CHAPTER 3 CONTENTS OF THE PROJECT

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3.1 Objectives

This Project aims to strengthen IHS as a scientific and technical support organization devoted to effectively improving human settlement situation in the Republic of Indonesia. The current IHS facilities, which are divided into two locations, shall be consolidated on a new site, and new facilities shall be constructed for expanding activities on research and development, information dissemination, and testing and technical guidance.

3.2 Review of the Request

3.2.1 Review of Facility Scale

The requested facilities were reviewed, and their appropriateness judged, based on the following criteria.

(1) Are the requested facilities and rooms therein, indispensible and rational for the activities of IHS?

(2) Laboratory scale is determined by factors like testing and experimental equipment size, quantity, working space and method of use. Is the requested scale appropriate?

(3) The scale of seminar facilities is calculated based on the yearly program (scheduling, number of participants, frequency). Is the requested scope appropriate?

(4) Have offices and research rooms been planned according to the projected number of occupants?

In addition to the above, appropriateness of the requested scale was reviewed by referring to the current facility area of IHS and the area of similar facilities in Japan. The result was that, as shown in the following Table 3.1, a total floor area of about 11,500m^2 was deemed appropriate, though the requested total floor area was 12,600 m^2 (Table 3.1).

Table 3.1 Comparison of Facility Areas

	Requested Area (m^2)	Existing Facility Area (m^2)*	Planned Facility Area (m^2)
Main Building			
· Administration	4,000	4,560	6,245
· Research and Development			
· Information Dissemination			
· Housing Environment			
· Seminar/Exhibition	2,400	1,160	
· Canteen/Dormitory			
Laboratories			
· Structure/Earthquake Laboratory	2,500	1,650	1,776
· Building Material Laboratory	1,400	1,150	1,052
· Sanitary Engineering Laboratory	800	470	819
· Fire Testing Laboratory	800	40	740
· Workshop	500	480	573
Utility Building/Guardhouse, etc.	200	100	316
Total	12,600	9,610	11,521

* Total area of Tamansari and Turangga

3.2.2 Review of Requested Equipment

The list of requested equipment was reviewed, and its appropriateness judged, based on the following criteria.

a. Is the equipment appropriate for the scope and level of activities planned to be done by IHS?

b. Compatibility with the existing equipment.

c. The purpose of introducing computer systems.

d. Maintenance and repair system, and budgetary measures.

e. Availability of spare parts and consumables, and budgetary measures.

(1) Housing Environment Laboratory

The only equipment this division currently possesses is drafting machines, and the division is incapable of the basic data collection and analytical research necessary for regional development. Therefore, the appropriate needed equipment includes computers for statistical analysis, data collection equipment, aerial photograph analysis survey equipment and map analysis equipment. However, there are problems in safety, maintenance and operation regarding the requested ultra-light aircraft, and this has been eliminated from the list of requested items. The easy mapping machine in the list has been replaced with an optical pantograph which will be more useful for the research activities of the laboratory (Table 3.2).

Table 3.2 Comparison of Existing, Requested and Planned Major Equipment for Housing Environment Laboratory

Existing Equipment	Q'ty	Requested Equipment	Q'ty	Planned Equipment	Q'ty
		· Equipment for Statistical Analysis		· Equipment for Statistical Analysis	
		PC computer systems with fixed disk, printer, etc.		PC computer systems with fixed disk, printer, etc.	
		- High level	1	- High level	1
		- Standard	4	- Standard	4
		· Equipment for Survey Data Collection		· Equipment for Survey Data Collectin	
		Camera etc.	L.S.	Camera etc.	L.S.
		Ultra-light Aircarft	1		
		· Equipment for Analyzing Aerial Photography		· Equipment for Analyzing Aerial Photography	
		Stereo viewer	L.S.	Stereo viewer	L.S.
		Easy mapping machine	1	Optical Pantograph	1
		Others	L.S.	Others	L.S.
		· Equipment for Map Analysis		· Equipment for Map Analysis	
		Planimeter	1	Planimeter	1
		Digityzer	1	Digityzer	1
		X-Y plotter	2	X-Y plotter	2
· Drafting machine	°5				

Note: ° To be relocated to the new site by IHS

(2) Building Material Laboratory

Almost all the equipment currently held by IHS are from the 1960s, and much of it has deteriorated. Measurement devices like compression testing machines have large measurement errors, often breakdown and cannot withstand normal use. Dimensional errors of concrete moulds for making specimens are common, and the majority of equipment needs renovation. Aggregates quality is generally poor in Indonesia, but IHS has no analytical equipment even to handle alkali aggregate-reaction which has recently become particularly a severe problem.

In the IHS request, the building materials laboratory requires one 200tf compression testing machine for concrete and four universal testing machines (adaptable for compression, tension and bending strength) for load testing with the following capacities: 20tf and 2tf (both for general physical testing), 10tf (for wood testing) and 50tf (for metal testing). These requests have been reviewed with the aim of promoting efficient and smooth activities throughout IHS as a whole. The following decision has been made in due consideration of the fact that IHS is not just a research and development organization and plays an important role in testing and technical guidance.

200tf compression testing machine:

Judging from the planned activities of IHS, a 100tf concrete compression testing machine is sufficient.

20tf universal testing machine:

A 20tf mortar compression testing machine is suitable for mortar compression and bending tests.

2tf universal testing machine (Strain velocity control type):

A 10tf universal testing machine (strain velocity control type) is needed for ordinary building materials testing such as tension tests of plastics, reinforcing bars, iron wire and tile bond tests.

10tf universal testing machine:

Judging from the planned activities, a 10tf wood universal testing machine is deemed appropriate.

50tf universal testing machine:

A 50tf capacity is not sufficient for tension testing of metal materials. The 500tf universal testing machine requested by the structure/ earthquake laboratory will be changed to a 500tf compression testing machine. Taking these into account, a 200tf universal testing machine is needed for metal testing. Tension testing of structural members can also be done with this 200tf testing machine.

The requests for other equipment have, with the exception of the following equipment, been judged appropriate (Table 3.3).

X-ray diffractometer	Not necessary, judging from the activities
Calorimeter	Not necessary, judging from the activities
Capping compound warmer	Not necessary because IHS already owns one.
Spring type creep test apparatus	Not necessary, judging from the activities
Pesticide retention analyzer (Two sets)	One set is sufficient.
Non-destructive wood stress testing machine	Not necessary because of problems regarding measurement accuracy
Personal computer (five sets)	Four sets are sufficient.
Geoelectric and supporting equipment	Not necessary, judging from the activities of IHS

Table 3.3 Comparison of Existing, Requested and Planned Major Equipment for Building Material Laboratory

Existing Equipment	Q'ty	Requested Equipment	Q'ty	Planned Equipment	Q'ty
		· General Physical Testing Apparatus		· General Physical Testing Apparatus	
		20 tf Universal testing machine	1	20 tf Mortar compression testing machine	1
		2 tf Universal testing machine	1	10 tf Universal testing machine	1
· Hardened Concrete Testing Apparatus		· Hardened Concrete Testing Apparatus		· Hardened Concrete Testing Apparatus	
50 tf Concrete compression testing machine	(*1)	200 tf Concrete compression testing machine	1	100 tf Concrete compression testing machine	1
		· Testing Apparatus for Wood & Wood-based Materials		· Testing Apparatus for Wood & Wood-based Materials	
		10 tf Universal wood testing machine	1	10 tf Universal wood testing machine	1
· Metal Testing Apparatus		· Metal Testing Apparatus		· Metal Testing Apparatus	
30 tf Universal testing machine	(1)	50 tf Universal testing machine	1	200 tf Universal testing machine	1
100 tf Universal testing machine	(1)				

Notes: ( ) Superannuated (*) Out of order

(3) Structure/Earthquake Laboratory

The equipment this division currently has only allows structural testing of structural members, frames and single-story mock-up small dwellings. With increased concentration of population in the cities, the need sharpens for low-cost walk-up flats, and hence research is necessary on medium-rise housing structural safety (against earthquake, fire, wind, rain, etc.). Therefore, such reaction walls and floors as will enable tests of structures having three stories are essential for this research purposes. Further, to perform mock-up tests of columns and beams, which are regarded as structural members, at least a 500tf compression testing machine is necessary. Landslides are also common in Indonesia due to unstable ground conditions, so there is an urgent need for investigations and research relating to soil quality.

Since the requested equipment will improve this situation, and the aim is to respond to the needs of IHS, the requests have been deemed appropriate except for the following equipment (Table 3.4).

Photo-copy machine	: One to be provided in the Main Building will do.
Blue printing machine	: Blue printing can be done by placing orders with outside shops as has been done so far.
Mercury method density set	: Not necessary, as another equipment can serve this test.
Standard personal computer (seven sets)	: Five sets are deemed sufficient.
Forklift (capacity: six-ton)	: Three-ton is deemed sufficient.
Sound insulation testing equipment	: Not necessary, as another equipment can serve this testing.

Table 3.4 Comparison of Existing, Requested and Planned Major Equipment for Structure/Earthquake Laboratory

Existing Equipment	Q'ty	Requested Equipment	Q'ty	Planned Equipment	Q'ty
		· Seismic Loading System		· Seismic Loading System	
		Small shaking table	1	One way ultra-small shaking table	1
		Reaction wall (15 m×10 m)	1	Reaction wall (15 m×10 m)	1
		Reaction floor (15 m×15 m)	1	Reaction floor (15 m×15 m)	1
· Permanent Loading System		· Permanent Loading System		· Permanent Loading System	
300 tf Compression testing machine	(1)	500 tf Universal testing machine	1	500 tf Compression testing machine	1

Note: ( ) Superannuated

(4) Fire Testing Laboratory

Fire testing research began in 1983, and later fire safety guidelines for the Republic of Indonesia were drafted based on the "Report on Overseas Development Projects of Fire Prevention Construction Technique" published in 1985 by the International Engineering Consultants Association in Japan. In 1987 DPU promulgated "Fire-proofing and Safety Criteria" based on these guidelines.

The division currently has equipment for testing fire-proofing materials based on standards of various countries, i.e. JIS (Japanese Industrial Standards), ISO (International Organization for Standardization), ASTM (American Society for Testing and Materials) and BS (British Standards), and a small furnace for walls (models) based on JIS.

A large furnace will be needed to enable such actual size experiments on structural members as is required for the fire prevention and resistance authorization system to be legislated in the near future.

Therefore the requested equipment accords with the aim of strengthening IHS and has been deemed appropriate except for the following equipment (Table 3.5).

Flammability tester : Not necessary, judging from the activities

Toxicity test apparatus : A CO analyzer can be used for this purpose

Table 3.5 Comparison of Existing, Requested and Planned Major Equipment for Fire Laboratory

Existing Equipment	Q'ty	Requested Equipment	Q'ty	Planned Equipment	Q'ty
· Fire Prevention Testing Apparatus		· Fire Prevention Testing Apparatus		· Fire Prevention Testing Apparatus	
Surface test apparatus	° 1	Flammability tester	1		
Non combustibility test apparatus	(*1)	Fire resistance test furnace	1	Elementary material heating furnace	1
2-ft Flame tunnel	° 1	Ignition tester	1	Ignitability tester	1
Fire tube apparatus	° 1	Toxicity test apparatus	1	CO analyzer	1
Thermal conductivity meter	° 1				
· Fire Resistance Testing Apparatus		· Fire Resistance Testing Apparatus		· Fire Resistance Testing Apparatus	
Fire resistance test furnace for wall	° 1	Furnace for wall (2.5 m×2.5 m)	1	Furnace for wall (2.5 m×2.5 m)	1
		Multiple type furnace (2.5 m×3.5 m×3.0 m)	1	Multiple type furnace (2.5 m×3.5 m×3.0 m)	1

Notes: ° To be relocated to the new site by IHS ( ) Superannuated

(5) Sanitary Engineering Testing

The sanitary engineering division focuses on basic investigation to collect key data of water supply and drainage systems, well water utilization and water quality testing technology, research relating to water quality improvement techniques, and performance test of water treatment tanks. However, the division does not have precision measurement equipment and must rely on outside testing organizations for detection of heavy metals and minute amounts of organic salts. This situation results in that it takes too long to obtain results of analysis and entails extra cost. Therefore equipment requested to remedy this situation has, with the exception of the following, been deemed appropriate.

