per student. ETNU planned to collect school tuition fee US$15 per

student for each semester in 2001/02, but the student objected to this proposition, and the negotiation between school side and students does not come to an end yet.

This full amount of operation cost needs definitely after completion of renovation work, therefore, we propose to ETNU to take action for obtaining the full amount of operation cost.

① To request Ministry of Education, Culture, Youth and Sports to allocate requested amount of operation cost as much as possible

② To have conference with ETNU and students to pay school tuition for the shortage amount of operation cost by explaining about necessity of operation cost and beneficiary need to share the cost.

③ To expand the incomes by renting the vacant rooms, by providing seminars to the citizens, by providing testing services as public institution using test devices.

(1) Operating Cost

1) Electricity Cost

[Without blackout]

The maximum duration of electricity use at the campus is assumed to be seven hours/day. As teaching takes place on six days/week, electricity will be used for 25 days/month. Long holidays are assumed to total four months/year.

[Semester Period]

Monthly power consumption
80.7 kW x 7 hours/day x 25 days/month = 14,122.5 kWh/month

Power consumption for semester period
14,122.5 kWh x 8 months/year = 112,980 kWh/year

[Off-Semester Period]

Monthly power consumption
28.7 kW x 7 hours/day x 25 days/month = 5,022.5 kWh/month

Power consumption for semester period
5,022.5 kWh x 4 months/year = 20,090 kWh/year

[Annual Electricity Cost]

112,980 kWh/year + 20,090 kWh/year = 133,070 kW/year

US$ 0.25 x 133,070 kWh/year = 33,268US$/year

[Basic Costs]
Assuming a maximum electricity demand of 160 kW, the basic monthly cost is as follows.

(A) US$ 2 x 25 kW = 25.0US$/month
(B) US$ 0.25 x 135 kW = 33.8US$/month

[Semester Period]
The annual electricity cost based on the above assumption is as follows.

US$ 58.8/month x 12 months = 705US$/year

The annual electricity cost is, therefore, as follows.

US$ 705/year + US$ 33,268/year = 33,973US$/year
(approximately 35,000US$/year)

[Assumption of 3 hours blackout]
The maximum duration of electricity use at the campus is assumed to be four hours/day and three hours' blackout everyday. As teaching takes place on six days/week, electricity will be used for 25 days/month. Long holidays are assumed to total four months/year.

[Semester Period]

Monthly power consumption
80.7 kW x 4hours/day x 25 days/month = 8,070 Kwh/month

Power consumption for semester period
8,070Kwh x 8 months/year = 64,560 Kwh/year

[Off-Semester Period]

Monthly power consumption
28.7 kW x 4 hours/day x 25 days/month = 2,870 Kwh/month

Power consumption for semester period
2,870 Kwh x 4 months/year = 11,480 Kwh/year

[Annual Electricity Cost]

64,560 Kwh/year + 11,480kWh/year = 76,040 kW/year
US$ 0.25 x 76,040kWh/year = 19,010US$/year

[Basic charge]
The basic monthly charge is same whether there is blackout or not.

[Semester Period]
The annual electricity cost based on the above assumption is as follows.

US$ 58.8/month x 12 months = 705US$/year

The annual electricity cost is, therefore, as follows.

US$ 705/year + US$ 19,010/year = 19,715US$/year
(Approximately 20,000US$/year)

[Diesel oil cost for Generator]
There are three generator sets for workshops and computer room. Based on the three hours blackout in every six days, we calculate the fuel cost for the generators.

① Diesel generator sets for Mechanical and Electrical Workshop, and Civil Workshop 9[kVA] single phase and triple phase.
- generator set (24hp) : 2sets
- fuel consumption : 2.7 l/hour
- duration of blackout : 3 hours every six days
- cost of fuel : 0.48US$

Cost of diesel oil
3 (hours) x 2.7 (l/hour) x 0.48 (US$) x 2 (sets) = 8.01US$/day
8.01 (US$/day) x 25(days) =200.25US$/week
200.25(US$/week) x 8(months) =1,601US$

② Diesel generator set for computer room 20kVA single phase
- generator set (44hp) : 1sets
- fuel consumption : 6.0 l/hour
- duration of blackout : 3 hours every six days
- cost of fuel : 0.48US$

Cost of Diesel Oil
3 (hours) x 6.0 (l/hour) x 0.48 (US$) x 1(sets) = 8.64US$/day
8.64(US$/day) x 25(days) =222.5US$/week
222.5(US$/week) x 8(weeks) =1,780US$

Total 3,381US$

10% of diesel oil cost 338US$ added as additional cost for maintenance cost.

