No.

STUDY REPORT

ON

THE PROJECT FOR IMPROVEMENT OF EQUIPMENT FOR ARCHAEOLOGICAL ACTIVITIES ON MAYA CIVILIZATION

IN

THE REPUBLIC OF HONDURAS

MARCH 2001

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

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PREFACE

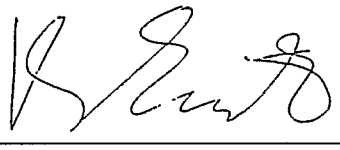
In response to a request from the Government of the Republic of Honduras, the Government of Japan decided to conduct a study on the Project for Improvement of Equipment for Archaeological Activities on Maya Civilization and entrusted the Japan International Cooperation Agency (JICA).

JICA sent to Honduras a study team from November 21 to December 18, 2001.

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

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Honduras for their close cooperation extended to the teams.

March 2001

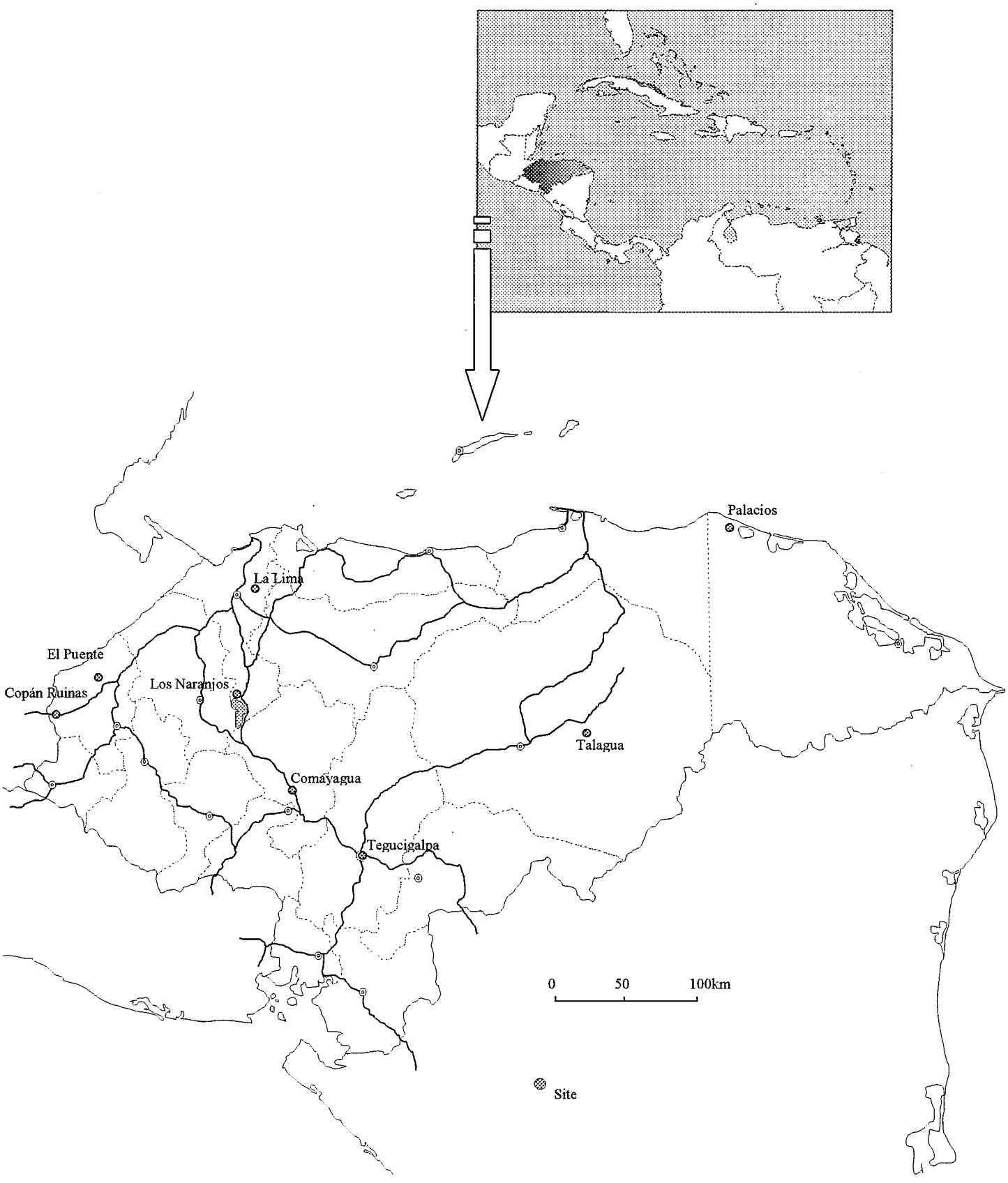


Kunihiko Saito

President

Japan International Cooperation Agency

LOCATION MAP



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CHAPTER 1 BACKGROUND OF THE PROJECT

Prior to the period of Spanish rule, the Republic of Honduras (hereinafter referred to as Honduras) was located at the point of contact between different civilisations as the western part and central to southern part of Honduras belonged to the southwestern part of the Mayan Civilisation Zone and the Low Central American Civilisation Zone respectively. There are, therefore, many vestiges of Mayan and non-Mayan civilisations. Among the vestiges of Mayan civilisation, the ruins at Copán are the most representative ruins of the Mayan Dynasty which prospered from the 5th century to the 9th century as Copán was an important centre of Mayan civilisation together with Tikal[1] in Guatemala and Palenque[2] in Mexico.

Archaeological sites in Honduras consist of the ruins at Copán, one of the the most famous ruins of Mayan civilisation, the ruins at El Puente which are related to Mayan civilisation and the ruins of other civilisations which coexisted with or existed prior to Mayan civilisation. At the ruins at Copán in particular, there are many highly artistic remains, including the Steps of Sacred Letters, the highest number of inscriptions using Mayan letters among the ruins of Mayan civilisation and unique stone sculptures called relief sculptures, and Copán was designated a world cultural heritage site by the UNESCO in 1980. In recent years, a temple of presumably an early age has been excavated almost intact inside the pyramid. A new tomb of a king was discovered in 2000, suggesting that there is potential for further discoveries. Because of the recent rapid progress in the deciphering of Mayan letters, the scope of knowledge and understanding of Mayan archaeology has also been enhanced. Meanwhile, the ruins in Honduras have been well preserved compared to Mayan ruins in other countries due to conscious efforts by the Government of Honduras and the Honduran Institute of Anthropology and History (*Instituto Hondureño de Antropología e Historia* - hereinafter referred to as the *IHAH*) for many years. Accordingly, there have been few cases of illegal excavation.

There are many Mayan ruins existing not very far from the ruins at Copán, including the ruins at El Puente. Ruins of non-Mayan civilisations, such as the ruins at Los Naranjos and the ruins at Yarumela, exsist in central part of Honduras. With so many cultural heritage sites as described above, Honduras is aiming at developing comprehensive tourism which incorporates both natural and cultural remains, centering on the ruins of Mayan civilisation. Through the development of tourism, it hopes to free itself from the industrial structure dependent on the export of such

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[1] Located some 300 km north of Guatemala City, Tikal was almost at the centre of the old Mayan World and prospered as a centre of Mayan civilisation for a long period of time from around BC 200 to AD 900.

[2] Palenque is located at the base of the Yukatan Peninsula and was situated at the western end of the Mayan Lowland in ancient times. It prospered from around AD 400 to AD 800 and boasted a beautiful pyramidal temple, lattice-work crest, stucco statues on the outer walls and sculptures on the front side of the mansard roof.

agricultural products as bananas and coffee which are highly susceptible to the weather conditions and price fluctuations in the international market to improve the stability of the national economy. In 1952, IHAH has been established as the sole government institution for the survey, protection, conservation, management and operation of historical and anthropological cultural heritage in Honduras which is not only valuable from the academic point of view but which also constitutes important tourism resources. It has the headquarters in Tegucigalpa, two district offices (at Copán Ruinas and La Lima[= San Pedro Sula]) and three branch offices (at La Entrada, Omoa and Trujillo). Although the IHAH is under the jurisdiction of the Ministry of Culture, it has been pursuing the goal of protecting the ruins in Honduras as an independent organisation in terms of policy decisions and budget execution.

However, despite the series of measures introduced by the IHAH to protect the ruins, the deterioration of the ruins is still taking place, including the partial loss of the ruins at Copán due to heavy rain resulting from Hurricane Mitch in October, 1998 and several downpours thereafter. This process has been exacerbated by artificial factors, including excessive excavation surveys without measures to conserve the ruins conducted at Copán in the 1990's (for example, excavation involving a complicated tunnel network inside the acropolis[3]). Other archaeological ruins currently face such problems as their destruction due to housing and other development activities in urban areas and illegal excavation at unregistered ruins in the eastern part of Honduras which largely remains undeveloped. Under these circumstances, the IHAH prepared the Cultural Ruins Rescue and Registration Programme in 1999 to speed up the process of recording and registering the ruins scattered throughout the country and the Integral Conservation Program for Copan Archaeological Park (*Programa Integral de Conservación del Parpue Arqueológico Copán* - hereinafter referred to as *PICPAC*) at the same time. Then these programmes were commenced in March, 1999.

The wide ranging contents of the PICPAC include (i) the urgent excavation of ruins in the Copán Valley which are rapidly disappearing due to district development work and a development plan for the rehabilitation of the hurricane damage, (ii) the restoration and reinforcement of tunnels inside the acropolis and *corte*[4], (iii) the surveying and recording of the ruins of Mayan civilisation and (iv) education of the public to improve their awareness of the importance of the preservation of cultural heritage through the production and television broadcasting of video programmes on the ruins at Copán with the cooperation of the Ministry of Culture. In this context, the IHAH is currently facing the problem of a critical equipment shortage to implement the PICPAC as the

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[3] The acropolis consisting of temples and other buildings was built on a hill through a series of additions and rebuilding.