- Multigas detector measurer microprocessor
  Not necessary, judging from the activities
- Differential scanning calorimetry and flash point testing system
  Not necessary, judging from the current activities
- Particle size analyzer
  Not necessary, judging from the activities
- Sterilizer
  Another instrument can serve the purpose

Table 3.6 Comparison of Existing, Requested and Planned Major Equipment for Sanitary Engineering Laboratory

Existing Equipment	Q'ty	Requested Equipment	Q'ty	Planned Equipment	Q'ty
· General Testing Apparatus for Water Quality		· General Testing Apparatus for Water Quality		· General Testing Apparatus for Water Quality	
		Liquid chromatograph	1	Liquid chromatograph	1
		Polarized reeman atomic absorption spectrophotometer	1	Polarized reeman atomic absorption spectrophotometer	1
		Water still	1	Water still	1
		COD, BOD analyzer	L.S.	COD, BOD analyzer	L.S.
		Others	L.S.	Others	L.S.
Magnetic stirrer	°1				
Shaking machine	°1				
Water bath	°1				
Titrator	°1				
· General Testing Apparatus for Liquid & Solid Waste		· General Testing Apparatus for Liquid & Solid Waste		· General Testing Apparatus for Liquid & Solid Waste	
Muffle furnace	(*1)	Monitor type muffle furnace	1	Monitor type muffle furnace	1
		Apparatus for determination and distillation of solid waste	1	Apparatus for determination and distillation of solid waste	1
		· Gas Analysis Apparatus			
		Multigas detector measurer microprocessor	1		
· General Microbiological Test Apparatus		· General Microbiological Test Apparatus		· General Microbiological Test Apparatus	
Ordinary Microscope	°1	Sterilizer	1		
Incubator	°1	Microscope etc.	L.S	Microscope etc.	L.S
Oven	°1				
· Chemical Test Apparatus		· Chemical Test Apparatus		· Chemical Test Apparatus	
		Differential scanning calorimetry and flash point testing system	1		
		Automatic total organic carbon analyzer	1	Automatic total organic carbon analyzer	1
		Others	L.S.	Others	L.S.
Thermometer etc.	°L.S.				

(to be continued)

(continued)

Existing Equipment	Q'ty	Requested Equipment	Q'ty	Planned Equipment	Q'ty
· Physical Test Equipment		· Physical Test Equipment		· Physical Test Equipment	
		Particle size analyzer	1		
		Total dust sample	1	Total dust sample	1
		Digital abbe refractometer	1	Digital abbe refractometer	1
Compressor etc.	° L.S.				
		· Portable Test Kit		· Portable Test Kit	
· Portable Test Kit		Portable NOx content meter	1	Portable NOx content meter	1
		Portable SOx content meter	1	Portable SOx content meter	1
		Portable CO content meter	1	Portable CO content meter	1
Water pollution outfit	° 1	Others	L.S.	Others	L.S.
		· Data Acquisition System for Water and Sanitary Tests		· Data Acquisition System for Water and Sanitary Tests	
		Standard type Personal computer system	1	Standard type Personal computer system	1

Notes: ° To be relocated to the new site by IHS ( ) Superannuated (*) Out of order

(6) Information Dissemination Division

Information dissemination activities play a critical role in the improvement of human settlements conditions. The results of research and development by IHS will have no real effect if they are not disseminated to government officials and local residents. Previously the main medium for information dissemination has been printed matter, but more extensive use of audio-visual aids is needed to improve the effects of the dissemination.

Printed materials include unit price information of building materials for each region published about once every one to three months, and introductory and guidance pamphlets on construction methods for various building materials published about once every one to two months, but the current printing equipment is old and there are limitations on paper size and printing colors. Previously the only use of audio-visual materials has been overdubbed videos from Japan and other countries, but the develop-

ment of Indonesia's own technology has made it necessary to independently produce instructional video materials.

1. Audio-visual Equipment

For video production

IHS currently has some television sets and video equipment, but many of them are based on the NTSC system which does not work with the Indonesian national television system. Therefore, these kinds of equipment are not inter-changeable with those other organizations have. The following systems are necessary for the production of video materials and have been deemed appropriate.

a) Studio system (camera set)

b) Video control system

c) Telop system

d) Editing equipment

e) Audio control equipment

f) Lighting system

Three cameras are necessary in a system to produce high quality teaching materials. For example, for an interview program one camera would be used for the overall scene, with two cameras for stand-by images (the interviewer and guest), so that images can be easily selected and switched. However, although three cameras were requested, IHS currently has one camera which can be incorporated into the system, so only two new cameras will be provided.

Seminar and exhibition equipment

All of the IHS's current equipment is broken, except for one overhead projector. Overhead and slide projectors have been deemed necessary to enable seminar activities.

Information must also be disseminated to local residents, so the request for a video projector to enable viewing by many people was deemed appropriate.

This video projector will be the movable type so that it can be used within IHS as well.

Portable VTRs and audio systems are necessary to gather field data. The request asks for two video cameras, but two of the cameras for the studio system can be used for this purpose, so video cameras specifically for fieldwork have been deemed unnecessary.

A van is also necessary to carry this equipment for shooting and for information dissemination activities (incl. demonstration tests). The new site is located about 16 km away from the city center of Bandung, so a bus is needed to transport participants in seminars.

Table 3.7 Comparison of Existing, Requested and Planned Major Audio-Visual Equipment

Existing Equipment	Q'ty	Requested Equipment	Q'ty	Planned Equipment	Q'ty
· Video Production System		· Video Production System		· Video Production System	
Video camera (U-Matic)	°1	Studio system (camera)	3	Studio system (camera)	2
Video camera (NTSC)	°L.S.	Video control equipment	L.S.	Video control equipment	L.S.
Video camera (PAL)	°L.S.	Telop system	L.S.	Telop system	L.S.
VTR (U-Matic)	°2	Editing system	L.S.	Editing system	L.S.
VTR (NTSC)	°L.S.	Audio control system	L.S.	Audio control system	L.S.
VTR (PAL)	°L.S.	Lighting	L.S.	Lighting	L.S.
· Seminar & Exhibition Equipment		· Seminar & Exhibition Equipment		· Seminar & Exhibition Equipment	
Overhead projector	°1	Overhead projector	3	Overhead projector	3
Slide projector	(*3)	Slide projector	5	Slide projector	5
Film projector	(*1)	Screen for slide projector	1	Screen for slide projector	1
		Video projector	1	Video projector	1
		Screen for video projector	1	Screen for video projector	1
		Screen for OHP	1	Screen for OHP	1
		Echtachrome slide duplicating	L.S.	Echtachrome slide duplicating	L.S.
		Portable VTR system for outdoor (incl. 2 cameras)	L.S.	Portable VTR system for outdoor (not incl. 2 cameras)	L.S.
		Audio system for outdoor	L.S.	Audio system for outdoor	L.S.
		Standard van	1	Standard van	1
		Bus	1	Bus	1

Notes: ° To be relocated (*) Out of order

2. Printing Equipment

Most kinds of the printing equipment IHS currently has are superannuated or out of order as shown in Table 3.8. Therefore the requested equipment has been deemed appropriate, except for the micrographic printer and processor which are deemed unnecessary for the time being judging from the activities of IHS.

Table 3.8 Comparison of Existing, Requested and Planned Major Printing Equipment

Existing Equipment	Q'ty	Required Equipment	Q'ty	Planned Equipment	Q'ty
Typewriter	°1	Word processor	1	Word processor	1
Typewriter	(*2)	Computer printer	1	Computer printer	1
Typewriter	(1)				
Reprographic Camera	(*1)	Reprographic Camera	1	Reprographic Camera	1
Plate Maker	(2)	Plate Maker	1	Plate Maker	1
Offset Printing Machine	°1	Offset Printing Machine for Double Folio	1	Offset Printing Machine for Double Folio	1
Offset Printing Machine	(*2)	Text Making Machine	1	Text Making Machine	1
Offset Printing Machine	(1)	Automatic Slides Drawer	1	Slides Drawer	1
		Binding Machine	1	Binding Machine	1
Burnt Paper machine	(1)				
Mimeograph	(*2)				
Scanning Machine	°1	Micrographics Reader	1	Micrographics Reader	1
		Micrographics Printer & Processor	1		
Photo Copy Machine	(*1)	Photo Copying Machine	1	Photo Copying Machine	1
Cutting Machine	(1)	Cutting Machine	1	Cutting Machine	1
Cutting Machine (Manual)	(*1)				
Paper Folding Machine	(*1)				
Layout Table	(1)	Drafting Table for Layout and mounting	1	Drafting Table for Layout and mounting	1
Sorter Machine	°1				

Notes: ° To be relocated ( ) Superannuated (*) Out of order

(7) Workshop Equipment

Workshop equipment is necessary for fabricating test pieces and supporting testing and experimental activities such as fabrication of test pieces. However, almost all the current equipment was purchased around the 1960s, and much of it is old and lacking functionality. Therefore the requested equipment has been deemed appropriate except for the following already owned machines which are still usable.

Bench drill press for metal:

The existing equipment is usable by relocating it.

Welding machine, diesel, kerosine:

The existing equipment is usable by relocating it.

Air compressor, compact unit:

The existing equipment is usable by relocating it.

Band saw, compact unit:

The existing equipment is usable by relocating it.

Mountable drill for wood:

The existing equipment is usable by relocating it.

Sharpening grinder:

A grinder can be used for this purpose.

Circular saw:

The existing band saw can be used for this purpose.

Groover, compact unit:

A universal profiling machine can be used for this purpose.

Table 3.9 Comparison of Existing, Requested and Planned Major Equipment for Workshop

Existing Equipment	Q'ty	Requested Equipment	Q'ty	Planned Equipment	Q'ty
· General Metal Workshop Equipment		· General Metal Workshop Equipment		· General Metal Workshop Equipment	
Lathe machine	(*2)	Sawing center lathe machine	1	Lathe machine	1
Shaping machine	(*1)	Shaping machine	1	Shaping machine	1
Milling machine	(*1)	Horizontal milling machine	1	Milling machine	1
					1
Drilling machine	°1	Bench drill press	1		
		Universal saw	1	Panel saw	1
Arc welding machine	°1	Welding machine, diesel/kerosine			
Air compressor	°1	Air compressor, compact unit			
Lever shear	°(1)	Hand shear, compact unit	1	Lever shear	1
		Spot welding machine, compact and integrated unit	1	Spot welding machine	1
Pipe bending machine	°1				
Grinder	(*1)	Disc grinder	1	Disc grinder	1
Cutting saw	°1				
· General Wood Workshop Equipment		· General Wood Workshop Equipment		· General Wood Workshop Equipment	
Surface planer	(*1)	Automatic planer, compact unit	1	Surface planer	1
Surface planer	°(1)				
Band saw	°(1)	Band saw, compact unit	1		
		Handy drill	1	Handy drill	1
Bench drill press	°1	Mountable drill	1		
Grinder	(*1)	Bench grinder	1	Grinder	1
Grinder	°(1)				
		Sharpening grinder	1		
		Belt sander	1	Belt sander	1
		Circular saw	1		
		Jig saw	1	Universal scroll saw	1
		Groover, compact unit	1		
			1		
Universal profiling machine	(*1)	Universal profiling machine		Universal profiling machine	1
Jointer machine	(*1)				
Jointer machine	°(1)				
Face cut machine	(*1)				
Face cut machine	°(1)				
Tool grinder	°1				

Notes: ° To be relocated ( ) Superannuated (*) Out of order

3.3 Outline of the Project

3.3.1 Implementing Organization and Operation Plan

(1) Implementing Organization for this Project

IHS, which belongs to the Agency for Research and Development of the Ministry of Public Works and is Indonesia's sole public research organization concerned with human settlements, will be the organization to implement this Project. The staff of IHS has already worked to plan and promote this Project in Indonesia, and hence it is judged that they are familiar with the Project's purpose and significance.

In IHS, staffing will be increased for the research and development division, testing and inspection division and information dissemination division, but the Institute's basic organization shall remain the same.

(2) Operation Plan

The budget of IHS is composed of a routine budget, project budget, foreign aid and outside contract research fees.

The routine budget covers staff salary, facility costs, equipment renewal costs and administrative costs, and comes from the Agency for Research and Development. The project budget covers research and development costs, testing and inspection costs, experimental production costs, and information dissemination costs, and comes from both the Agency for Research and Development and the Directorate General of Human Settlements. Most of the foreign aid comes from Japan, the Netherlands and UNIDO. Outside contract research fees are mainly gathered from related organizations like PERUMNAS and private construction firms for experimentation and testing commissioned. The future plan is to increase this contract research so that IHS can afford equipment maintenance and renovation, and this is highly possible if building material fire-proofing and other quality certification systems can be established through legislation.

The budget of IHS grew satisfactorily during the Fourth Five Year National Development Plan (1984/1985 - 1988/1989), but in the year 1987/88, the Indonesian budget as a whole shrunk due to the drop in international crude oil prices, and the budget for IHS accordingly

decreased. However, from 1987/88 to 1992/93 both the routine and project budgets are expected to be doubled or more.