Total 3,719US$

(Approximately 3,700US$/8 months)

2) Water Cost

No water cost will be incurred because of the use of groundwater from the deepwell on the premises.

3) Sewerage Cost

No sewerage cost will be incurred because of the use of the septic tank on the premises.

4) Diesel oil Cost

The diesel oil cost is based on the estimated petrol consumption volume for the generator used for welding.

Total training hours for welding : 18 hours/year
Diesel oil consumption volume : 1.6 litres/hr; 28.8 litres/year
Diesel price : 0.48US$/litre x 28.8 litters = 13.8US$
(Approximately 14US$)

5) Oxygen and acetylene gas charges

[Oxygen]

・Setting Condition：Practical training operation hours in a year ：30 Hours
Duration of leasing gas cylinder ：12 Months
Cylinder size ：G Size

① Initial Charge for leasing cylinder
Deposit（US$）＋ leasing charge（US$/Mon.）×Duration（Mon.）＋Charge of Oxygen
312.0US$＋9.0US$/Mon.×1 Month＋90.0〔US$/Cylinder〕×2〔Cylinder〕＝501.0US$

② Charge after leased cylinder (11 months)
9.00US$ x 11 Months ＝99.00US$

③ Total Charge1
501.00US$ ＋ 99.00US$ ＝600.00US$

[Bases for the calculation]

To use the acetylene gas, it needs 2.5 times volume of oxygen.
（∵ 2 C_2H_2+5O_2 →4CO_2+2H_2O）
It needs additional oxygen to cut the material, so 3 times volume of oxygen is applied.
3×140〔L/h〕×30〔h〕＝12,600〔L〕
Divide by G size cylinder.

12,600〔L〕／7,245〔L/Cylinder〕＝1.7〔Cylinder〕→（2 Cylinders）

Table 2-32　Oxygen Charge and Cylinder Lease Charge

Cylinder Size	Volume of Cylinder (liter)	Volume of Oxygen (1 pressure・RM Temperature)(liter)	Oxygen Charge (U$)	Charge for Cylinder lease (U$)	Deposit(U$)
D	9.3	1,395	35.00	5.00	228.00
E	23.4	3,510	51.00	7.00	245.00
G	48.3	※7,245	90.00	9.00	312.00

Source: Supplier

[Acetylene Gas]

・Setting Condition　：Practical training operation hours in a year:30 Hours
　　：Duration of leasing gas cylinder　　: 12 Months
　　：Cylinder size　　: G Size

① Initial Charge for leasing cylinder
Deposit（US$）＋ leasing charge（US$/Mon.）×Duration（Mon.）＋Charge of Oxygen
312.0US$＋ 9.0US$/Mon. × 1 Mon.＋150.0〔US$/Cylinder〕×1〔Cylinder〕＝471.0.0US$

② Charge after leased cylinder (11 months)
9.00US$ x 11Months ＝99.00US$

③ Total Charge1
471.00US$ ＋ 99.00US$ =571.00US$

[Bases for the calculation]
・＃140 nozzle size applied for calculation
・Total consumption of acetylene gas by 140 nozzle is 140 liters/hour
40 liter/hour x 30hours =4,200 liters
・To convert to the weight of acetylene gas.
4,200 (liter) / 22.4(liter/mol) x 26 (g/mol) x 1/1,000 =4.9 kg
（∵Weight of acetylene gas per mol is 26 g）

G size of cylinder shall be applied from Table 2-32

Table2-32　Acetylene Gas Charge and Cylinder Lease Charge

Cylinder Size	Volume of Cylinder (liter)	Weight of Acetylene Gas (kg)	Acetylene Gas Charge (U$)	Charge for Cylinder Lease (U$)	Deposit(U$)
D	9.3	1.6	42.00	5.00	228.00
E	23.4	4.0	90.00	7.00	245.00
G	48.3	※8.2	150.00	9.00	312.00

Source: Supplier

Total charge for the oxygen and acetylene gas is approximately 1,171US$ per year.