[4] This refers to a section of the acropolis at the ruins at Copán which is now exposed due to erosion by Copán River. Several layers of plaster floors are observed in this section, indicating past Mayan activities to add or rebuild the area and constituting an important academic site.

equipment in its possession almost entirely consists of equipment provided by Japanese cultural grant aid in fiscal year 1983. In the meantime, following a temporary suspension caused by Hurricane Mitch, the Cultural Heritage Relief and Registration Programme has earnestly recommenced nationwide and is facing a particularly urgent need for the registration of cultural heritage in the eastern part of the country and Comayagua Province.

Urgent tasks to be addressed by the IHAH are listed below.

- Prevention of the disappearance of ruins due to housing development in Honduras
- Restoration of the ruins damaged by Hurricane Mitch and downpours
- Acquisition of the manpower and funding for the conservation, restoration and security of archaeological sites to be opened to the public
- Management, conservation, restoration or refilling of tunnels and test excavation sites which have been left unattended following excessive surveying and excavation in the past
- Prevention of illegal excavation in undeveloped areas in eastern Honduras (Mosquitia and others)
- Improvement of the preservation method for ruins
- Proper arrangement and management of excavated articles and excavation/survey data
- Rationalisation of the management of archaeological park facilities

In order to improve the situation, the IHAH has requested the Government of Japan's provision of grant aid for procurement of the equipment for surveying, excavation and restoration, PR and education and the improvement of park environment (see Table 1), all of which are essential for the continuation of archaeological activities in Honduras. The purpose of the present Project is, therefore, to contribute to the study and conservation of the ruins of Mayan civilisation as well as non-Mayan civilisations dotted throughout Honduras.

Table 1　Contents of the Request

No	Type of Equipment	Details
1	Communication and Transportation Equipment	Truck (3); pick-up truck (3); HF radio apparatus; VHF radio apparatus
2	Excavation and Surveying Equipment	Dump truck (1); total station; theodolite; level; GPS; excavation tools; Photo apparatus; photography scaffold; video equipment; belt conveyer; environmental surveying equipment; underground radar surveying instruments; fibrescope camera
3	Analytical and Restoration Equipment	P/C and peripheral equipment; scanner; drawing apparatus; soil analyser; washing equipment for excavated articles; measuring instruments for excavated articles; scaffold for restoration work; generator
4	Audio-Visual (Educational) Equipment	Multi-projector; slide projector; video display unit; video editing system; copier
5	Storage Equipment	Storage containers for excavated articles; racks; prefabricated warehouse
6	Park Environment Improvement Equipment	Lawn mower; chainsaw; water pump; welding machine; generator

CHAPTER 2 CONTENTS OF THE PROJECT

2.1 Basic Concept of the Project

Since the latter half of the 1980's, the Government of Honduras has been making conscious efforts to preserve and protect archaeological sites and excavated articles which are important national assets of the country. However, since the country still suffers loss of ruins by housing development and natural disasters, appropriate countermeasures have to be taken urgently. In addition, the conservation of those ruins, which were opened to the public after rehabilitation or restoration is also urgently required, together with the need to improve the conservation method. The Cultural Ruins Rescue and Registration Programme and the PICPAC introduced by the Government of Honduras are designed to solve the problems of registering and conserving archaeological sites in Honduras by means of (i) registering those ruins facing disappearance, sites hitherto not surveyed, excavated articles subject to theft or illegal excavation and other historical remains as national assets and (ii) improving the state of conservation of the ruins at Copán, which are particularly important among the number of ruins of Mayan civilisation, and the restoration/rehabilitation method.

As part of the above programmes, the Project aims at (i) solving the problems of registration, preservation/restoration and maintenance of ruins and excavated articles in Honduras to prevent their destruction, disappearance or theft and (ii) promoting the preservation of data for archaeological study and the intensification of PR and educational activities. The main objective of the Project is to procure communication and transportation equipment, surveying and excavation equipment, restoration equipment, educational equipment, storage equipment, equipment to improve facilities and analytical/scientific equipment.

The equipment to be selected for the Project will consist of that equipment which is judged to be essential for the implementation of the various types of work envisaged in the Cultural Ruins Rescue and Registration Programme and the PICPAC in view of the contents of these programmes. The types of envisaged work and the requested equipment required to conduct such works are listed in Table 2.

Table 2 Planned Work and Related Equipment

Stage	Type of Work	Related Equipment
Preparatory Stage	Confirmation and registration of the locations of ruins: reconnaissance of those sites which appear to be ruins based on aerial photographs and an interview survey to confirm their status and recording and registration of their locations on a map.	Survey vehicle; GPS; surveying equipment; radio apparatus
	Inference of the geographical extent of each site based on the remains, etc. contained in the top soil layer to determine the area of excavation: test excavation (5 m x 5 m) prior to determination of the excavation area to check the state of the ruins in advance. In the case that a stone coffin or traces of a dwelling are found, the internal state will be investigated.	Survey vehicle; excavation equipment; fibrescope camera
Preparatory Stage	Checking of the coordinates and elevation of the nearby control points of each target excavation site. If there are no control points nearby, new control points will be established by means of either traverse surveying from the existing control points or direct GPS application. While the latter is the most appropriate method, it may not be usable in a forest zone or a cave obstructing the GPS because of the need for this system to use satellite information. It will, therefore, be best to make both GPS and total station available for use.	Survey vehicle; GPS; surveying equipment; radar range-finder; radio apparatus
	Compartmentation of each target excavation site after the establishment of control points. Compartments of 5 m x 5 m each will be established by installing the total station at the control points.	Surveying equipment; excavation equipment
Field Work	Excavation work: The basic principles of excavation work will be to always maintain a level excavation plane and to stop the work when ever remains are found to check the state of the remains and articles.	Surveying equipment; belt conveyor; excavation equipment; radio apparatus
	Photography: If important remains are found, the state of the remains will be recorded by a stills camera or video camera. Such photography is necessary at each important turn of surveying to record a realistic appearance and feeling, etc. which are difficult to represent in a drawing. Examination of such visual footage will lead to the improved efficiency and quality of the field work. Visual records are also important as future reference materials.	Photo apparatus; video equipment; rolling tower (photography scaffold); fibrescope camera
	Removal of discovered artifacts: Such artifacts as earthenware and jewellery should be removed and stored for each compartment. If walled rooms or a graveyard, etc. are clearly identified, the artifacts should be removed and stored for each identified remain. Items (bones, shells and stone objects, etc.) requiring preservation should be appropriately treated (emergency temporary treatment) prior to their removal.	Excavation equipment
	Restoration and preservation: Civil engineering work will be conducted to restore and preserve the remains using the original materials where possible. While the restored remains will be subject to academic study, they will also be on view to the public. In the case of sculptures and wall paintings which are difficult to preserve, environmental observation will be conducted to determine the appropriate preservation method.	Dump truck; environmental observation equipment; water pump; radio apparatus
Indoor Work	Washing of removed artifacts: The soil and mud attached to the recovered artifacts will be washed off. The artifacts will be classified as those to be disposed of and those to be stored.	Washing and storage equipment
	Registration of important artifacts: Registration of selected important artifacts in a collection register, etc. with data on the length, width, height, thickness and weight together with photographs and/or drawings. For this registration, the artifacts will be subject to appropriate chemical preservation treatment if necessary.	Measuring instruments; non-contact 3D digitiser; Photo apparatus; PC and peripheral equipment
	Arrangement of reference materials: Arrangement of photographs and drawings, etc. in view of their easy retrieval when necessary.	PC and peripheral equipment (PC, printer and scanner, etc.)

	Analysis of reference materials: The excavated articles and soil samples from the excavation sites will be analysed to obtain data for further study and to assist the future improvement of the ruins and remains preservation methods.	Soil testing equipment; PC and peripheral equipment
Public Viewing, Display and Reporting	Preparation of a report publicly announcing the survey findings: Preparation of a survey report using photographs and drawings, etc. The survey findings will be made public by means of their reporting at academic meetings and printing/publication.	Copier; colour copier; PC and peripheral equipment
	Storage of artifacts: Classification and storage of the artifacts, drawings and photographs, etc. collected through excavation and their arrangement so that they can be rented or used for new academic studies.	PC and peripheral equipment; storage containers; prefabricated warehouse
	Display of and public access to the remains and artifacts: Public access to the restored remains and artifacts. While the artifacts will be displayed in a museum or a special exhibition, the remains will usually be made into a park to which an entry fee may be charged in view of the large manpower and funding required for its maintenance. Signboards and explanatory notes for the exhibits in a museum and benches, fencing, ticket counter and gate, etc. at a park will be introduced with an appropriate manpower level. The situation of ongoing excavation and/or restoration work may be displayed in a museum.	Transport truck; generator; chainsaw; welding machine; lawn mower; pump; PC and peripheral equipment; copier; video display unit
	Reporting at symposia, etc.: Reporting of the findings of the excavation work at cultural symposia and in various publications. The IHAH regularly publishes bulletins.	Video display unit; audio visual equipment; video editing machine; copier; colour copier; multi-projector capable of projecting real objects

2.2 Basic Design for Requested Japanese Assistance

The Project intends the procurement of communication and transportation equipment, ruins reconnaissance and surveying equipment, ruins restoration equipment, ruins excavation and surveying equipment, arrangement and analysis equipment for excavated articles, storage and restoration equipment for excavated articles and ruins park environment improvement equipment at the IHAH Headquarters (Tegucigalpa, Comayagua and their surrounding areas), the IHAH Northern District Office (La Lima and its surrounding area and Los Naranjos), the area under the jurisdiction of the IHAH Western District Office (Copán Archaeological Park and other major IHAH facilities at Copán and El Puente Archaeological Park), Taragua (Taragua Cave) and Prasio (base for surveying in the Pratano river basin). The actual contents of the Project will be determined based on the characteristics and manpower at each site and also on the design policy (principles) described in 2.2.1, taking the natural and social conditions of Honduras into consideration.