The following table shows the actual and projected budgets for IHS from 1986/87 to 1992/93 (Table 3.10).

Table 3.10 IHS Budget (1986/87 to 1992/93)

(Unit: 1,000 Rupiahs)

Year	Routine Budget	Project Budget	Foreign Aid	Contract Research
1986/87	581,753	927,660	192,650	215,000
1987/88	558,950	595,925	199,650	290,000
1988/89	703,597	907,991	30,002,000	300,000
1989/90	920,000	995,000	211,650	292,000
1990/91	1,015,500	1,104,810	143,224	292,000
1991/92	1,083,620	1,118,337	50,000	315,000
1992/93	1,168,000	1,232,204	50,000	425,000

(Source: IHS)

(3) Budgetary Measures on the Indonesian Side

Indonesia has made substantial budgetary provisions for the construction to be shouldered by Indonesia in this Project. For the years 1987/88 and 1988/89 a total of Rp.210 million was budgeted, and construction of access roads has been implemented. However, as a result of discussions between the Team and the Indonesian counterparts during the basic design study, the work to be done by Indonesia was made clear as to its scope and specifications. Budget figures of Rp.366,280,000 for this year, and Rp.747,320,000 for the coming year were proposed and confirmed accordingly. Reliable assurances were obtained from Public Works Minister Ir. Radinal Moochtar and National Development Planning Board Secretary Ir. M. Soebekti Indrohadikoesoemo that the current year's construction will be completed and the necessary funds will be budgeted for the coming year.

3.3.2 Activity Plan

(1) Research and Development

Areas for research and development at IHS cover a diverse range of technologies which must be mastered in order to improve human settlement conditions. Research and development is therefore divided into the following three divisions.

1) Housing environment and sanitary engineering division
2) Building material division
3) Construction and structure division

An outline of the research plan of each division is as follows.

1) Housing Environment and Sanitary Engineering Division

This division focuses on two areas: city and housing planning, and sanitary engineering.

a. In the city and housing planning field, research is directed towards promoting healthy, organic and efficient utilization of cities. Current research includes investigation of the basic situation regarding housing conditions in cities and villages; research on development of infrastructure; research on supply planning of housing and housing lots for the low-income bracket; research on natural disasters and their prevention in communities; and research on urban settlement policy which covers all these issues more generally.

b. In the sanitary engineering area, research aims to conquer the unsanitary conditions which arise due to the incompleteness of water supply and public sewage systems -- a common problem in cities of developing countries. Current research includes research relating to simplified purification technology, water quality testing technology, and water quality improvement technology; research relating to the quality and performance of plumbing equipment such as valves, piping and flow gauges; research on treatment systems for sewage and domestic waste; research on development of efficient septic tanks; and

research on analysis of and remedies for foul odors and gas leaks in urban housing districts.

2) Building Material Division

This division watches the production and supply situation for building materials, an area where Indonesia is rather far behind the developed countries. The division works to make Indonesian technology independent, and to establish effective and appropriate utilization techniques. Another important issue is research and development aimed at developing independent low-cost building materials suited to the country's resources and development. The following are actual research subjects.

a. To promote use of concrete- and cement-based building materials, the following researches are essential.

Research on the supply and development of aggregates, which are short in supply

Research on concrete mixing and quality control techniques

Research on cement-based building materials such as concrete blocks, slate tiles and PC panels

b. To promote use of wood and other organic building materials, the following researches are essential.

Research on processing, strength and anti-deterioration treatment techniques of wood and bamboo

Research on effective utilization of plywood, bamboo mats, particle boards and cemented excelsior boards, and other similar kinds of boards

c. Research on utilization of asbestos slates, gypsum board, pulp-cement boards and galvanized sheet metal

Research on utilization of ceramic materials such as clay tiles and bricks

Research on utilization of adhesives, paints and sealants

Research on utilization of modern materials such as glass, iron, aluminum and plastic

d. Research on converting industrial and agricultural waste products into building materials

Research on utilization and development of unused resources and new materials like laterite soil

e. Research on testing and inspection techniques for finding out quality and performance of these building materials

f. Research on standardization of the dimensions, shape, quality and performance of these building materials

g. Research on the overall utilization of materials which takes into consideration factors like construction, safety, habitability, economy, etc.

3) Construction and Structure Division

This division will do research on structural engineering and construction techniques relating to housing and buildings.

a. Structural System Planning

Research on various structural systems such as masonry building, combined masonry building, reinforced concrete building, steel encased in reinforced concrete building, wood building and steel structure building

Research on details of foundations, roofs, walls, and openings.

b. Structural Safety

Research will be conducted on structural safety (against dead load, wind, earthquake and ground settlement) of each of the forms of building indicated above to establish appropriate structural design methods. To achieve this, numerous fundamental experiments must be conducted relating to prediction of external forces, prediction of strength of materials and members, and prediction of durability and strength of walls, columns and beams.

c. Fire Prevention

This includes research on building fire prevention design, whose purpose is to establish use of non-combustible and semi-combustible interior materials for buildings to prevent expansion of fire; and research on fire countermeasures in design,

i.e. factors relating to evacuation from fire and structural safety.

Essential to this research are persistent experiments such as fire resistance tests for individual materials and columns, beams and walls.

d. Building Interior Environment

Research to be conducted includes research on sound shielding and absorption; research on ventilation; research on insulation and energy conservation; and research on lighting and illumination. The aim is to improve interior environments.

e. Construction Technology

Research to be conducted includes research on the rationalization of masonry, wood and reinforced concrete building and other forms of construction; research on quality inspection and construction management; research on labor productivity; research on construction machinery; research concerning on-site material production technology; research on construction method standardization; research on industrial production of housing; and research on construction methods appropriate for local sites and services.

(2) Testing and Technical Guidance Division

In the current relocation and expansion plan for IHS, the Testing and Technical Guidance Division is of key importance, and has been placed at the center of strengthening program.

1) This division has the following three roles:

a. Implementing tests at the request of the research and development division

b. Implementing tests and inspections at the request of DPU, related public organizations and private enterprises, and providing impartial test and inspection data

c. Providing guidance for Testing Division, KANWIL PU, and guiding and disseminating information on simple test methods for use at construction sites.

Also included in the above duties are preparation of test samples for testing and inspection, and preparation of jigs for testing.

2) The following are the reasons why the current expansion will focus on the Testing and Technical Guidance Division, although the Research and Development Division remains as the center of IHS activities.

a. The Institute has been organized according to Western management principles, and there is a clear-cut division between researchers and technicians who implement tests. Hence the goal in focusing on the Testing and Technical Guidance Division is to reduce the heavy burden placed on researchers, and raise the responsibility and capability of technicians.

b. In order to increase the relative weight of contractural testing services of materials, structure, fire-resistance and sanitary engineering which are consigned by those in field operations (DPU, Directorate General of Human Settlements, private enterprises) who directly contribute to improving the housing environment in Indonesia, the work of the Testing and Technical Guidance Division needs to be reorganized closer to the Japanese system, so that the Division is like the Japanese Building Material Testing Center in Sohka which differs in organization from the Japanese Construction Ministry's Building Research Institute in Tsukuba.

c. It is expected that much of the fund for research and development of IHS as a whole can be raised through fees for contractural testing, which will increase with the expansion of the Testing and Technical Guidance Division.

(3) Information Dissemination Division

1) The Importance of Information Dissemination in Improving Housing Environment Situation

The roles and capabilities of the people who are concerned with the facilities and the services which support housing and its environment are quite diverse.

To raise standards of living by improving housing environment, it is extremely important that the location, characteristics of the problem, aim and nature of improvement methods, necessary technical knowledge and skills, etc. be disseminated as widely as possible to all parties involved at all levels.

Judging from the fact that the problem is too large or spread out to be solved by the government, it is critical that information be disseminated to all involved parties, including the local people themselves.

This dissemination mechanism of information network can also function effectively as a means of understanding and analyzing immediate needs of improvement which arises from the people's housing conditions.

2) The Significance of the Expansion of Information Dissemination Activity at IHS

IHS is the sole research organization concerned with human settlements for the entire Indonesian society as well as the one for the central government, and the current expansion of IHS has been planned with this wider role in mind.

Therefore it is necessary to create an organization which can bring together the results of a diverse range of research. That is, IHS must be one of the central nodes for information relating to research, and should act as the key nucleus in this field.

IHS already has a long history as one of the United Nations Regional Center for Research on Human Settlements (UNRCRHS),

and has implemented the Training Course for Developing Coutries. So the IHS is placed well to grow as a key center of activity.

IHS has domestically performed many information dissemination activities, either in cooperation with related organizations or alone, including: gathering literature, collating statistics, printing and distributing standards, laws and technical information documents, preparing audio-visual materials like films, videos and slides, and implementing training courses. The work of IHS in this area has been widely respected, so the Institute is positioned not only as a research organization, but also as a base for information dissemination.

3) Strengthening Improvement Plan

The current plan for IHS is to strengthen the Institute as one link in the overall information system of the DPU, and as a central nucleus of an information dissemination system relating to human settlement improvement.

The following Fig. 3.1 shows a schematic diagram of the system.

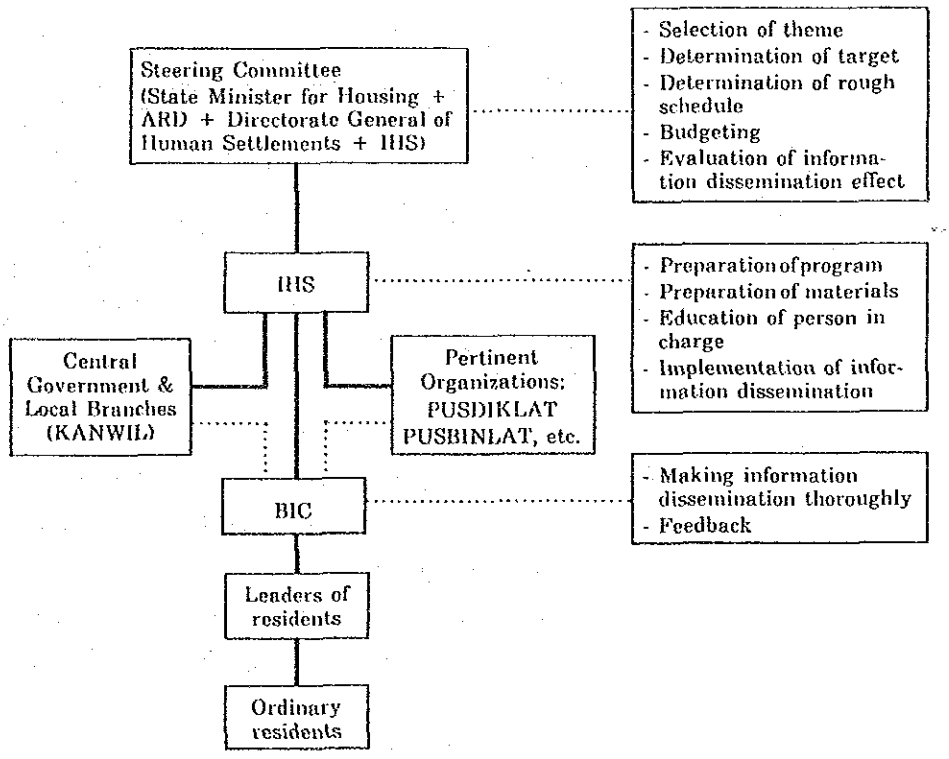


Fig. 3.1 Information Dissemination System

Based on the policy guidance of the steering committee composed of the Directorate General of Human Settlements and the Agency for Research and Development, the IHS forms programs relating to information exchange, prepares materials hold seminars, and disseminates information. These activities are carried out directly or in cooperation with the Building Information Centers and the Testing Divisions, KANWIL PU in each local area.

The ultimate target of information dissemination is the ordinary people. But the system should not simply be an information dissemination mechanism. Rather it should be an information exchange network which conveys local problems and the requests and desires of the people, and reflects these factors in policy and action.

The targeted recipients of information in this network are divided into the following four groups.

a. Government employees (National and Local)

b. Specialists and practitioners in construction industry

c. Local extension workers

d. Local people

PUSDIKLAT is an education and training center for civil servants involved in public works, and PUSBINLAT is an education and training center for private citizens engaged in construction industry. Both centers are operated according to their own programs.

The current problem with both centers is lack of teaching materials, teachers and budget for education and training. Both centers now host about 150 seminars annually. So far IHS has supplied teaching materials and lecturers to these centers, but for the future IHS is expected to furnish qualitatively and quantitatively better teaching materials and to dispatch more lecturers actively.