The total operating cost, consisting of the electricity cost and the cost of petrol to run the generator for welding and cost for acetylene gas and oxygen as estimated to be approximately 35,157US$ (approximately 35,000 US$).

(2) Maintenance Cost of Buildings and Building Service Equipment Maintenance Cost

Based on the maintenance plan described earlier, the average annual maintenance cost over a long period of time is estimated to be approximately US$ 7,108 (¥878,000). Because the estimated cost is the annual average, the maintenance cost will start to increase from 2002 when the use of the new facilities commences. The basis for this estimation is explained below.

1) Building Maintenance Cost

Even though the building maintenance cost considerably changes with the aging process, the necessity for major repair, etc. does not usually emerge for some 30 years after building completion. During this period, repair work should be conducted based on the check list shown in Table 2-27. Actual examples of the maintenance cost for similar buildings suggest that the average annual repair cost is approximately 0.07% of the direct construction cost. This translates to approximately US$ 2,000 or US$ 0.44/m2.

¥350 million x 0.007% = ¥245,000/year
¥245,000 ÷ ¥123.5/US$ = 1,983 US$ （approximately 2,000US$/Year）

2) Building Service Equipment Maintenance Cost

The amount of this type of maintenance cost will remain small for some five years after completion but will begin to increase thereafter because of the need for the replacement of parts and the replacement of equipment due to aging. The standard life of the building service equipment is shown in Table 2-28 and the average annual repair cost over a 10 year span is estimated to be approximately 0.2% of the building service equipment cost.

¥44,986,000 x 0.2% = ¥89,972/year
¥89,972 ÷ US$ 123.5 = US$ 729/year (approximately 730 US$/year)

3) Equipment Maintenance Cost

While the equipment maintenance cost and the spare parts cost changes with the length and frequency of use, the maintenance cost of the main equipment planned under the Project after its procurement is estimated in the following manner. The personnel cost is separately accounted for under the existing equipment maintenance system.

Table 2-33 Equipment Maintenance Cost

Equipment	Cost Item	Cost
Electrical Engineering Equipment -Testing devices **Civil Engineering Equipment** -Concrete compression tester -Soil tester Marshall compression tester **Mechanical Engineering Equipment** -Lathe -Vertical milling machine -Shaper -Sawing machine -Bending machine -Shearing machine -Universal tester -Welding machine -Double-ended grinder, etc.	1.The consumables procurement cost is 0.05% of the equipment cost: $ 400/year	400$/year
Various Measuring Equipment -Soil tester -Oscilloscope and other surveying equipment -Physics laboratory equipment	1. The consumables (concrete test pieces and asphalt test pieces) procurement cost is shown in Table 2-34.	0$/year
Tools and Other Equipment -Drawing table -PC set -Furniture and fixtures	1. Consumables (paper, ink, paint, lacquer, nails and keys): $ 1,000/year	1,000$/year
Total		1,400$/year

Table 2-34 Consumables Procurement Cost per year

Production of concrete test pieces	250US$/semester x 2 semesters = $ 500US$/year
Production of asphalt test pieces	250US$/semester x 2 semesters = 500US$/year
Machining materials	US$250/semester x 2 semesters = US$ 500/year
Materials for electrical experiments	US$250/semester x 2 semesters = US$500/year
Drawing materials (paper)	US$250/semester x 2 semesters = US$500/year
Computing materials (paper)	US$250/semester x 2 semesters = US$500/year
Total	3,000US$/year

In total, the annual maintenance cost is estimated to be approximately US$ 7,108 (approximately US$ 7,000/year = ¥865,000/year).

It will not need maintenance cost for the first 5 years after turn over the building, in general. However after this period, it starts to need maintenance to the building, facilities and equipment step by step and maintenance cost also starts to need. Therefore, it needs to device to save the estimated maintenance

cost every year even if there is no maintenance cost required in the first five years, and this budget can be spent whenever it is needed in the future.

Consumables Procurement Cost is essential for procurement of the practical training materials following the syllabus, so the operational budget is the most important factor for the school operation.