2.2.1 Design Policy

(1) Basic Principles

- Archaeological sites with academic value regarding Mayan and non-Mayan civilisations will be selected.
- Equipment which is suitable for each archaeological site based on the scale, characteristics and number of archaeological articles excavated at the site will be selected.
- Equipment which is essential and which conforms to the Japan's grant aid scheme will be selected from the viewpoint of not only academic study but also archaeological study at the IHAH as well as the general management of the archaeological sites.

(2) Principles Regarding Natural Conditions

- In general, the equipment selection will take the high temperature and high relative humidity into consideration and appropriate measures to protect the equipment will be necessary.

(3) Principles Regarding Socio-economic Conditions

- While the official language is Spanish, English will be considered the operating language in order to ensure the commonality of PCs, peripheral equipment and software.
- Equipment with an automatic start-up and other functions will be selected to cope with the regular power cuts at Copán.

(4) Principles Regarding Construction and Procurement Conditions

- The skill level and size of the workforce and the quality of local equipment and materials will be taken into careful consideration in relation to the installation or assembly of equipment on site.

(5) Principles Regarding Local Operation and Management Capability During Project Implementation Period

- The number and technical level of the staff members who will operate the equipment at the IHAH will be taken into consideration.
- The local availability of consumables, the technical level of maintenance and the availability of agents will be taken into consideration in the equipment selection process.

(6) Principles Regarding Equipment Grade

- High level analytical equipment and measuring instruments will be selected for the CRIA.
- In regard to other types of equipment, the local maintenance capability and the feasibility of parts supply will be taken into consideration for their selection.

(7) Principles Regarding Procurement Method and Project Period

- Based on the principles specified in (6) above, procurement will basically be conducted in Japan and Honduras. The procurement of third country products will be considered if necessary.

2.2.2 Basic Plan (Equipment Plan)

(1) General Plan

The original request was the provision of equipment for the PICPAC under the Japan's cultural grant aid scheme. In the subsequent period, however, the IHAH is now facing such direct problems as the collapse of ruins and the deterioration of park environment and the indirect problem of declining income from tourism due to fewer visitors to museums, etc. caused by Hurricane Mitch and the series of downpours thereafter. The field survey confirmed that there is a strong need at other sites for equipment similar to that requested for the PICPAC. At Copán which are officially designated ruins and also a world heritage site, there is a strong need for surveying equipment, photo apparatus, audio visual equipment and a PC and peripheral equipment for the surveying, excavation, recording, restoration and protection of the ruins and artifacts and advanced analytical equipment and measuring instruments for soil analysis and measurement of the remains and artifacts (excavated articles). The importance of providing educational and PR equipment, such environmental improvement equipment as lawn mowers and generators, vehicles, communication equipment and equipment to store the excavated articles is also very high in other areas in view of the wide-ranging archaeological activities of the IHAH in Honduras.

The selected equipment will be distributed to the eight sites described in the Chapter 2.2. As some of these sites do not have developed infrastructure, the equipment to be selected for these sites will take such state of undeveloped infrastructure into consideration and additional equipment will also be provided for these sites. The planned installation site of the prefabricated warehouse (CRIA) has sufficient space and good drainage and its suitability was confirmed during the field survey.

(2) Equipment Plan

The contents, main specifications, quantity and purpose of use of equipment are described in Table 3.

Table 3 Description of Equipment

No.	Equipment	Main Specifications	Quantity	Purpose of Use
1	Truck	7 tons; UNIC; with power gate	2	Transportation of exhibits, materials and excavated articles
2	Dump truck	5 m^3; with crane	1	Transportation of ruins restoration materials
3	Pick-up truck	Double cabin; 4 WD; with winch	4	Study and surveying of ruins
4	Fixed VHF radio station	Maximum output: approx. 50 W; 110 V/60 Hz	5	On-site communication during the study and restoration of ruins
5	Vehicle-mounted VHF radio station	Maximum output: approx. 25 W; 110 V/60 Hz	5	On-site communication during the study and restoration of ruins
6	Portable VHF radio apparatus	Maximum output: approx. 5 W; with replacement battery and battery charger	18	On-site communication during the study and restoration of ruins
7	HF radio transmitter/receiver	SSB output: approx. 100 W; 6 fixed type; with SWR meter and 2 dummy loads	6	Communication with local offices
8	GPS and accessories	L1; 12 channels; static; kinematic	3	Surveying of ruins
9	Total station (1)	Range-finding accuracy: ≦ 3mm + 3 ppm; non-prism function; tripod; accessories	5	Surveying of ruins
10	Total station (2)	Range-finding accuracy: ≦ 1 mm + 2 ppm; 3D analysis software; tripod; accessories	1	Surveying of ruins, configuration of inside of tunnels and structure
11	Digital theodolite	Accuracy: ≦ 5”; tripod and other accessories	3	Surveying of ruins
12	Auto level	1 km return deviation: ≦ 1.5 mm; tripod and other accessories	5	Surveying of ruins and restoration work, etc.
13	Laser range-finder (1)	Measurable distance: 0.2 - 30 m; error: ± 3 mm; minimum display unit: 1 mm	4	Surveying of ruins
14	Laser range-finder (2)	Measurable distance: 20 - 1,000 m; error: ±1 m	4	Surveying of ruins and excavation work
15	Surveying tool set (A)	Staff; pole; tape-measure; convex; others	3	Surveying of ruins
16	Surveying tool set (B)	Staff; pole; tape-measure; convex; pin pole; inside diameter gauge; others	1	Surveying of ruins and excavation work
17	Set of drawing tools	Drawing table; T-ruler; drawing instruments	3	Drawing of ruins and excavation sites
18	PC and peripheral equipment (A)	PC; printer; scanner; others	1	Preparation and analysis of study data and data on excavated articles
19	PC and peripheral equipment (B)	PC; printer; scanner; other peripheral equipment; networking tools	1	Preparation and analysis of study data and data on excavated articles
20	Scanner	800 dpi or higher; size: A0	2	Reading of maps and drawings
21	Printer	360 x 360 dpi (colour/monochrome) or higher; size: A0	1	Map and drawing output

22	Film scanner	For both positive and negative film; 2,700 dpi or higher	1	Reading of films
23	Video recording set	DVCAM camera; tripod; others	3	Recording of surveys
24	Video editing equipment set	Monitor; DVCAM for editing; VTR; S-VHS VTR; others	1	Editing of survey records
25	Video editing system	PC; video board; software	1	Editing of survey records
26	Indoor photo apparatus set	Single lens reflex camera; digital camera; tripod and accessories	3	Preparation of records of excavated articles
27	Outdoor photo apparatus (A)	Analogue; digital; lens; others	2	Recording of surveying and excavation work
28	Outdoor photo apparatus (B)	Analogue 35 mm AF; digital; lens; others	1	Recording of surveying and excavation work
29	Video display equipment set	Monitor; VTR; other	5	PR, education and display of archaeological activities
30	Audio visual equipment set	Slide projector; monitor; screen; speaker; amplifier; others	2	PR, education and display of archaeological activities
31	Multi-projector with epidiascope	CCD camera for projection of real objects; speaker; video input/output; analogue RGB input/output	2	PR, education and display of archaeological activities
32	Copier	Monochrome console type; 11 x 17 inch; minimum speed: 20 ppm; 3 trays	2	Preparation of PR, educational and display materials
33	Colour copier	A3 size; console type; monochrome: 16 ppm or faster; colour: 5 ppm or faster	2	Preparation of PR, educational and display materials
34	Soil testing equipment set	Soil moisture meter; soil colour chart; balance; loupe; others	1	Ruins conservation surveying
35	Fibrescope	External diameter: 10 mm or less; minimum effective length: 3 m; light source; camera adapter	1	Ruins excavation surveying
36	Environmental observation equipment set	Hygrothermograph; data logger; anemometer; water level gauge; others	1	Ruins conservation surveying (particularly inside tunnels)
37	Excavation equipment set	Chain blocks; drainage pump; stepladder; plate holder; wheelbarrow; helmet; dust mask; others	1	Excavation of ruins
38	Excavated articles measuring and analysis equipment set	___; calipers; slide calipers; turntable; others	1	Analysis of excavated articles
39	Non-contact 3D digitiser	Triangulation; optical cutting type; laser; CCD; exclusive PC; accessories	1	Analysis and recording of excavated articles
40	Washing and arrangement equipment set	Electric grinder; moisture separator; sample box; sample container; washing basket; others	1	Washing and drying of excavated articles

41	Belt conveyor	350 mm x 7 m; engine output: approx. 3 HP	20	Excavation work
42	Generator (1)	45 KVA; diesel	1	Power supply to park and museum
43	Generator (2)	15 KVA; diesel; standby unit	6	Power supply to park facilities
44	Storage container and pushcart, etc. (A)	Plastic folding type: large, medium and small; lid; pushcart; dolly	1	Arrangement of excavated articles
45	Storage container and pushcart, etc. (B)	Plastic folding type: large, medium and small; lid; pushcart; dolly; metal rack	1	Arrangement of excavated articles
46	Lawn mower (1)	Hand-pushed or self-propelled type; 4 – 6 HP; 50 – 60 cm cutting width	16	Improvement of park environment
47	Lawn mower (2)	Tractor type; approx. 15 – 20 HP	5	Improvement of park environment
48	Chainsaw	Approx. capacity: 2.2 kw/3 HP; bar size: 18 inch	6	Improvement of park environment
49	Electric welding machine	110/200 V; 60 Hz; output: approx. 40 – 130 A	2	Improvement of park environment
50	Pump with engine	Diameter: 4 inch; approx. 10 HP	5	Improvement of park environment
51	Underwater turbine pump and accessories	0.15 m^3/min; total head: 45 m; approx. 2.2 Kw	1	Improvement of park environment
52	Rolling tower	9 – 10 m	2	Recording at the time of excavation work
53	Prefabricated warehouse	15 x 27 m; assembly type	1	Arrangement and storage of excavated articles

[Communication and Transportation Equipment]

1) Truck (with power gate and crane): 2 cars

These trucks will be used for the transportation of archaeological artifacts, historic paintings and documents between the IHAH Headquarters located at Tegucigalpa and excavation sites/museums and also for the transportation of exhibits for exhibitions at home and abroad. In the Western District, these trucks will be used for the transportation of excavated articles and stone sculptures, etc. in Copán Province. As park environment improvement work and conservation/restoration work are in progress in the Western District, these trucks will be used together with a dump truck (to be deployed for the PICPAC) to transport materials for emergency restoration or large-scale conservation/restoration work.