A key role of KANWIL PU is coordinations on public construction works in rural areas between central and local governments and construction management therefor. The Testing Division at KANWIL PU has mainly performed testing and inspection for public construction, but they have also done some testing and inspection on contract from the private sector. In recent years, emphasis in construction has been placed on material testing and inspection in order to qualitatively improve buildings and ensure safety. The local test divisions have been playing a large role in this effort, and testing and inspection technology must be improved. IHS has heretofore given technical guidance to these local testing divisions, and these activities should be pursued more actively.

BIC stands between the central or local government and citizens and disseminates information on building technology in the human settlement field, holds seminars for local extension workers and distributes technical information. To make BIC more active and effective, appropriate teaching materials, in particular AV materials, are needed. For IHS to support these BIC activities, it must have better capacity to produce AV-media materials. BIC has been distributing price information for local building materials six to ten times a year, which has been prepared through a process where BIC collects data and IHS arranges and analyzes it.

It is important to grasp the needs of the general populace through the various regional activities of BIC, and reflect these needs in the research and development goals of IHS. The specific tasks of the IHS information dissemination division are as follows:

a. Data processing section - In cooperation with BIC, this section shall work to refine the content of the two issues of "Building material price information papers", and shall issue these papers once per month rather than irregularly as at present.

b. Publication, production and library section - This section plans to increase publications by more than double to issue 100 kinds and 200,000 volumes in total, including: pamphlets, periodical journals, standards, materials, etc. The section also plans to double its current yearly output of both videos and slide-audio presentations to 24 productions annually.

c. Standards and guidance section - This section prepares manuals, guidelines and standards such as SKBI. As more legislation is enacted relating to building, the quantity of these materials should increase.

d. Training and dissemination section - In addition to the aforementioned seminars conducted by PUSDIKLAT and PUSBINLAT, there are also training and seminars conducted by IHS. At present 30 courses are held per year, but the plan is to hold about 20 training courses per year, each lasting one to four weeks with seating capacity of 25 to 30 people, and 22 seminars per year, each lasting one to seven days with seating capacity of 50 to 80 people.

3.3.3 Planned Site Location and Situation

(1) General

The site prepared for this Project by DPU is in Cileunyi, about 16 km east of central Bandung City. Selection of the site was based on the following two points. First was the desire to keep the facility close to the other institutes in the Agency for Research and Development -- the Institute of Hydraulic Engineering and the Institute of Road Engineering -- and second was the desire to ease travel to Jakarta. It was also desirable to avoid the congestion of the city's centeral area and locate in a Bandung suburb. So based on the above consideration, a location near the toll road interchange under construction on the east side of Bandung was selected as the site for this Project.

According to the Greater Bandung Municipality Plan as shown in Fig. 3.2, there is a plan to make the area around the Cileunyi district an academic and research park. Besides the relocation plans of university facilities like the Padjadjaran University (partly relocated), the ITB (in the planning stage of relocation), and the proposed technical college, there are also plans for PERUMNAS housing, teachers residences, student dormitories, shopping centers and various research institutions, both newly constructed and relocated.

The formal address of the site is KAMPUNG PANYAWUNGAN, BLOK JERUK MIPIS, DESA CILEUNYI WETAN, KECAMATAN UJUNG BERUNG, KABUPATEN BANDUNG, PROPINSI JAWA BARAT.

The site is located in a paddy field area about 800 m south of the intersection of the highway (the Bandung loop which runs along the periphery of Bandung) and a toll road which is currently under construction.

The site is about 1.3 km from the Cileunyi bus terminal and about 1.0 km from the proposed Cileunyi railroad station.

The access road from the Bandung loop to the site is currently being paved for use as a construction road by IHS. By the time construction is completed for the new IHS facilities, IHS will have widened the road (from 4.0 to 6.0 m) and improved road side ditches.

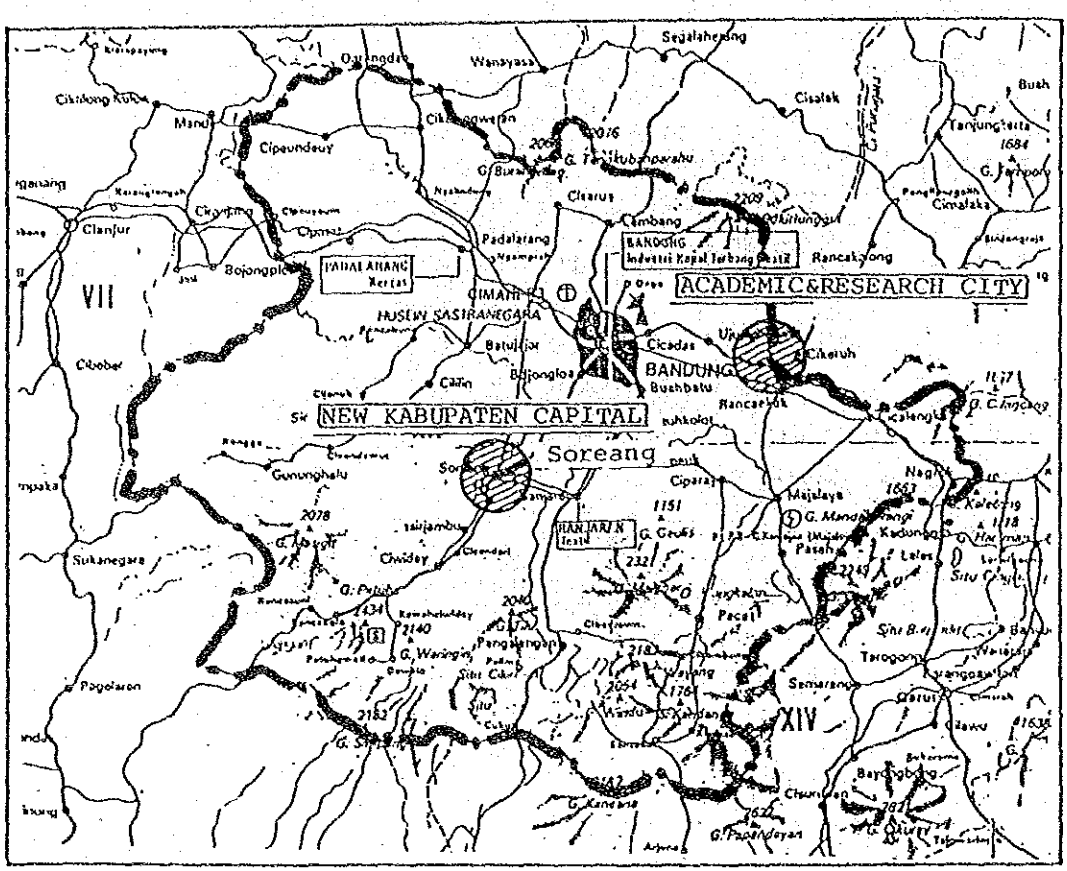


Fig. 3.2 Greater Bandung Municipality Plan

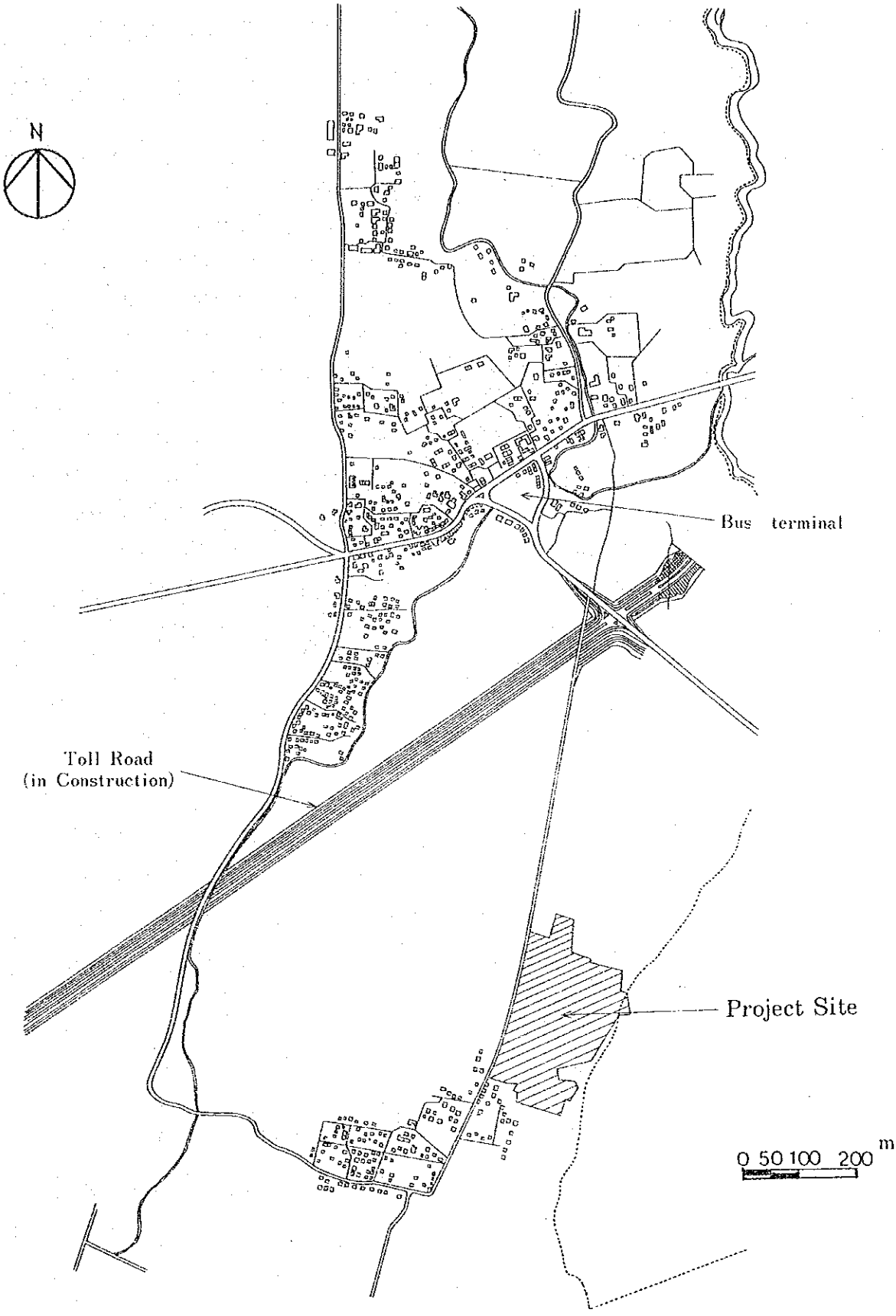


Fig. 3.3 Site Location

(2) Site Conditions

The site extends about 380 m in the north-south direction and about 270 m in the east-west direction, and is of an irregular shape covering a total area of 93,610 m^2. The access road on the west side of the site has an average grade from north to south of about 1.5 %. The site is about 30-60 cm lower than the road and is inclined parallel with the road. By the time DPU purchased the property, the site had been a paddy field, and footpaths and stumps still remain. There is an irrigation ditch on the east side of the site, and this connects to a small river (about 3.0 m in width) at a point about 800 m south of the site. A drainage ditch runs across the middle of the site, dividing it into east and west halves. Since waste from the upstream leather factory is discharged into this ditch, the waste water being drained by this ditch has a dark color and foul odors. For the purpose of resolving this problem and securing effective utilization of the site, it has been decided that the Indonesian side will change the flow path of the ditch on the north side of the site. As mentioned above, the site could easily be flooded, and so it must be raised above the level of the road. To do this, top soil (including rice stumps and weed roots) must be removed, and the land must be reclaimed by about 30 cm over the road surface by placing pit soil.

Due to the previous use of the site as a paddy field, the upper part of the ground is soft clay. IHS has already done a boring test of the site, which showed the following sub-soil conditions.

From 0 to -6 m, there is a silty clay layer with poor water permeability. The layer is quite soft and has N values of 0 to 5 with high compressibility.

From -6 to -18 m, there is a silty sand layer with gravel mixture. The average N value is 5 to 10, and at -18 m there is hard ground of which N value exceeds 80.

Normally the water level is about -6.0 m, but during rainy conditions it will rise to -4 m or higher.

(3) Conditions of Infrastructure

Electric power can be drawn from a 20 kV high-tension line which were already laid above the highway. At present, a high voltage service wire has not been laid above the access road, but PLN has agreed in discussions to extend the wire to the site to meet the project construction schedule.

Water will be supplied by a 30 m well currently being prepared, and a 100 m deep well, to be bored on the site.

Storm water can run off into the irrigation ditch on the east side of the site, and into the road-side ditch on the west side of the site. However, both of these are simple open ditches and must be improved with concrete or stone. IHS has agreed to do this improvement in the years 1988/89 and 1989/90.