2) HF radio and accessories: 6 sets

In view of the anticipated future activities of the IHAH, the installation of a new HF radio at the IHAH Headquarters (replacement), El Puente (replacement), Copán (replacement), Taragua (new installation), Los Naranjos (new installation) and Palacios in the Mosquitia Region (new installation) is necessary. All of the sites for new installation are located outside the telephone network and are also outside the range of the mobile telephone service. The Mosquitia Region in particular is an undeveloped area where public power supply is unavailable and where fuel is difficult to obtain. Accordingly, the HF radio equipment to be installed in the Mosquitia Region (at Prasio) will be accompanied by solar panels to generate the required electricity. At the above site for replacement, at present, HF radios are installed at the IHAH Headquarters, the El Puente Archaeological Park and the Copán Archaeological Park Visitors Centre (Western District Office). As all of the units are more than 10 years old, they are failing to provide a constant, reliable service.

3) VHF radio unites: 5 fixed VHF radio station, 5 vehicle-mounted VHF radio stations and 18 portable handsets

The VHF radio equipment will be used at the Los Naranjos Park of which the construction is currently in progress (one vehicle-mounted station and four portable handsets), Comayagua (one vehicle-mounted station and two portable handsets), El Puente Archaeological Park (two fixed stations, one vehicle-mounted station and two portable handsets), Copán Archaeological Park and surveying, excavation and restoration sites near this park (three fixed stations, two vehicle-mounted stations and 10 portable handsets). The handsets at the Los Naranjos Park and Comayagua will be used by researchers and survey members. At the El Puente Archaeological Park, a fixed station will be set up at the Archaeological Museum in the park and at a warehouse in the city of La Entrada located at a distance of some 8 km together with one vehicle-mounted station and two portable handsets. At Copán, a fixed station will be set up at the Copán Archaeological Museum, Visitors Centre and CRIA while two stations will be set up with two pick-up trucks to be provided under the Project. Ten portable handsets will be used at Las Sepulturas (2), the park entrance (1), near the main groups inside the Archaeological Park of the Copán Ruins (2), the tunnel entrance (1) and restoration sites (2), etc. The VHF radio communication system will serve multiple purposes, including everyday administrative communication, communication with the restoration sites, security within the park and emergencies (to request the transportation of sick or injured persons).

4) Pick-up trucks: 4 cars

A total of four pick-up trucks will be deployed at Tegucigalpa (IHAH Headquarters) (replacement), Copán West District Office (replacement) and PICPAC Office (at the CRIA) (new provision) for transportation and surveying purposes and at the El Puente Archaeological Park (replacement). Three pick-up trucks will replace three vehicles (one of which is a station wagon type) which were provided under Japan's cultural grant aid scheme in fiscal year 1983.

[Surveying and Excavation Equipment]

Surveying equipment and excavation equipment are often used in a flexible manner to serve both types of activity. For example, at the time of reconnaissance, the exact location will be determined by GPS and surveying as well as photographing may be conducted depending on the need. Another example is the accurate recording of the locations where artifacts are excavated at various stages of the excavation work.

1) Surveying equipment (GPS receiver, total station, total station for tunnel, digital theodolite, level, surveying equipment (Set A) and (Set B) and drawing tools)

Basically surveying equipment will be required for reconnaissance and surveying work in areas under the following jurisdiction of Tegucigalpa (including Comayagua), the Northern District Office, El Puente, Copán and Mosquitia. Constant reconnaissance work is, however, only conducted at Tegucigalpa (Comayagua), Copán and Mosquitia.

At those areas under the jurisdiction of the Northern District Office and that of El Puente, surveying equipment is only used for emergency excavation or regular surveying which are conducted once or twice a year. Reconnaissance and surveying work which contains interviews and other work at Mosquitia recommenced in October, 2000 after suspension due to Hurricane Mitch. Accordingly, two sets of reconnaissance and surveying equipment are necessary to be provided for the IHAH Headquarters to cover the areas of the Northern District, Mosquitia, Comayagua and Tegucigalpa.

At Copán, two total stations and two sets of other land survey equipment such as auto level and range finder, will be provided in view of the ongoing detailed surveying in the already developed park and the study on the entire Copán ruins covering an area of some 20 ha. In addition, a total station with higher precision and equipped with software capable of the 3D analysis of survey data will be provided for the surveying of the vast archaeological site, the

some 6 km long tunnels created by the excavation work and huge structures of significantly varying elevations.

While the necessity for a total station is particularly strong at Tegucigalpa and El Puente, theodolites will also be provided in view of the fact that many staff members are accustomed to using theodolites for surveying work.

The allocation of such surveying equipment as GPS receivers, total stations and others by site is shown in Table 4. The surveying tools Set A to be allocated to Tegucigalpa and El Puente consists of staffs and poles, etc. for surveying work not involving excavation. In contrast, the surveying tools Set B to be allocated to Copán will include scale rod, pin poles and levelling string, etc. which are used for surveying work involving excavation in addition to that tools in surveying tools Set A.

Table 4 Surveying-Related Equipment

Project Site	Equipment
IHAH Headquarters (Tegucigalpa)	Two sets of GPS receivers; two sets of total stations; two sets of theodolites; two sets of levels; two sets of surveying tools (Set A); two sets of drawing tools (drawing tables and T-rulers, etc.)
El Puente Archaeological Park	One set of total stations; one set of theodolites; one set of levels; one set of surveying tools (Set A) (no drawing tools are provided as the existing quantity of drawing tools is sufficient)
Copán (for PICPAC)	One set of GPS receivers; three sets of total stations (one set will be of the non-prism type providing high surveying accuracy); two sets of levels; one set of surveying tools (Set B); one set of drawing tools (drawing tables and T-rulers, etc.)

2) Video recording and photo apparatus for field surveys

This group of apparatus is required for reconnaissance and emergency excavation. As no emergency excavation is basically conducted at El Puente, this group of equipment will not be provided for El Puente. As in the case of surveying equipment, one set of equipment for Tegucigalpa will be used for ruins rescue and registration work and emergency excavation in areas around Tegucigalpa and Comayagua. Another set will be used for emergency excavation in areas under the jurisdiction of the Northern District Office and for ruins rescue and registration work at Mosquitia.

At Copán, it is necessary to quickly edit video film for use for subsequent surveys and seminars, etc. Accordingly, simple editing equipment will also be provided.

In regard to the PICPAC, detailed analogue or digital recording of the excavation as well as surveying work and findings is strongly necessary. Assuming photography work inside tunnels, a range of lens will be provided together with slide preparation equipment.

3) Rolling tower (photography scaffold): 2 sets

Two sets of rolling towers will be procured for the recording of the excavation situation and the locations of excavated articles (artifacts). The platform height will be 9 – 10 m. These rolling towers will also be used for work in high places at the Stone Sculpture Museum.

4) Excavation equipment: 1 set

The necessary range of equipment is identified for each excavation site. Given the facts that the IHAH adopts a policy of conducting the excavation of ruins within the framework of the PICPAC except for emergency excavation and that the available manpower for the PICPAC can only cover the excavation of one site at a time, the set of excavation equipment to be provided under the Project will consist of a chain block, drainage pump, generator, tarpaulin sheet, wooden maul, plumb bob, plate holder and stepladder, etc. to serve one excavation site.

Excavation work generally involves some 10 workers and a supervisor. Everyone carefully digs the ground, removes the soil and records the shape and location of any excavated article. As this series of work may be conducted inside a tunnel, helmets and dust masks will be included to ensure worker safety inside tunnels. However, expendables (work gloves), spoons and ladles, etc. which are common household or general-purpose items and which can be easily obtained locally will be removed from the list of requested items to finalise the items to be provided under the Project.

5) Belt conveyor

The transportation of excavated soil constitutes a large proportion of excavation work and it is important to deposit the excavated soil outside the excavation site so that the excavation work can be properly recorded and the location of each excavated article can be clearly established. As the later re-use of excavated soil is intended under the Project, the transportation of soil to a distant dumping site will be unnecessary. Nevertheless, a belt conveyor will be provided at each site to transport excavated soil outside of the site. The belt conveyor set includes a generator for power supply, a switchboard and cables, etc. The belt conveyor will be equipped with an emergency stop device in view of safety.