Soak-away is the usual method of sewage disposal in Indonesia, but the ground at the site is silty and hence underground permeation will not work Therefore sewage will be run off into those drainage ditches after treatment. Waste water from laboratories cannot be directly disposed of, so it will be neutralized before discharge.

For the telephone system, two lines can be laid from the nearby telephone station about 3 km apart from the site. Construction of a new telephone station is scheduled for 1988/89, and after this station opens, there will be a sufficient surplus of lines.

Since city gas lines have not been laid near the site, the Project will use LPG cylinders.

3.3.4 Outline of Facilities and Equipment

(1) Planned Facilities

Planned facilities are as follows.

1) Main Building (incl. Seminar, Exhibition, Dormitory and Canteen facilities)

2) Laboratories
   - Building Material Laboratory

- Structure/Earthquake Laboratory
- Sanitary Engineering Laboratory
- Fire Testing Laboratory
- Workshop

3) Utility Building, Guardhouse, etc.

Total Floor Area: 11,521 m^2

(2) Planned Equipment

Such equipment as is in compliance with the scope and grades of activities set forth in Sec. 3.3.2 "Activity Plan" will be provided. The equipment is outlined as follows.

1) Housing Environment Laboratory (Main Building)

a. Equipment for Statistical Analysis

b. Equipment for Survey Data Collection

c. Equipment for Analyzing Aerial Photographs

d. Equipment for Map Analysis

2) Building Material Laboratory

a. General Physical Testing Apparatus

b. General Chemical Testing Apparatus

c. Cement Testing Apparatus

d. Fresh Concrete Testing Apparatus

e. Hardened Concrete Testing Apparatus

f. Testing Apparatus for Cement-based Materials

g. Testing Apparatus for Wood & Wood-based Materials

h. Testing Apparatus for Plastics and Coating Materials

i. Durability Testing Apparatus

j. Aggregate Testing Apparatus

k. Metal Testing Apparatus

3) Structure/Earthquake Laboratory

a. Seismic Loading System

b. Permanent Loading System

c. Data Acquisition System for Structural Tests

d. Static Soil Testing System

e. Equipment for Testing on Building Physics

4) Sanitary Engineering Laboratory

a. General Testing Apparatus for Water Quality

b. General Testing Apparatus for Liquid and Solid Waste

c. General Microbiological Testing Apparatus

d. Chemical Test Equipment

e. Physical Test Equipment

f. Portable Test Kits

5) Fire Testing Laboratory

a. Fire Prevention Testing Apparatus

b. Fire Resistance Testing Apparatus

6) Workshop

a. General Metal Workshop Equipment

b. General Wood Workshop Equipment

7) Information Dissemination (Main Building)

a. Audio Visual Equipment (Incl. production)

b. Printing Equipment

c. Automobiles (For dissemination of information, and transportation of seminar participants)

3.3.5 Manpower Plan

IHS is organized into four divisions, each under the direction of the Director. The current Project plans for 392 employees at the Bandung headquarters and 60 employees at six experimental sub-stations, for a total of 452 employees by 1993/94 as shown in Table 3.11.

In the seven year interval from 1980/81 to 1987/88, the staff of IHS increased by about 35 %, and, as a result, in September 1987 there were 272 employees (excluding 6 sub-stations). By 1993/94 (5 years later) the staff is expected to be 392 people with increase by about 45 %, or by 120 people .

These increments can be broken down by group as follows: About 60 % in the research and development divisions (85 people to 136 people), about 90 % in the experimental stations (44 people to 85 people) and about 58 % in the information dissemination division (38 people to 60 people). This agrees with the scope of the IHS expansion intended by the Indonesian Government. Part of the staff will come from the transfer of people with appropriate skills from DPU. In fields which require special talents, for instance scenario writing in the information dissemination area, outside specialists will be bought in on a temporary basis.

Table 3.11 Staffing of IHS

	Key Personnel	Assistants and Staff	Subtotal	Other Personnel	Total
Director	1 (1)				
Secretaries		2 (2)			
Subtotal	1 (1)	2 (2)	3 (3)		3 (3)
Div. of Administration and Operation					
Head	1 (1)				
Chief, Sub-div.	4 (4)				
Staff	4 (2)				
Junior Staff		12 (10)			
Clerk, etc.		40 (38)		47 (47)	
Subtotal	9 (7)	52 (48)	61 (55)		108 (102)
Div. of Building Material					
Head	1 (1)				
Researcher	10 (6)				
Junior Researcher		14 (11)			
Technicians		15 (10)			
Subtotal	11 (7)	29 (21)	40 (28)		40 (28)
Div. of Construction and Structure					
Head	1 (1)				
Researcher	13 (9)				
Junior Researcher		20 (7)			
Technicians		16 (13)			
Subtotal	14 (10)	36 (20)	50 (30)		50 (30)
Div. of Housing Environment & Sanitary Eng.					
Head	1 (1)				
Researcher	14 (10)				
Junior Researcher		20 (11)			
Technicians		11 (5)			
Subtotal	15 (11)	31 (16)	46 (27)		46 (27)
Experimental St. for Housing & Building					
Head	1 (1)				
Chief, Sub-div.	2 (2)				
Engineer	8 (3)				
Junior Engineer		13 (4)			
Technicians		20 (16)			
Subtotal	11 (6)	33 (20)	44 (26)		44 (26)
Experimental St. for Sanitary Engineering					
Head	1 (1)				
Chief, Sub-div.	2 (2)				
Engineer	8 (3)				
Junior Engineer		12 (4)			
Technicians		18 (8)			
Subtotal	11 (6)	30 (12)	41 (18)		41 (18)
Div. of Documentation and Dissemination					
Head	1 (1)				
Chief, Sub-div.	4 (4)				
Senior Staff	10 (5)				
Junior Staff		20 (7)			
Technicians		25 (21)			
Subtotal	15 (10)	45 (28)	60 (38)		60 (38)
Total for Bandung	87 (58)	258 (167)	345 (225)	47 (47)	392 (272)
Total for Experimental Sub-Stations	12 (10)	24 (20)	36 (30)	24 (20)	60 (50)
Grand Total	99 (68)	282 (187)	381 (255)	71 (67)	452 (322)

Note: Parenthesized values show the number of staff members as of September, 1987.

3.4. Technical Cooperation

3.4.1 Relationship of this Project and Technical Cooperation

Japan's technical cooperation aimed at Indonesia in the human settlement field has extended over more than ten years, and has covered a considerably wide range. The fact that a number of excellent researchers have been cultivated within IHS through this technical cooperation is one of the background histories of this Project. Japan's technical cooperation in this field started in 1974 when JICA dispatched a long-term expert to Indonesia and about 20 experts were dispatched so far on a long-term basis. Since then JICA has received Indonesian counterparts for training one to three persons annually. In addition to these programs, joint-research projects, third country training programs, development studies for various projects, etc. have been recently conducted by JICA. Besides the JICA's cooperation schemes, the Ministry of Construction conducted a series of Overseas Development Projects (for Housing and Construction, Fire Prevention and Building Materials) in these nine years. The following shows outline of Japan's technical cooperation in this field.

<Materials Development>

Development of Building Materials by Effective Use of Locally Available Raw-Materials — 1978 - 1983

Project-type Technical Cooperation by JICA

Purpose: Construction and operation of experimental plants for PCB (pulp cement boards) and ALA (artificial lightweight aggregate).

Overseas Development Project on Building Materials by the Ministry of Construction — 1985 - 1987

Purpose: Preparation of guidelines for building materials development

<Structure>

Overseas Development Project on Housing and Construction by the Ministry of Construction — 1979 - 1981

Purpose: Preparation of guidelines to establish a seismic code and supply of a tilting table

Dispatch of Experts by JICA — 1981 - 1986

Purpose: Technical guidance for earthquake technology and seismic design (Building Research Institute)

Third Country Training Program by JICA* — 1982 - 1987 (extended to 1991)

Dispatch of experts (Building Research Institute) and supply of equipment

Purpose: Seminar and training for earthquake technology

<Fire Prevention>

Overseas Development Project on Fire Prevention Construction Technique by the Ministry of Construction — 1982 - 1984

Purpose: Preparation of guidelines to establish fire prevention standards and supply of a furnace for surface tests.

Dispatch of Experts by JICA (Building Research Institute) — 1986

Purpose: Technical guidance for preparation of fire prevention standards

<Housing Policy>

Fundamental Investigation for Housing Strategy for Urban Low Income Groups (Joint Research Project by JICA) — 1984 - 1987

Purpose: Joint research on the subject by IHS and Building Research Institue

Dispatch of Experts by JICA* (Housing Bureau of MOC of Japan) — 1987 - 1988

Purpose: Technical advice for urban housing strategy

Third Country Training Program by JICA* — 1987 - 1991

Dispatch of experts (Building Research Institute) and supply of equipment

Purpose: Seminar and training for housing strategy

<Other Themes>

Dispatch of Experts by JICA* — 1974 - to date

Purpose: Guidance and advice for a 5-year plan and information dissemination activities (Housing Bureau of MOC of Japan)

Dispatch of Experts by JICA* — 1974 - to date

Purpose: Guidance and advice for public housing and urban renewal (Housing and Urban Development Corporation)

Development Studies by JICA

- Study on Urban Renewal Housing Project in Jakarta	1982 - 1983
- Study on Low-Cost Housing at Cengkareng	1978 - 1980

* indicates the on-going technical cooperation programs.

3.4.2 Request for Technical Cooperation

The Indonesian Government made a request to the Japanese Government to dispatch experts in relation to this Project as follows.

a. One short-term expert in the field of general management on the research and development.

b. One long-term expert in the field of communication and information network.

c. One long-term expert in the field of testing.

The Indonesian Government aims at the improvement of the human settlements, and expects the strengthening of IHS' function. The requested short-term expert in the field of general management is deemed reasonable for formulating research and development strategy for this target. The development of information dissemination division is most essential for making the activities of IHS effective in the actual life of Indonesian people, and hence proper facility, equipment and staff should be provided. The topics under investigation in the area of testing and technical guidance include obtaining operating technology for new equipment and developing a legislation system. Taking these into consideration, it is deemed essential to enhance the technical coorporation in dispatching the long-term expert in the field of communication and information network and the one for testing.

CHAPTER 4 BASIC DESIGN

CHAPTER 4 BASIC DESIGN

4.1 Design Principles

IHS is an organization which aims to improve human settlement conditions in Indonesia through research and development, testing and technical guidance, and information dissemination. To keep the purpose of this facility specific, the basic design will be prepared based on the following principles.

(1) To design the facilities as laboratories by stressing the "human scale".

(2) To structure the building for easy adaptation to future changes in function. Also, to make the overall plan flexible to allow for future growth of the IHS.

(3) To make the building with local identity by taking into consideration the weather and climate of the locale, and to exercise due care so as to minimize maintenance costs.

(4) To consider local custom, and make the facility easy to use.

(5) To make the facility suit the local landscape, and work well as a core facility of the academic and researach park projected in the Greater Bandung Municipality plan.

(6) To consider local construction techniques.

(7) To use as a rule locally available materials. However, this principle should be reviewed with due consideration for their future durability, availability, etc.

(8) To conform as a rule to Indonesian laws and standards, and, when necessary, to refer to Japanese relevant regulations and standards for buildings and building services.

(9) In selecting machinery and equipment, to make sure the equipment is easy to operate and does not malfunction in short pepriod, to make sure the equipment does not entail high upkeep costs, to consider whether the equipment can easily be maintained in Indonesia, and to make sure that spare parts can be obtained in Indonesia wthout difficulties.

4.2 Review of Design Conditions

4.2.1 Natural Conditions

Bandung is a city in the highlands with an altitude of about 680 m, and is surrounded by mountains which exceed 2,000 m in height. So even though the city is located near the equator at a Southern latitude of 6°4', it has a comparatively mild climate, with the highest temperature being 29.7°C, the lowest 15.7° and the mean 22.8° throughout a year. The dry season runs from May to October, and the rainy season from November to April, but there is no great difference between the seasons in amount of rainfall; there is a considerable amount of rain even in the dry season. The average humidity is 83.7 %, and a westernly wind is predominant, with an average wind speed of 2.0 m/sec. The area has no history of typhoons, and the maximum wind speed from 1980 to 1988 was only 10 m/sec.

In light of the above climate conditions, it appears that a comfortable interior environment can be achieved, without air-conditioning equipment, by preventing direct sunlight and facilitating natural ventilation.