[Study Equipment]

1) Video fibrescope: 1 set

This equipment is used to investigate inside a stone coffin which could be discovered during trial excavation in the course of reconnaissance work. In addition to the recently discovered king's tomb which has been attracting much attention, there are many dwelling remains of Mayan civilisation at the Copán site (approximately 24 km^2), all of which are accompanied by a burial site. The graves of presumably high ranking people contain a stone coffin which is buried at the side of the house entrance. The investigation inside such a stone coffin discovered in the process of trial excavation, full-scale excavation or restoration often discloses the status of the person buried there, providing extremely important information for decisions on subsequent excavation and restoration policies. Accordingly, the provision of a video fibrescope under the Project is quite important.

2) Environmental observation equipment: 1 set

The environmental observation equipment set consists of a hygrothermograph, data logger (temperature and relative humidity), anemometer, radiation thermometer and water level gauge. Underneath the main group at the Copán Archaeological Park lie stone buildings decorated with colourful plaster reliefs, including the huge and hardly damaged Temple of Rosarira and Temple of Margarita which have been attracting much attention since their recent discovery. At present, one of the most important issues for future activities under the PICPAC is how to preserve such plaster reliefs, making the provision of environmental observation equipment and surface temperature measuring equipment (radiation thermometer) highly necessary. A preservation plan will be formulated after the collection of the relevant data for one year.

[Restoration and Preservation Equipment (Outdoor)]

1) Dump truck: 1 car

Mayan buildings were expanded or remodelled when ever a new king was inaugurated and the results of such expansion or remodelling can be observed at the corte. For the preservation of the *corte*, mortar called "*mezcla*", consisting of local soil and a smaller proportion of cement than usual, is used in Honduras. One reason for the use of *mezcla* is to make subsequent research activities easier. At present, soil and aggregate (sand) are transported from sites located at a distance of some 20 km and 7 km respectively to produce *mezcla* for

the PICPAC. Each trip involves payment of the dump truck rental charge. More than 10 trips a day are made for the restoration work under the PICPAC while more than 20 trips a day are made for the work at the Copán Archaeological Park. The introduction of a dump truck is required to increase the scale of the restoration work. The mounting of a crane on this dump truck will also make the transportation of stone sculptures (statues) possible. Along with the truck to be deployed at the Western District Office, this dump truck will be used for the transportation of large stone sculptures and others.

2) Water pump with engine: 2 out of 5 machines

These two water pumps will be used to supply water from Copán River to the meskura production site. The remaining three water pumps will be used as environmental improvement equipment as described next.

[Environmental Improvement Equipment]

1) Generators: one 45 KVA and six 15 KVA

One 45 KVA generator will be used to supply electricity to the facilities in the El Puente Archaeological Park. The six 15 KVA generators will be used in the following manner.

- Emergency power supply source for the Visitors Centre, the Stone Sculpture Museum, the Copán Archaeological Museum and the tunnel open to the public in the main group, all of which are under the jurisdiction of the Western District Office in view of the frequent power cuts at these facilities (four generators).
- Power source for lighting and work inside the tunnel used to survey the main group at the Copán Archaeological Park (one generator).
- Power source for lighting inside the tunnel open to the public at the main group at the El Puente Archaeological Park (one generator).

2) Lawn mowers(16 lawn mower sets(1) and 5 lawn mower sets(2)), and 6 chainsaws

These lawn mowers and chainsaws will be used to improve the environment at archaeological parks. Improvement of the park environment means the laying of turf in areas open to the public and landscaping work, including tree planting. A vast turfed area has already been created at both the El Puente and Copán Archaeological Parks, consuming a large proportion of the maintenance cost and manpower. By improving the efficiency of such work, surplus manpower can be generated for allocation to restoration and preservation work. Equipment is

required to cut overgrown grass, shrubs and trees to create and maintain nature trails and to assist the restoration of the ruins (dwelling remains of Maya civilisation and others). The detailed allocation of the lawn mowers and chainsaws is described below.

The lawn mower set (1) consists of hand-pushed or self-propelled small mowers to replace those currently used to maintain the part facilities while the lawn mower set (2) consists of small tractor type mowers to achieve a higher efficiency. The required quantities of these lawn mowers are calculated based on the number of persons who are capable of using the mowers.

- Lawn mower set (1) : ten for the Western District Office and six for the El Puente Archaeological Park (either hand-pushed or self-propelled type)
- Lawn mower set (2) : three for the Western District Office and two for the El Puente Archaeological Park (tractor type)
- Chainsaws : four for the Western District Office and two for the El Puente Archaeological Park

3) Welding machines: 2 machines

One welding machine each will be allocated to the Western District Office and the El Puente Archaeological Park for the fabrication and repair of park fences as well as lids for drainage holes.

4) Water pump with engine: 3 out of 5 machines

Two pumps and one pump will be allocated to the Western District Office and the El Puente Archaeological Park respective for the preparation of concrete to make park facilities (benches, litter boxes and ashtray stands, etc.) and for watering to maintain the lawn.

5) Water pump for well: 1 set

This water pump will be used to supply water for various facilities at the El Puente Archaeological Park (museum, office and cafeteria, etc.) Water will be drawn from the existing well and fed to the existing water tank.

[Arrangement and Analytical Equipment (Indoor)]

1) Photo apparatus: 3 sets

One set each of photography equipment will be allocated to (i) the IHAH Headquarters, (ii) the Comayagua Warehouse managed by the Headquarters or the Northern District Office at La Lima (as in the case of the surveying equipment and video equipment for surveying, this set will be stored at the IHAH Headquarters until further arrangements are made) and (iii) the CRIA (Copán). These sets will be used to record excavated articles, restored artifacts and excavation notes and drawings so far prepared.

2) Computer system: 2 sets

Two PCs with the necessary software, standard accessories and printer will be allocated to the Preservation Department at the IHAH Headquarters to create a database on excavated articles for restoration and preservation purposes while one laptop PC for field survey purposes and two PCs for the analysis of survey data and the preparation of charts will be provided for the Anthropological Study Department together with the necessary software, standard accessories and printers. The number of PCs operable by the current staff strength is calculated as four desktop PCs and three laptop PCs (including that for field survey purposes). A printer and other peripheral equipment will form part of the LAN based on the pier to pier method.

3) Scanners: 2 sets

These scanners will be used for the digitalisation of maps, charts and drawings of excavated articles, etc. and will be allocated to the Anthropological Study Department at the Headquarters and the PICPAC Administration Office at Copán.

4) Printer: 1 set

This printer will be used to output maps and drawings of the excavation sites and excavated articles, etc. and will be allocated to the PICPAC Administration Office at Copán as study-related equipment.

5) Film scanner: 1 set

The CRIA at Copán stores some 7,000 rolls of film and some 30,000 slides which have been produced since its establishment. While there is likely to be a constant need for the production of still photographs and slides in the coming years, the digitalisation of existing and future still photographs and slides is planned in view of their active use and improved storage. For this purpose, one scanner (for both monochromatic and colour negatives and positives) will be provided.

6) Soil testing equipment: 1 set

For conservation of the entire ruins at Copán, the sampling and analysis of soil from each site is essential so that future conservation plans properly reflect the soil properties and environmental impacts. For this purpose, one set of analytical equipment and measuring instruments will be provided for the CRIA. This equipment and instruments includes a soil acidity tester, soil moisture meter, soil hardness meter and soil sample arrangement tools, etc.

7) Washing and arrangement equipment: 1 set

At present, the CRIA uses commonly available baskets and plastic juice bottles, etc. to wash and dry excavated articles. Given the large number of excavated articles despite the small number of people conducting this type of work, there is a strong need to improve the work efficiency and arrangement (sorting) capacity of excavated articles in the coming years. Special equipment and tools will be provided to improve the efficiency of the washing and drying work of excavated articles and to increase the capacity for arranging small excavated articles.

8) Measuring and recording equipment: 1 set

The following equipment and tools will be provided for the CRIA for the measuring and recording of excavated articles.

- Turntables (large, medium and small) for restoration work
- Set of calipers
- *Mako* (Measure for earthen vessel conformer)
- Other measuring tools (triangular ruler and slide calipers, etc.)

9) Non-contact 3D digitiser

The original request included one vision drafting system as part of the measuring and recording equipment. This system will improve the efficiency of the current sketching of excavated articles by allowing those who are unused to such work to conduct the blocking and sketching of excavated articles.

The survey in Japan confirmed the development and market availability of a non-contact 3D digitiser which would serve multiple purposes with great efficiency. As this digitiser is superior to the vision drafting system in terms of the precision and working time, the originally requested vision drafting system has been replaced by a non-contact 3D digitiser with the approval of the project implementation body.

This digitiser will be used for the measuring and analysis of the shape of excavated articles and also for the storage of 3D image data on such articles at the PICPAC office.

[Restoration and Storage Equipment (Indoor Use)]

1) Storage containers and associated equipment

Storage containers are widely used to store soil containing archaeological artifacts at the time of emergency excavation and also to store classified artifacts at each site. Many unclassified excavated articles are currently stored in warehouses at Tegucigalpa, Comayagua, La Lima, Copán and La Entrada (El Puente). The number of these articles is some 80,000 at Copán, 40,000 at La Entrada, 30,000 at La Lima, 30,000 at Comayagua and 20,000 at Tegucigalpa. Based on interviews and visual observation, the field survey team estimates that some 25% of these 200,000 articles are large articles which cannot be stored in containers. Accordingly, the required number of containers to store the remaining 150,000 articles is estimated to be 7,500 (20 articles per container) which is divided into 3,000 at Copán, 1,500 at La Entrada, 1,125 at Comayagua and 750 at Tegucigalpa based on the storage capacity of the warehouse at each location.