Since the amount of rainfall and the number of rainy days are both large, facilities must be set up for rain, i.e. the buildings should have projected eaves and corridors with roofing to connect the buildings. Rainfall at its heaviest was about 60 mm/hour, so drainage systems must be secured, in such a way as placing ditches around buildings and making the ditch cross-section large enough to handle the expected amount of water.

Rice paddies surround the site, so a large number of insects will be drawn to the facility when lamps are lit at night. Therefore countermeasures against insects, such as mosquito nets for the openings of the buildings, must be thoroughly provided.

4.2.2 Local Construction Conditions

The rise in recent years of Indonesia's strength as a nation has resulted in a boom in the manufacture and production of construction materials and machinery. However, it is not long since industry began to commercialize products -- such as chemical and compound building materials, and technically sophisticated equipment -- and there are often questions on durability and reliability of the products. Therefore, in selecting building materials, the primary focus should be on materials with a proven record, like terrazzo blocks. In Indonesia masonry construction techniques using concrete blocks or bricks have been used for a long time and technically mastered, so using these techniques for partition walls is economical. It also eases renovation in response to future changes and gives the buildings greater flexibility.

4.2.3 Determination of Facility Scale

This Project involves various divisions and facilities, including: the administration division, research and development division, testing and technical guidance division, information dissemination division, seminar and exhibition area, dormitory, canteen, utility building, guardhouse, etc. The buildings have been divided as follows by function and structural conditions.

a. Main Building:

The following divisions composed of offices, research rooms and other rooms in which no large equipment will be installed.

Administration division, research and development division, information dissemination division, and housing environment division, seminar and exhibition, dormitory and canteen.

b. Structure/Earthquake Laboratory:

Houses experimental equipment taller than 10 m, thus requires the highest ceiling height.

c. Building Material Laboratory:

Houses facilities for experimentation in the building material field.

d. Sanitary Engineering Laboratory:

Houses facilities for experimentation in the sanitation field.

e. Fire Testing Laboratory:

Houses facilities for experimentation in the fire prevention field.

f. Utility Building:

Transformer, water treatment facility, toilets and kitchenette, etc.

g. Guardhouse:

Including night duties room

The scale of offices and rooms for the administration division, research and development division, seminar/exhibition area and dormitory is roughly determined by considering the number of room occupants, circulation of people, working conditions, layout of furniture, and necessary furniture dimensions, etc. The scale of the laboratories, rooms for the information dissemination division and printing area is roughly determined by considering existing IHS facilities, the dimensions and required area for equipment and materials, such as experimental equipment and printing and bookbinding equipment. Then, the module dimensions are determined by taking account of the several key points of architectural design, i.e. standard dimensions of building materials, detailing in floor plans, and regular arrangement of doors and windows. Based on these module dimensions, size of each room is determined.

The library is designed to the size necessary to house about 18,000 volumes already owned and about 3,000 volumes expected for next five years. The necessary rooms and their scale are determined as shown in the following Table 4.1.

Table 4.1 Room Floor Area

Room Name	No. of Occupants (Person)	Planned Area (m^2)	Room Name	No. of Occupants (Person)	Planned Area (m^2)
Main Building			(Research & Development)		
(Administration)			· Div. of Building Material		(260)
- Director General's Room	1	34	- Head's Room	1	26
- Director's Room	1	52	- Clerk's Room	3	26
- Secretary's Room	2	26	- Researcher's Room No. 1	4	26
- Foundation		17	- Researcher's Room No. 2	3	26
- Ladies Organization		17	- Researcher's Room No. 3	3	26
- Meeting Room No. 1		34	- Junior Researcher's Room	14	78
- Meeting Room No. 2		52	- Technician's Room	5	52
- Meeting Room No. 3		78			
- Reception Room		52			
· Div. of Administration and Operation		(260)			
- Head's Room	1	26			
- Clerk's Room	2	26	· Div. of Construction and Structure		(312)
- Planning Sec. Room	9	52	- Head's Room	1	26
- Finance Sec. Room	9	52	- Clerk's Room	3	26
- Inventory Sec. Room	10	52	- Researcher's Room No. 1	4	26
- Personnel Sec. Room	9	52	- Researcher's Room No. 2	3	26
			- Researcher's Room No. 3	3	26
			- Researcher's Room No. 4	3	26
			- Junior Researcher's Room	20	104
			- Technician's Room	5	52

Room Name	No. of Occupants (Person)	Planned Area (m^2)	Room Name	No. of Occupants (Person)	Planned Area (m^2)
· Div. of Housing Environment and Sanitary Engineering		(338)	**(Information Dissemination)**		
- Head's Room	1	26	· Div. of Documentation and Dissemination		(944)
- Clerk's Room	3	26	- Head's Room	1	26
- Researcher's Room No. 1	4	26	- Clerk's Room	3	26
- Researcher's Room No. 2	4	26	- Staff Room	14	86
- Researcher's Room No. 3	3	26	- Library		182
- Researcher's Room No. 4	3	52	- Librarian's Room	12	78
- Junior Researcher's Room	20	78	- Printing Preparation Room		52
- Technician's Room	11	78	- Film Preparation Room (incl. Darkroom)	10	67
			- Printing Room		104
			- Staff Room	12	78
			- Storage for Printing Materials		63
(Testing & Technical Guidance)			- Studio		52
			- Preparation Room	6	52
· Experimental St. for Housing and Building		(52)	- Staff Room	4	52
- Head's Room	1	26	- Mechanical Room		26
- Clerk's Room	2	26			
· Experimental St. for Sanitary Engineering		(52)			
- Head's Room	1	26			
- Clerk's Room	2	26			

Room Name	No. of Occu-pants (Person)	Planned Area (m^2)	Room Name	No. of Occu-pants (Person)	Planned Area (m^2)
• Seminar/Exhibition		(672)	• Dormitory		(603)
- Seminar Room No. 1	30	104	- Guest Room Nos. 1 to 16	2×16	416
- Seminar Room No. 2	30	78			
- Seminar Room No. 3	30	52	- Overnight Duty Room		26
- Preparation Room No. 1		26	- Office		13
- Preparation Room No. 2		13	- Guest Lounge		78
			- Toilet		13
- Conference Hall (incl. Control Room & Storage for Chairs)	80	144	- Storage		5
			- Laundry/Linen Room		26
			- Boiler Room		26
- Seminar Office	3	26			
- Lecturer's Room		26			
- Exhibition Corner		151	• Canteen		(221)
- Exhibition Preparation Room	4	52	- Dining Room	50	104
			- Stand		26
			- Kitchen		52
			- Anteroom of Kitchen (incl. Office, Locker Room, Storage and Toilet)		39

Room Name	No. of Occu-pants (Person)	Planned Area (m^2)	Room Name	No. of Occu-pants (Person)	Planned Area (m^2)
(Common)					
- Computer Room		78			
- Mechanical Room		26			
- Foreign Expert Room Nos. 1 and 2	2	52			
- Copy Room (1F)		20			
- Copy Room (2F)		13			
- Kitchenette (1F)		6			
- Kitchenette (2F)		6			
- Toilet		240			
- Archives (1F)		26			
- Archives (2F)		13			
- Musholla		52			
- Alarm Panel Room		11			
- Overnight Duty Room		26			
- Driver's Room		26			
- Janitor's Room		26			
- Storage		30			
- Storage for Chairs		26			

Room Name	No. of Occupants (Person)	Planned Area (m^2)	Room Name	No. of Occupants (Person)	Planned Area (m^2)
Structure/Earthquake Laboratory		(1,776)	Building Material Laboratory		(1,052)
- Test Hall	13	1,100	- Concrete Mixer Room	11	428
- Tool Storage		32			
- Measuring Equipment/Data Room		32	- Wood Testing Room		42
- Soil Testing Room		64	- Chemical Testing Room		68
- Illumination/Acoustics Testing Room		32	- Cement/Concrete Testing Room		105
- Chief's Room No. 1	2	17	- Curing Room		34
- Chief's Room No. 2	2	17	- Aggregate Testing Room		105
- Engineer's Room	11	72	- Plastics/Coating Material Testing Room		25
- Drafting Room	2	24			
- Meeting Room		47	- Loading Testing Room		56
- Storage for Outdoor Soil Testing Apparatus		32	- Engineer's Room	4	34
- Corridor		307	- Drafting Room	2	17
			- Meeting Room		38
			- Storage		15
			- Corridor		85

Room Name	No. of Occupants (Person)	Planned Area (m^2)	Room Name	No. of Occupants (Person)	Planned Area (m^2)
Fire Testing Laboratory		(740)	Sanitary Engineering Laboratory		(819)
- Test Hall		390	- Test Hall (incl. Physical Lab.)		325
- Material Combustibility Room		64	- Chemical Laboratory		75
- Tool Storage	6	32	- Preparation Room No. 1		24
- Engineer's Room	4	47	- Microbiological Laboratory		53
- Drafting Room	2	22	- Preparation Room No. 2		24
- Meeting Room		24	- Chief's Room No. 1	2	17
- Storage		32	- Chief's Room No. 2	2	17
- Corridor		129	- Engineer's Room	20	96
			- Drafting Room	2	14
			- Meeting Room		36
			- Storage		25
			- Air Conditioning Unit Room		16
			- Corridor		97

Room Name	No. of Occu-pants (Person)	Planned Area (m^2)	Room Name	No. of Occu-pants (Person)	Planned Area (m^2)
Workshop		(573)	**Guardhouse**		(23)
- Wood Workshop		240	- Guardhouse (incl. Overnight Duties and Toilet)		23
- Metal Workshop		240			
- Tool Storage	10	40			
- Storage		40			
- Corridor		13			
Utility Building		(293)			
- Electrical Room (incl. Generator Room)		77			
- Water Treatment Room		81			
- Toilet/Shower		50			
- Kitchenette		11			
- Corridor		23			
- Staff Room		16			
- Maintenance Engineer's Room		16			
- Storage		6			
- Elevated Water Tank		13			

4.3 Basic Plan

4.3.1 Site Plan

The site slopes down from the north to the south at a grade of about 1.5 %, and the maximum difference between high and low points is about 7 m. The planned facilities include: the Main Building, Structure/Earthquake Laboratory, Building Material Laboratory, Sanitary Engineering Laboratory, Fire Testing Laboratory, Workshop, Utility Building, Elevated Water Tank, and Guardhouse.

The laboratories are tall and house a lot of heavy equipment, and will likely generate a great deal of noise and vibration during experimentation. These buildings require sufficient floor area and should be kept as far as possible away from the Main Building. Roads must be provided for large trucks which will bring in experimentation materials, and the laboratories should be properly arranged so as to secure area for future extension.

The construction to be shouldered by Indonesia must be minimized wherever possible due to Indonesia's budgetary constraints, and when considering the conditions for setting up the above facilities, it was decided to arrange them all within an area of about 4.8 ha. This enables Indonesia to budget for the site development work in two stages, first for the work on the 4.8 ha site, and then for a 1.5 ha site on the north side in the next year. The site plan is shown in Fig. 4.18. The basic ideas behind the site plan are as follows.

(1) The Main Building will consist of the administrative division, the information dissemination division, the research and development division, seminar rooms, dormitory facilities, and the canteen, and will be placed in the west of the site with the long side of the building being placed in almost parallel with the access road running in the north-south direction.

(2) The Laboratories are arranged on the east of the Main Building, at a distance, leaving a sufficient space which will act as a buffer zone against noise and vibration between the laboratories. This empty space between buildings, will also be used as a yard to keep specimens and materials for testing, and tested materials to be disposed of.

(3) The number of rainy days per year at the site exceeds 180, so roofed corridors will be used to connect between the laboratories and the Main Building. These connecting corridors extend the middle corridor of the square Main Building to the east like branches of a tree, and the laboratories are compared to the leaves at the ends of these branches. The ceiling of these connecting corridors will also be used for piping and wiring space of service lines (such as power supply wiring, telephone lines, and water supply piping) between buildings.

(4) The Structure/Earthquake Laboratory will be east of, and farthest away from, the Main Building. This laboratory building will be the highest (16.1 m above the ground) and have a larger building area, so it is located in this way to keep balance with the other laboratories.

(5) As the building material division and the construction and structure division will partially share each other's facilities and have an close relationship, the Building Material Laboratory will be placed adjacently to the Structure/Earthquake Laboratory.

(6) The Fire Testing Laboratory will deal with explosive materials in its experiments, so it will be placed far away from the Main Building.

(7) The Sanitary Engineering Laboratory will not produce much noise compared to the other laboratories, and hence it will be the closest laboratory to the Main Building.

(8) The Workshop will fabricate test samples and jigs used by the testing and inspection division, and repairs equipment and tools. Therefore it will be placed to allow easy interaction with the laboratories.

(9) The Utility Building will have a transformer and a water treatment facility, as well as toilets and a kitchenette for the staff of the laboratories. Placing toilets and a kitchenette in the Utility Building instead of in each laboratory will facilitate maintenance of these facilities which tend to malfunction or become unsanitary. This will also allow the overall area for the facilities to be more compact and centralized.

(10) The elevated water tank will be adjacent to the Utility Building and on the central axis of the site so as to make it the symbol of the entire facilities.

(11) The front gate will be located in line with the entrance of the Main Building. The front gate, the Main Building and the Utility Building will form the central axis of the facilities.

(12) The guardhouse will be located at the side of the front gate and guards can monitor entrance and exit of employees and visitors. The overnight duty room is also provided in this house.

(13) The parking lot will be placed around the Main Building. Since about one fourth of the employees are expected to commute by car, about 100 parking spaces are deemed necessary including visitors' parking. Due to the customary morning gathering at IHS, space is needed to line up about 400 people, and the entrance turn area near the front entryway on the west side will be used for this purpose.

(14) Indonesia plans to use the undeveloped southern side of the site for future extension of the laboratories and for outdoor fire and exposure experiments.

4.3.2 Architectural Plan

(1) Floor Plan

1) Main Building

The Main Building is planned as a 2-story structure with a hollow square floor plan. The ground is soft at the site, so all the buildings require pile foundations (average pile length: 18 m approx.) and slab floors, of which construction entails a large cost. This cost can be minimized by reducing the building area. If the building has more stories, vertical circulation within the building may increase and it may cause difficulty in communication between employees in the building. In addition, the number of stairs and toilets will increase and the net usable area ratio will decrease accordingly.

Further, in consideration of the considerably long construction time of the piling work, the extra construction time for the building having high ceilings enabling natural ventilation and lighting, and time for installation and adjustment of the equipment, the building was limited to two stories (Figs. 4.1 and 4.2).

Making the building a hollow square where side corridors surround the central courtyard enables natural lighting and ventilation even in the country's high-temperature, high-humidity natural environment. This accords with the desire of the Indonesian side for energy saving buildings with a minimal running cost which can be comfortably used even without lighting equipment and airconditioning.

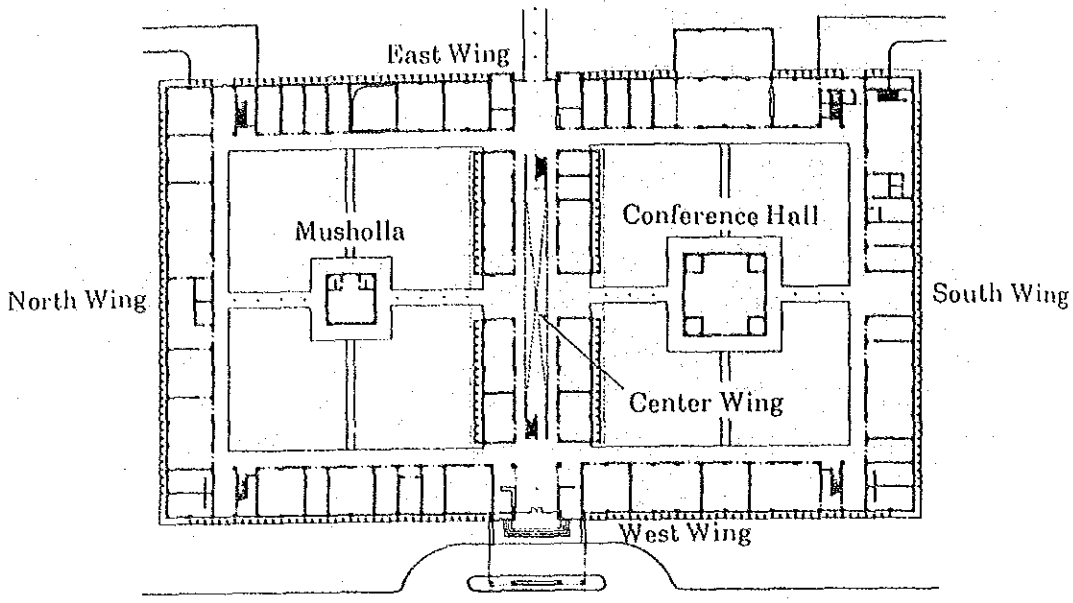


Fig. 4.1 First Floor Plan of the Main Building

On the first floor of the Main Building, rooms of the administrative division and of the information dissemination division, seminar rooms, a canteen, a musholla and a conference hall will be placed. Since the administrative division plays a role of exercising control over whole activities in the building and often acts as a liaison for visitors the rooms of the administrative division will be mainly placed at the central wing forming the center axis of this building and at the west wing having the main entrance of the building. The studio and printing room and all of such rooms of the information dissemination division as will have frequent handling of equipment and materials will be located in the north of the east wing and in the north wing so as to enable easy access from the road in the north of the site.

The seminar rooms will be collectively located in the south of the west wing and in the south wing so as to keep the research and development divisions quiet.

The canteen will be located in the south of the east wing so that it will be integrated with a terrace and will be easily accessible to every employee, trainee, etc. The kitchen will be placed facing the outside so that it will be accessible to services from the road in the south of the site. A musholla will be placed in the center of the courtyard in the North Zone to act as the symbol and tighten

up the space of the courtyard. The conference hall, which requires a high ceiling height, will independently be placed in the center of the South Zone so that its height requirement is satisfied.

The exhibition area will be placed on the axis connecting the central entrance and the connecting corridor, so this division will also play a role of the lobby of the entire Main Building.

Around this exhibition area, three meeting rooms will be provided, thus emphasizing the center of the building. This center axis area will be open to the above outdoor and connected with the second floor corridor, which will be integrated with the rooftop and the garden.

The space on the second floor except the dormitory facilities will house the rooms of the research and development divisions, and a library. The research and development divisions will be placed in the east and west wing and a relaxing environment will be designed to allow researchers to concentrate on their work. The library and computer room will be placed in the north wing which will connect the research and development division in the east wing and that in the west wing so as to make them easily accessible to the researchers.

The dormitory facilities will be collectively placed on the second floor of the south wing, whose first floor will house the seminar rooms. For daily access to the dormitory facilities, single staircase will be provided, and one must pass by the dormitory manager's room in order to go upstairs. This design is intended to prevent visitors from trespassing in the dormitory. In this connection, stairs (for researchers) on the west side will also play a role of an emergency stair for the guests of the dormitory.

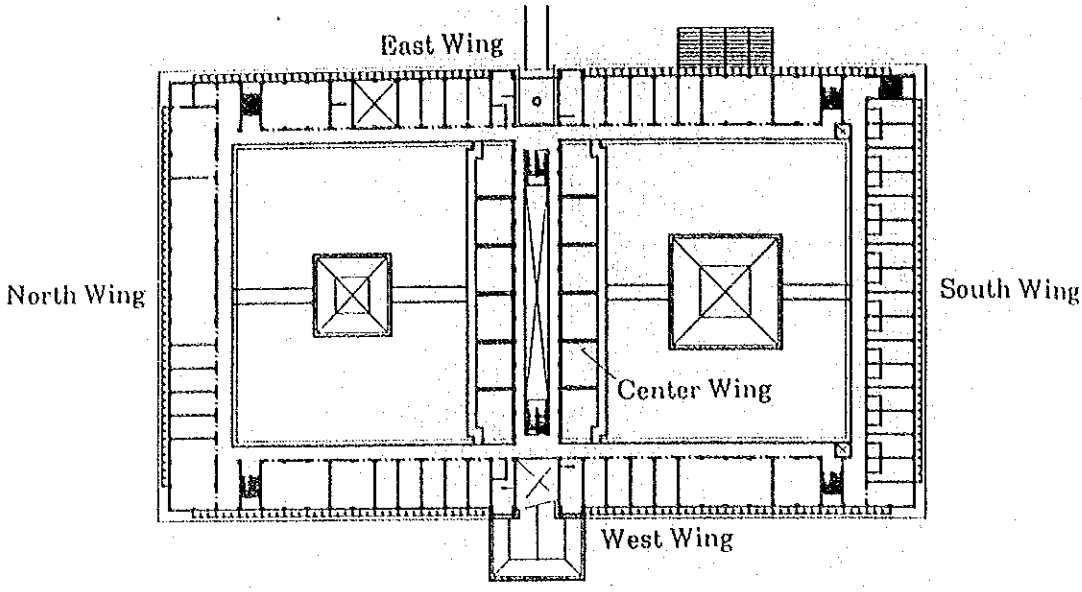


Fig. 4.2 Second Floor Plan of the Main Building

2) Laboratories

Each laboratory will include the following: a test hall for performing large scale experiments; and experiment rooms where precision measurement equipment will be installed; engineer's rooms; drafting rooms; meeting rooms; and equipment storage rooms. As previously described, toilets and a kitchenette will be centralized in the Utility Building. The buildings for the Structure/Earthquake Laboratory, Fire Testing Laboratory and Sanitary Engineering Laboratory must be high enough to enable large experiments, so these buildings will be partly two-story, placing the research room, engineer's room, drafting rooms, meeting rooms and other administrative rooms on the second floor for effective use of the space (Fig. 4.3). The buildings for the Building Material Laboratory and Workshop, however, do not need to be high and will be single-story structures. Except for the rooms for precision measuring equipment which is sensitive to dust and water, the laboratories will be left open as large rooms without partitions, thus facilitating natural ventilation. This design also has much greater flexibility for future changes than dividing the space into small rooms with fixed walls.

Test halls for performing large experiments will be equipped with entrance(s) on their gable side and at least one entrance on their ridge side to enable large trucks to bring in testing materials. Each laboratory will be equipped with skylights for natural lighting and with windows at a high level for natural ventilation and lighting.

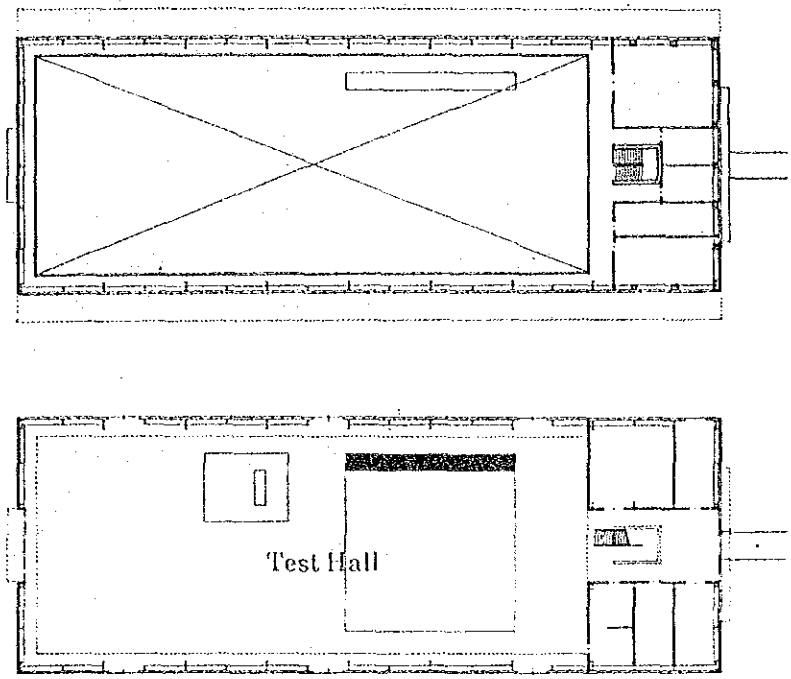


Fig. 4.3 First and Second Floor Plans of the Structure/Earthquake Laboratory

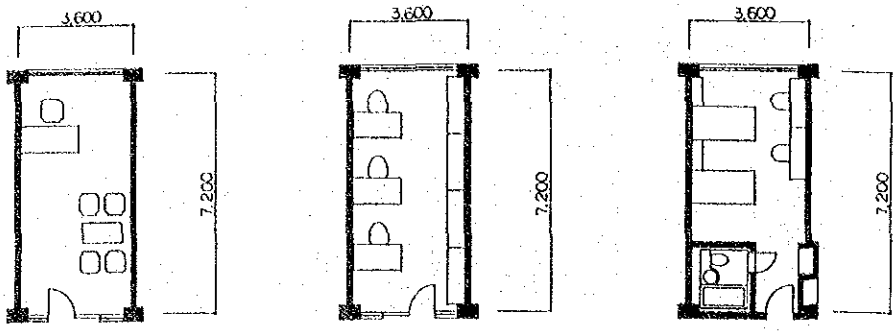
3) Utility Building, Elevated Water Tank and Guardhouse

The Utility Building will be a one-story structure, and house an electrical room, a water treatment room, toilets, a kitchenette, a storage room for equipment for outdoor use and a maintenance engineer's room. An elevated water tank adjacent to the Utility Building will be about 25 m high and will act as a landmark for the expansive site and its facilities. Electric wiring and piping for water supply from the Utility Building to the other buildings will be run through the ceiling of the connecting corridors.