Three container sizes are planned: large (50 – 60 cm in height), medium (approximately 30 cm in height) and small (approximately 15 cm in height). One lid will be provided for each stack of two containers. Two dollies and two pushcarts which are required for the transportation of containers, etc. in the warehouse will be allocated for each site in Tegucigalpa while two dollies and pushcarts each will be provided for La Entrada. In the case

of Copán, five dollies and five pushcarts will be provided based on the warehouse size and number of workers (to sort excavated articles for the PICPAC).

Metal storage racks have been partially introduced at the warehouses of the Preservation Department and the Anthropological Study Department of the IHAH Headquarters, the Northern District Office (at La Lima), La Entrada and the CRIA (Copán). The conventional wooden racks are being gradually replaced by metal racks through the self-help efforts of the IHAH. For the Project, therefore, the number of required metal racks is calculated for use at the new prefabricated warehouse. The quantities of the storage containers, lids, dollies and pushcarts, etc. for the Tegucigalpa area (Tegucigalpa, Comayagua and La Lima: Set A) and the Copán area (Copán and La Entrada) are finalised as described below based on the earlier calculation results.

Set A: Tegucigalpa Area

Containers	:	1,000 (large), 1,000 (medium), 1,000 (small)
Lids	:	500
Dollies	:	6
Pushcarts	:	6

Set B: Copán Area

Containers	:	1,500 (large), 1,500 (medium), 1,500 (small)
Lids	:	750
Dollies	:	7
Pushcarts	:	7
Metal racks	:	200

2) Prefabricated warehouse

Stone sculptures which cannot be stored inside a warehouse, etc. are left unattended both inside and outside the Copán Archaeological Park. Even though there is little concern in regard to the theft of these sculptures because of the introduction of the Cultural Heritage Protection Law and activities to educate the public, they could be liable to damage due to direct sunlight and rain over time. A prefabricated warehouse will, therefore, be provided for the PICPAC for erection on the premises of the CRIA to facilitate the indoor storage of as many archaeological artifacts (such as stone sculptures) as possible in view of their preservation.

[Display and Educational Equipment]

1) Video display equipment: 5 sets

A set of video display equipment consists of a monitor, VCR, amplifier, speaker(s) and cables, etc. and will be used for educational activities on ruins and archaeology, introduction of archaeological parks and brief seminars, etc. Two of the three sets for the Tegucigalpa area will be allocated to the IHAH Headquarters (one set will be used for travelling education as well as at the Visitors Centre at the Los Naranjos Park after its completion). The remaining set will be allocated to the Comayagua Archaeological Museum. The two sets for the Copán area will be installed at the El Puente Archaeological Park and the Copán Archaeological Museum.

2) Audio visual equipment: 2 sets

An audio visual equipment set consists of a slide projector and a screen, etc. in addition to a video display unit and will be used for advanced seminars, conferences and academic symposia, etc. One set each will be provided for the AV Room at the Republic Museum (Tegucigalpa) and the meeting room at the Copán Archaeological Park Visitors Centre.

3) Multi-projectors with epidiascope: 2 sets

A multi-projector with an epidiascope will be provided as part of the above AV equipment set and should provide connections with the VCR and PC and have the function of projecting books and documents.

4) Copiers: 2 colour and 2 monochrome copiers

These copiers will be used for the preparation of materials for seminars, meetings, display and education, etc. and for various types of pamphlets. A set consisting of a colour copier and a monochrome copier will be provided for (i) the IHAH Headquarters, and (ii) the PICPAC Office at the CRIA at Copán.

(3) Equipment Allocation Plan

The allocation of the wide range of equipment described above is planned as shown in Table 5 in view of the anticipated activities at each project site.

Table 5 Equipment Allocation Plan

Site	Commun-ication Equipment	Transport-ation equipment	Survey Equipment	Excavation Equipment	Surveying Equipment	Recording Equipment	Washing and Analytical Equipment	Restoration Equipment	Storage Equipment	Educational Equipment	Environmental Improvement Equipment
Tegucigalpa	- HF radio apparatus - VHF radio apparatus	- Truck - Pick-up truck	- Video equipment - Photo apparatus	None	- GPS - Total station - Theodolite - Level - Others	- Photo apparatus - PC and peripherals - Drawing tools - Scanner	None	None	- Storage containers - Pushcarts	- AV equipment - Copier	None
Copán	- HF radio apparatus - VHF radio apparatus	- Truck - Pick-up truck	- Video equipment - Photo apparatus - Fibrescope - Generator - Photography scaffold - Environ-mental observation equipment - Soil analysis equipment - PC and peripherals	- Belt conveyor - Excavation equipment	- GPS - Total station - Levels - Others	- Photo apparatus - PC and peripherals - Drawing tools - Scanner	- Washing equipment - Measuring instruments - Non-contact 3D digitiser	- Dump truck - Pump	- Storage containers - Pushcarts	- AV equipment - Copier - PC	- Lawn mower - Grass cutter - Chainsaw - Pump - Welding machine
El Puente	- HF radio apparatus - VHF radio apparatus	- Pick-up truck	None	None	- Total station - Theodolite - Levels - Others	None	None	None	- Storage containers - Pushcarts	- Video display equipment	- Lawn mower - Grass cutter - Chainsaw - Pump - Welding machine
Comayagua	None	None	None	None	None	None	None	None	- Storage containers - Pushcarts	- Video display equipment	None
Los Naranjos	- HF (VHF) radio apparatus	None	None	None	None	None	None	None	None	(Video display equipment)	None
La Lima	None	None	None	None	None	None	None	None	- Storage containers - Pushcarts	None	None
Taragua	- HF (VHF) radio apparatus	None	None	None	None	None	None	None	None	None	None
Purasio	- HF radio apparatus	None	None	None	None	None	None	None	None	None	None

* Equipment in parenthesis in the table is mobile equipment or equipment borrowed by the branch office, etc. from the headquarters.

2.2.3 Implementation Plan

(1) Implementation Period

The longest delivery time for the equipment to be procured is slightly more than four months. The Project can be easily implemented within one fiscal year, including the installation and training periods.

(2) Country of Supply and Country of Origin

The analysis results suggest that most of the equipment and tools will be made in Japan and thus be procured in Japan. Even they are made in Japan, they are suitable for the Project in third countries. In the case of copiers and PCs, etc., the procurement of Japanese or third country products in Honduras is judged to be appropriate because of the need for regular maintenance services and the frequent purchase of consumables and spare parts. Items of which the country of supply or the country of origin is not only Japan are listed in Table 6 with the reasons for their selection.

Table 6 Items for Local Procurement and/or Third Country's Products

Item	Country of Supply	Country of Origin	Remarks
Pick-up truck	Japan	Japan or third country	One Japanese manufacturer has relocated its production base to Thailand. The pick-up trucks of this manufacturer are suitable for the purposes of the Project together with those made in Japan.
HF radio apparatus	Japan	Japan or third country	Japanese products are fully competitive. However, accessories (solar panels) can be procured more cheaply from the US with the same performance.
GPS and accessories	Japan	Japan or third country	US products of equal performance are cheaper.
Total stations 1. and 2.	Japan	Japan or third country	Given the specifications of the required equipment, it will be difficult to conduct a fair open tender without including Swiss products.
Digital theodolite	Japan	Japan or third country	Given the specifications of the required equipment, it will be difficult to conduct a fair open tender without including Swiss products.
Auto level	Japan	Japan or third country	Given the specifications of the required equipment, it will be difficult to conduct a fair open tender without including Singaporean products.
Laser rangefinders 1. and 2.	Japan	Japan or third country	No competition is feasible with only Japanese products.
PC and peripherals	Honduras	Japan or third country	Because of the need for regular maintenance after-sale services, the procurement of these items in Honduras is appropriate. It is difficult to specify the country of origin given the present situation of manufacture.
Scanner	Japan	Japan or third country	Only one Japanese manufacturer is available while third country products offer a wider range of general-purpose application.

Printer	Japan	Japan or third country	Only one Japanese manufacturer is available while third country products offer a wider range of general-purpose application.
Video editing system	Honduras	Japan or third country	Because of the need for regular maintenance after-sale services, the procurement of this system in Honduras is appropriate. It is difficult to specify the country of origin given the present situation of manufacture.
Video display equipment set	Japan	Japan or third country	Japanese products for export are manufactured in a third country.
AV equipment set	Japan	Japan or third country	Japanese products for export are manufactured in a third country.
Copier	Honduras	Japan or third country	Because of the need for regular maintenance after-sale services, the procurement of this item in Honduras is appropriate. It is difficult to specify the country of origin given the present situation of manufacture.
Colour copier	Honduras	Japan or third country	Because of the need for regular maintenance after-sale services, the procurement of this item in Honduras is appropriate. It is difficult to specify the country of origin given the present situation of manufacture.
Electric welding machine	Honduras	Japan or third country	A third country product meeting the required specifications can be procured cheaply in Honduras.

(3) Places for Handing Over

The procured equipment will be handed over to the Honduran side at the warehouse of the IHAH Headquarters at Tegucigalpa and at the Western District Office Headquarters at Copán Ruinas. The IHAH will then be responsible for the delivery of the procured equipment to the destination sites.

(4) Erection and Installation

Erection work will be required for the prefabricated warehouse. The site for the warehouse will be on the premises of the CRIA and has already been secured by the IHAH (see Appendix 6-1). The IHAH will bear the cost of the ground levelling and foundation work as well as the personnel cost of the workers to conduct the work. A Japanese engineer will be dispatched to Honduras to supervise the erection of the prefabricated warehouse within the scope of the Project as described in (5) next. Installation work will be required for the HF radio stations, PCs and peripheral equipment, video editing system and non-contact 3D digitiser. A HF radio station will be installed at the IHAH Headquarters and the CRIA in Tegucigalpa and at Prasio. In the case of the PCs and peripheral equipment, video editing system and non-contact 3D digitiser, installation, connection and initial setting will be required. The places of installation of the above equipment at the CRIA are listed in Appendix 6-2.

(5) Local Procurement Supervision and Technical Guidance

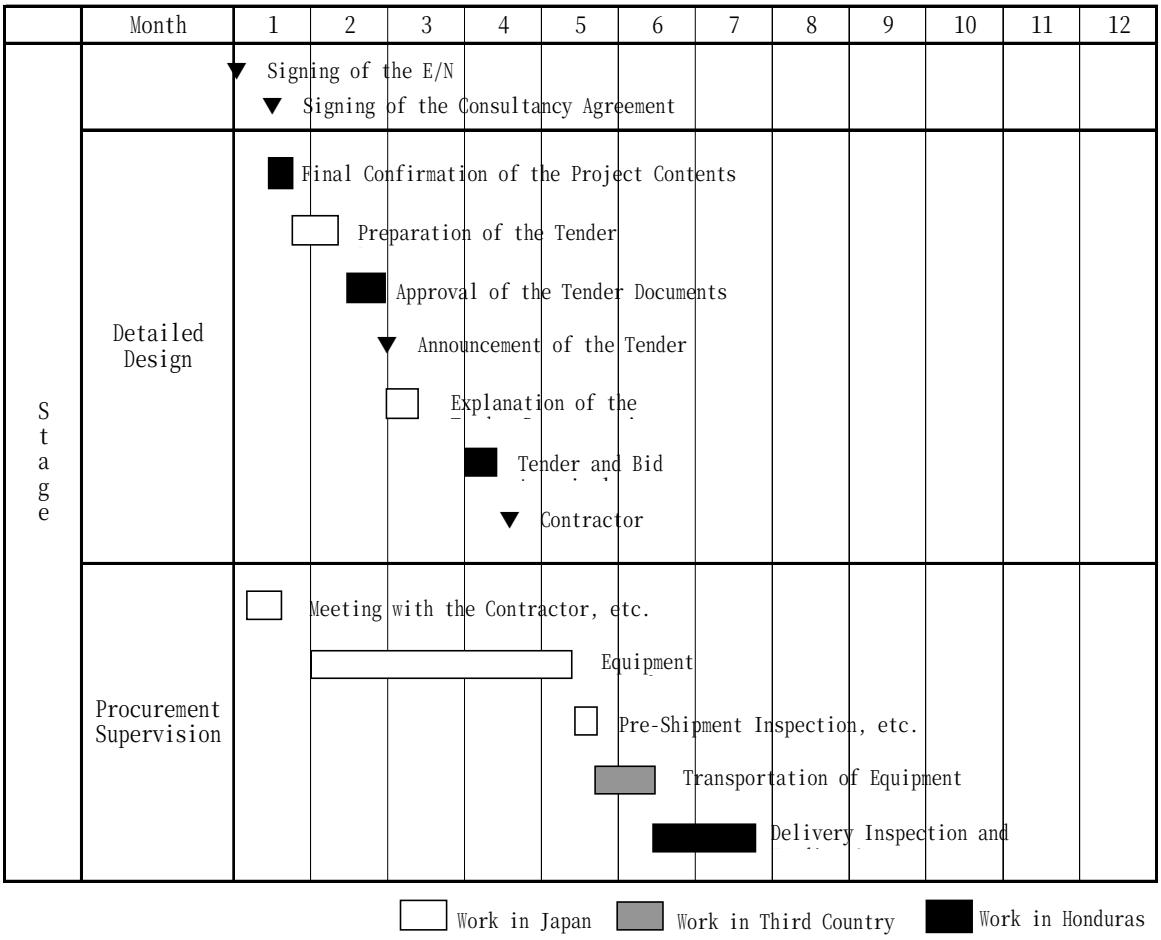
One local procurement supervisor will be dispatched from Japan to conduct the general coordination of transportation, erection, operation guidance, handing over and installation, etc. of the equipment procured in Honduras by the Contractor. Other Japanese or third country engineers and local engineers will also be assigned at the time of the handing over of the equipment to the Honduras side as shown in Table 7.

Table 7 Local Procurement Supervision Plan

Engineer (Equipment)	Number	Description of the Work
Japanese Engineer A (Belt Conveyor and Prefabricated Warehouse)	1	The belt conveyor consists of the main body and the generator. Installation of the generator, guidance on the connection of the conveyors and confirmation of the proper working of the system will be required. Further guidance will also be required. As more than 10 units will be introduced at excavation sites, guidance on the deployment procedure, etc. will be necessary. The prefabricated warehouse will require foundation work and an engineer familiar with drawings and construction work will be necessary to determine the anchor bolt locations and other matters. This engineer will also provide guidance on crane operation which is necessary for the assembly of the prefabricated warehouse. One engineer will, therefore, be dispatched to provide guidance on the equipment installation and operation and also to provide technical guidance on the assembly work and construction work, etc. at Copán.
Japanese Engineer B (GPS and Total Station)	1	GPS is precision equipment which will be used to confirm geographical positions using satellites. The incorrect operation of the equipment in Honduras will lead to the acquisition of incorrect data and/or possible equipment breakdowns. A total station is also precision equipment which is used to accumulate and analyse survey data. The incorrect operation of this equipment in Honduras will lead to the acquisition of incorrect data and/or possible equipment breakdowns. One engineer will, therefore, be dispatched to provide guidance on operation at Tegucigalpa (three days) and at Copán (four days, including travelling time).
Japanese Engineer C (Non-Contact 3D Digitiser)	1	This precision equipment will be used for the restoration and study of excavated articles. The incorrect operation of the equipment in Honduras will lead to the acquisition of incorrect data and/or possible equipment breakdowns. One engineer will be dispatched to provide guidance on operation at Copán (four days for installation and initial setting and four days for guidance on operation).
Japanese Engineer D (HF Radio Station)	1	This is a fixed type radio station using a solar power generation system. The on-site assembly, erection and wiring, etc. of the solar system will be required. It will also be necessary to confirm the good state of communication and to decide the optimal location for the installation of the antenna. One engineer will be dispatched to supervise the installation, to provide guidance on operation and to confirm the good state of communication at Tegucigalpa (three days), Copán (four days, including travelling time) and Prasio (six days, including travelling time).
Third Country Engineer (Video Editing System	1	The system will use non-linear video editing software and expert knowledge will be required for initial setting and operation. An engineer will provide the necessary guidance, including guidance on connection with a PC and peripheral equipment (storage) at Copán.
Local Engineer A (Tractor Type Lawn Mower)	1	The lawn mower in question will be equipped with a grass-cutting rotating blade at the central part of the tractor-like body. While the blade will be protected by a cover, incorrect operation could result in an accident. One engineer will be assigned to provide guidance on operation at Copán (two days for assembly and three days for guidance on operation and maintenance).
Local Engineer B (PC and Peripheral Equipment)	1	Although the equipment in question is of small size, operation based on pier to pier LAN is planned. One engineer from a local agent will be assigned to connect the equipment and to conduct the initial setting at Tegucigalpa (three days) and at Copán (three days).

(6) Project Implementation Schedule

Table 8 Project Implementation Schedule



2.3 Obligations of Recipient Country

The Honduran side will be responsible for the following for the implementation of the Project.

- Customs clearance of imported equipment and arrangement of tax exemption for locally procured equipment
- Transportation of equipment from Tegucigalpa or Copán to other project sites
- Payment of wages for local workers required to conduct the foundation work and assembly of the prefabricated warehouse
- Recruitment/assignment of the staff required to operate the newly provided equipment

The total personnel cost of the workers to conduct the foundation work and assembly of the prefabricated warehouse is estimated to be approximately L. 893,800 as shown in Table 9.

Table 9 Estimated Total Cost of Foundation Work for Prefabricated Warehouse

(Unit: Lempira)

Item No.	Description	Quantity	Unit	Unit Cost	Amount	Remarks
1	Levelling	421	m^2		0	Included in personnel cost
2	Inking	421	m^2		0	"
3	Excavation	82.3	m^3		0	"
4	Back-filling	71.1	m^3		0	"
5	Removal of surplus soil	11.3	m^3		0	"
6	Banking	127	m^3		0	"
7	Soil delivery to site	116	m^3		0	"
8	Crushed stones (foundations)	3.1	m^3	100	310	
9	Crushed stones (floor and slope)	42.1	m^3	100	4,210	
10	Blinding concrete (placement cost of ready-mixed concrete included)	1.5	m^3	300	450	Personnel cost to be included in No. 22
11	Foundation concrete (as above)	15	m^3	300	4,500	"
12	Floor and slope concrete (as above)	43.9	m^3	300	13,170	"
13	Ordinary forms	111	m^2	50	5,550	
14	Architectural forms	139	m^2	50	6,950	
15	Reinforcing bars: processing and assembly	731	kg	750	548,250	Replacement materials
16	Wire mesh for floor and slope: 5Ø	437	m^2		0	"
17	Polyethylene film for floor: t = 0.15	421	m^2		0	"
(16, 17)	Damp-proofing tiles (local materials for 16 and 17 above)	6,727	pieces	15	100,905	
18	Anchor bolt	84	pieces	30	2,520	Replacement materials
19	Mortar for crown of continuous footings	140	m	500	70,000	
20	Floor trowel finish	421	m^2	300	126,300	
21	Slope mortar repair: 4 m x 2 m	2	site	450	900	
22	Personnel cost	140	man-days	70	9,800	
	Total				893,815	

2.4 Project Operation Plan

The maintenance cost, including the personnel cost, for the equipment to be provided under the Project is estimated to increase by approximately L. 1.24 million/year as shown in Table 10 which is equivalent to some 4.1% of the total IHAH budget for fiscal year 2001. As the average increase rate of the budget is 23.14%, this maintenance cost increase will be easily covered by the annual increase of the budget. The basis for the estimation of the maintenance cost is given in Appendix 5.

Table 10 Project-Related Maintenance Cost

(Unit: Lempira)

Cost Item	Lempira (million)
Personnel Cost	0.47
Maintenance and Repair Cost of Vehicles, etc.	0.36
Fuel Cost of Vehicles, etc.	0.34
Lubricating Oil and Other Costs	0.01
Maintenance Cost of Other Equipment/Tools; Consumables Cost	0.06
Total	1.24

CHAPTER 3 PROJECT EVALUATION AND RECOMMENDATIONS

3.1 Project Effects

(1) Direct Effects

1) Communication and Transportation

- The swift and large volume transportation of excavated articles from various archaeological sites to Tegucigalpa or Copán and of repaired items and exhibits from warehouses to various museums will become possible, greatly expanding the surveying, PR and educational activities of the IHAH.

- The introduction of new communication equipment will enable daily as well as emergency communication between the headquarters and different branch offices/sites and will also facilitate the dispatch of engineers and archaeologists and communication regarding the transportation of equipment, etc., thus improving the quality of reconnaissance and surveying activities and the level of the activities of the IHAH together with widening of the scope of such activities.

- The introduction of radio apparatus at Prasio, to which immediate means of communication is currently available, will enable regular communication regarding reconnaissance and surveying work, thus improving the efficiency of such work. The safety of work in undeveloped areas where different languages and customs prevail will also be secured.

- The introduction of VHF radio apparatus will ensure the availability of a means of communication at restoration, excavation and survey sites and at park facilities, thus improving the efficiency and speed of various activities, including restoration work, urgent excavation work and the transportation of persons accidentally injured in an archaeological park, restoration site or tunnel, etc.

2) Reconnaissance, Surveying and Excavation

- The introduction of surveying equipment will facilitate the efficient and accurate surveying of ruins, the configuration of which has been altered due to collapse associated with disasters or survey and restoration activities, and of newly discovered ruins. In addition, it will become possible to constantly review out-dated data.

- The introduction of GPS and total stations will enlarge the surveying area in regions where reconnaissance has not yet been conducted, making it possible to prepare more accurate maps of ruins.

- The detailed recording of the reconnaissance and excavation results will enlarge the scope of research activities and will contribute to public relations and educational activities.

- The introduction of such equipment as a fibrescope to investigate inside stone coffins and a drainage pump to efficiently conduct excavation work will achieve a shortening of the excavation time and a reduction of the required labour, thus increasing the number of excavation sites.

- The safety of excavation work and surveys inside tunnels will be secured.

3) Surveys

- Surveys inside stone coffins which has so far not been possible will become possible without large-scale excavation.

- An appropriate preservation method for those ruins which are extremely important but which are difficult to preserve because of their fragility can be established for future work.

4) Restoration and Preservation

- The introduction of transportation equipment (vehicles) will shorten the time and improve the efficiency of restoration work.

- The time required to restore excavated articles and remains will be shortened and the efficiency of restoration work will be improved.

- Those ruins requiring urgent restoration because of damage due to a hurricane and/or heavy rain will be restored.

5) Environmental Improvement

- The environment of archaeological parks will be improved together with the extension of parks and the introduction of new facilities.

- The safety of visitors to tunnels, museums and archaeological parks will be secured.

- The replacement of welding machines and the introduction of chainsaws will enable staff members of the IHAH to efficiently manufacture handrails, litter boxes, ashtrays and benches, etc. for various facilities.

- The construction/improvement of drainage ditches will slow down the speed of collapse of ruins.

- The permanent supply of drinking water and the installation of lighting equipment at the El Puente Archaeological Park will not only improve the working conditions of staff members but will also provide new services for visitors, including the opening of a cafeteria.

6) Arrangement and Analysis (Indoor Activities)

- The time required to sort and arrange excavated articles will be shortened and it will become possible to file them more efficiently. At the same time, enquiries regarding data on excavated articles by other departments and offices, etc. will be facilitated, widening the scope and improving the quality of research activities.

- The digitalisation of images will allow reference work to be conducted more quickly. At the same time, the ease of copying and transferring images will greatly improve public relations activitiy, educational and research activities.

- The storage of past research data in a digital format will prevent the dispersement of data while ensuring the secured storage of data.

- The introduction of soil analysis equipment will improve the method of protecting ruins in the future.

- The quality of washing of excavated articles will be improved and the volume of sorting and arranging small archaeological artifacts will be increased.

7) Restoration and Storage

- The storage of those archaeological artifacts which are currently left unattached at or outside archaeological sites will become possible in large quantities, preventing the dispersement or theft of such artifacts.

- The improved quality of the work to arrange archaeological artifacts will make it possible to conduct subsequent restoration work more smoothly.

- The recovery of archaeological artifacts left on the ground will prevent damage to and the weathering of such artifacts.

8) Display and Education

- The quality of guidance, display and education for visitors to museums and archaeological parks, including school children, in Honduras will be much improved. The preparation of materials with better visual appeal will convey more information to visitors in an efficient manner.

- It will become possible to prepare appropriate display, public relations and educational materials and also to prepare attractive pamphlets for visitors to museums and archaeological parks.

(2) Indirect Effects

- Ruins and excavated articles are important tourism resources in Honduras. The improvement, increase and protection of these resources will increase the income from tourism, thus contributing to improvement of the economy of Honduras.

- The increased number of visitors and income with the improvement of the park environment will enable the improvement and expansion of archaeological parks and the enlargement of restoration areas, resulting in increased employment opportunities for local people to run and maintain these parks. The likely expansion of the sales volume of folk art articles and of hotels and other accommodation facilities will stimulate the local economy.

- The improved efficiency of park environment improvement work will enable the diversion of surplus manpower to excavation and restoration work.

- The installation of litter boxes, benches, handrails and ashtrays will ensure the safety of visitors and will keep the park facilities clean and tidy, contributing to a pleasant park environment.

- It will become possible to provide much more reference materials and information for a large number of researchers worldwide on the ruins of Mayan civilisation in Honduras.

3.2 Recommendations

(1) Human Resources Development in Honduras

The IHAH has been steadily expanding its authority and making great achievements in terms of the protection and study of cultural heritage under the auspices of the Government of Honduras which has been earnestly protecting cultural heritage for many years. However, the absence of any specialist archaeological course at domestic universities despite the presence of anthropology and history courses means that it has been necessary to invite foreign archaeologists to Honduras or to send domestic researchers abroad for study purposes. As of the end of 2000, there are only five qualified Honduras archaeologists. Given the fact that cultural heritage in Honduras predominantly falls in the category of archaeology, the fostering of domestic archaeologists and researchers in the field of archaeology is urgently required.

(2) Development of Transport Network

The development of the transport network is essential for both the progress of archaeological research and the promotion of tourism. While trunk roads linking the main sites are well developed, road access to some archaeological survey sites is not yet available. As such disasters as collapses, landslides, breaches of embankments and loss of bridges due to hurricanes or downpours occur almost every year, measures to prevent such disasters must be introduced. Road access to the ruins at Copán, which is the principal tourist site, from abroad is available from the international airport at San Pedro Sula, Guatemala City or Tegucigalpa. It takes approximately seven and a half hours from Tegucigalpa and some three hours from San Pedro Sula, making the improvement of access necessary by means of constructing a new (local) airport or other means. The absence of public transport to the El Puente Archaeological Park from La Entrada requires a reform measure.

However, it must be noted that the careless development of transport to assist tourism could lead to environmental destruction. Therefore, careful planning is required taking environmental conservation into consideration.

(3) Introduction of Advanced Technologies and Utilisation of Conventional Technologies

In the last few years, tremendous progress has been made in the digitalisation of information worldwide and the field of archaeology is no exception. The Project intends the provision of information abroad and the analysis of research data by means of digitalising images and actual measurement data. The training of engineers handling the digitalisation of information will be an important factor for future archaeological research in Honduras.

One essential condition for the introduction of advanced technologies is the firm establishment of conventional information processing technologies and ruins preservation and restoration technologies. These conventional technologies which have been developed to suit the environment of Honduras must not contradict advanced technologies. Individual ruins and archaeological artifacts have specific characteristics reflecting the age of creation or different civilisations and conventional technologies have been nurtured based on these characteristics. Therefore, the introduction of new technologies must be conducted as a logical succession or advancement of conventional technologies.

(4) Multi-Lateral Research and Technical Exchanges

Many foreign researchers have been involved in research activities of Honduran archaeology including research of Mayan civilisation. The elucidation of Mayan letters in recent years has been possible because of the involvement of researchers in many foreign countries. As stated earlier, the training of domestic researchers is an important task for Honduras, making multi-lateral research and technical exchanges necessary. In this context, the introduction of new equipment under the Project must be able to promote the technical level of archaeological surveys and research in Honduras.

(5) Development of Tourism and Preservation of Ruins

The development of tourism featuring cultural heritage occupies an important position in the economy of Honduras. Many efforts have been made so far to improve the site access and accommodation facilities. Meanwhile, the IHAH has been improving the facilities at archaeological parks and the tunnels for visitors to observe underground ruins as tourism resources. However, the improvement of archaeological parks has exposed ruins and artifacts which used to be protected by forests to direct sunlight and rain and has also exposed underground ruins to fresh air and such exposure has led to such preservation-related problems as discolouration and degradation. The situation where cultural heritage which has been preserved for more than one thousand years is degrading over a short period of time because of excavation to provide access for the public poses a dilemma between the preservation of ruins and the development of tourism. As this situation is likely to continue, therefore, the preservation method, extent and period of display and public access, etc. must be carefully reviewed in order to strike a reasonable balance between the preservation of ruins and the development of tourism.