The guardhouse will be a one-story structure where guards will monitor entrance and exit of employees and visitors.

4) Typical Modules

Establishment of typical modules begins by extracting space composition features of the rooms which form a single room, and this is done using minimal modules such as administration offices, researcher's rooms or bed rooms. Basic modules established in this way insure flexibility for future partitioning changes (Fig. 4.4).



Office Researcher's Room Bed Room

Fig. 4.4 Typical Module

In this plan, typical module dimensions have been set at 3.6 m (the X-direction) and 7.2 m (double the X-direction for the Y-direction) by considering the arrangement and use of furniture in researcher's rooms and offices in Indonesia. These dimensions enable effective use of three feet or four feet standard finishing materials. The basic minimum unit area obtained from the typical module X and Y dimensions is about 26 m^2, and this size agrees with about 25 m^2 basic minimum unit area of the existing IHS Main Building.

(2) Sectional Plan

1) Main Building

In order to ensure natural ventilation and lighting, the ceiling height is set at 3.3 m and the floor-to-floor clearance at 4.2 m. The roofing is tiled, with about 40° sloped.

The high profile sloped roof, the protrusion of the perimeter roof, the louvers provided on the outside of the window and the courtyard corridor will prevent sunlight and severe penetration of rain, as well as lending the buildings an atmosphere suited to the climate of a tropical country. The walls in the ridge direction will be provided with as many openings as possible, which will be equipped with fixed louvers or sliding windows with wire nets so as to promote natural ventilation (Fig. 4.5).

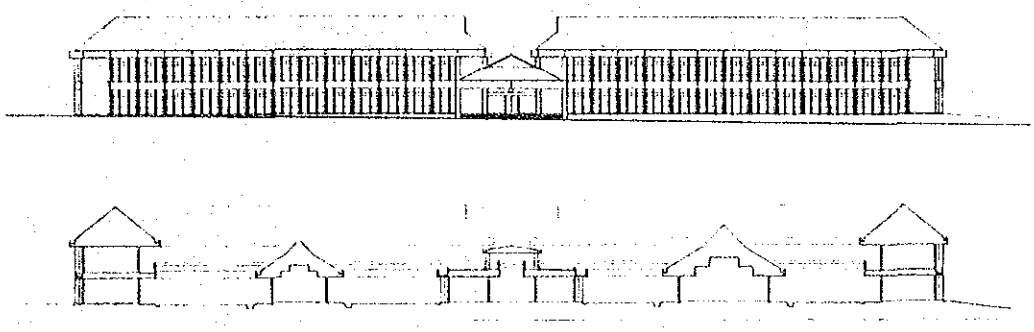


Fig. 4.5 Section of the Main Building

2) Laboratories

Each height of the laboratories is determined by the dimensions of the experimental equipment they will house and their use conditions. The Structure/Earthquake Laboratory will house a 10 m-high reaction wall (the tallest piece of equipment), and a 10-ton crane must run along the top of the wall. Therefore, the clearance is set at 15.0 m under the steel beam bottom.

This height will be used to make the structure partially two-stories with researcher's rooms and meeting rooms on the second floor (Fig. 4.6).

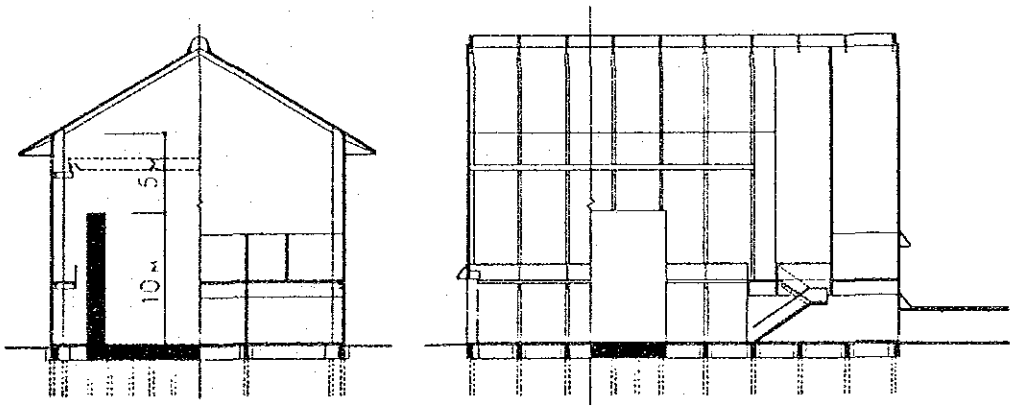


Fig.4.6 Section of the Structure/Earthquake Laboratory

The largest piece of equipment at the Building Material Laboratory will be a 200-ton universal testing machine, and no ultra-large equipment is expected to be introduced in the future. So test hall clearance, under the steel beam bottoms, will be set at 5.0 m to allow large trucks to enter (Fig. 4.7).

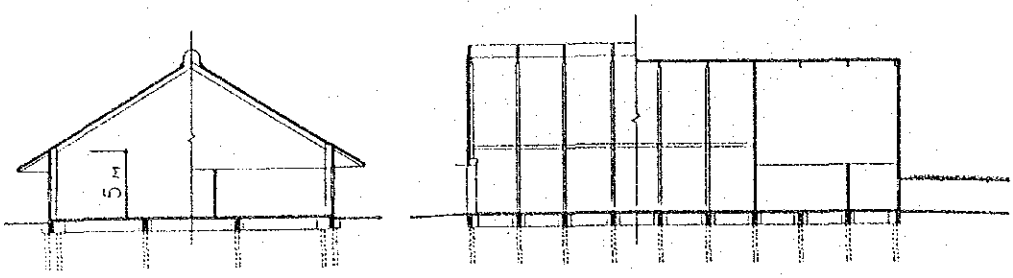


Fig.4.7 Section of the Building Material Laboratory

The largest experimental facility in the Fire Testing Laboratory will be a multiple type furnace whose height is 3.0 m, but a five-ton crane must run along the top of this furnace, so clearance under the steel beam bottom will be set at 7.0 m (Fig. 4.8).

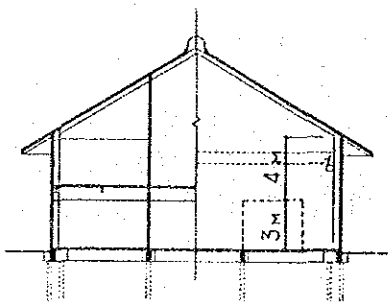


Fig.4.8 Section of the Fire Testing Laboratory

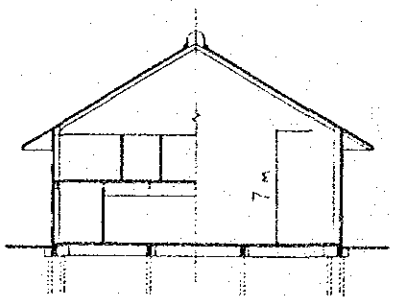


Fig. 4.9 Section of the Sanitary Engineering Laboratory

The test hall for the Sanitary Engineering Laboratory must house experimental equipment (such as a water purifier) whose height is greater than 5.0 m, so clearance under the steel beam bottoms will be set at 7.0 m, the same as for the Fire Testing Laboratory (Fig. 4.9). The Fire Testing Laboratory and Sanitary Engineering Laboratory will be both partly two-storied, with the second floor housing engineer's rooms, meeting rooms, etc.

The workshop will have no particularly large equipment, so its clearance under the steel beam bottoms will be set at 5.0 m, the same as for the Building Material Laboratory.

The Y-direction dimension for the laboratories will be as deep as 21.6 m, so these buildings will have skylights to enable natural lighting. Countermeasures against insects, a problem special to paddy fileds, must be taken for all the laboratories.

3) Utility Building, Elevated Water Tank and Guardhouse

In consideration of the size of equipment, the Utility Building will be given a clearance of 4.5 m, with a first floor level of GL + 200 mm.

The guardhouse will have a floor height of about 2.5 m with design matched with the front gate.

(3) Structural Design

1) Design Principles

In relation to the structure of the proposed facilities, a structural plan will be made according to the principles described below.

- The Main Building will be constructed of reinforced concrete. Although the structural system will be of a rigid frame structure, a part of the external walls will be in-situ reinforced concrete walls or masonry construction walls. In consideration of the dry shrinkage of the concrete, the buildings will be structurally divided by installing expansion joints appropriately.

- The main structure of the laboratories will be constructed of steel-frame work, and the structural system will be the one with rigid frame structure in the span direction and braced frame structure in the ridge direction.
- The foundation structure will be made of reinforced concrete with piles.
- The site consists mainly of a silty clay layer down to about 12 m to 15 m from the ground of the site. Since, there is a gravel layer below that level, piles will be supported on the gravel layer.
- Locally available structural materials will be adopted as much as possible.

2) Structural Design Standards

The structural design has been performed according to the standards of the Republic of Indonesia as shown below.

- Standards for calculating the reinforced concrete structures
- Standards for designing steel structures
- Standards for designing building foundations

3) Design Loads

- Dead Load

Reinforced concrete	2.4 t/m^3
Structural steel	7.25 t/m^3
Concrete Block	2.2 t/m^3

For other materials, actual weight will be adopted for computation.

- Live Load

The following live loads have been used (Table 4.2).

Table 4.2 Live Loads

(Unit: kg/m^2)

	For Floor	For Frame	For Seismic Load
Roof	100	75	30
Laboratories	400	320	320
Office	250	150	75
Dormitory	250	200	200

- Seismic Load

According to the Indonesian Standards, the project site is located in Zone 3 in the Zoning Map as shown in Fig. 4.10.

The total horizontal seismic base shear (V) for design of buildings is denoted by the following formula.

$V = C \cdot I \cdot K \cdot Wt$

where, Wt : Dead weight of a building

C : Base shear coefficient = 0.07 (at Zone 3)

I : Importance Factor = 1.5

K : Structural type factor

Rigid frame structure	: 1.0
Braced frame structure	: 2.5
Elevated water tank	: 3.0

The seismic loads will be computed with this formula.

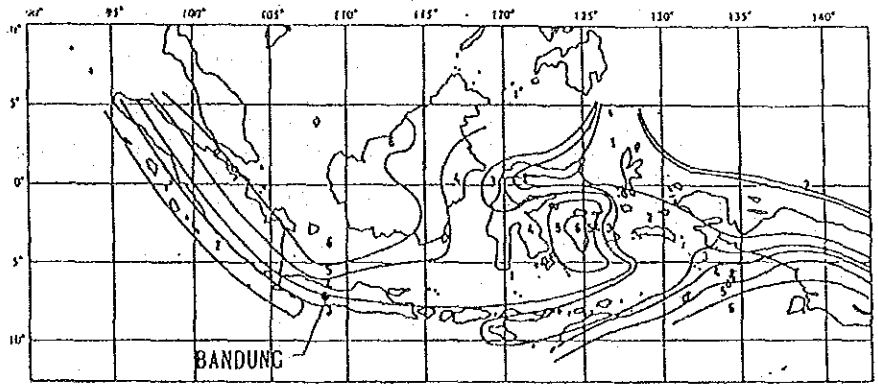


Fig. 4.10 Zoning Map for Establishing Base Shear Coefficient

- Wind Load

Wind load (P) is denoted by the following formula.

$P = C \cdot q \cdot A$

where, C : Coefficient of wind force

q : Wind velocity (25 kg/m^2)

A : Area to receive wind (m^2)

The coefficient of wind force will be set to the values shown in Fig. 4.11 below in accordance with the Indonesian standards.

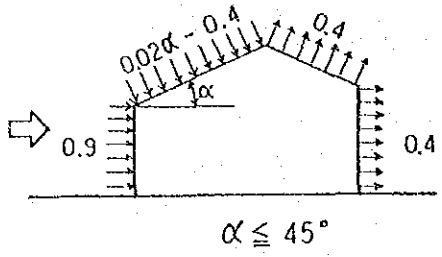


Fig. 4.11 Coefficient of Wind Force

(4) Building Services Planning

1) Electrical Installation System

a. Power Receiving and Transforming System

Electrical power will be supplied by the PLN 20 kV line predetermined to be installed at the west side of the site. Construction of the electrical room and installation of the power receiving panel therefor will be shouldered by PLN. Facilities following the secondary side of the power receiving board will be shouldered by Japan (Fig. 4.12). The electrical room will be provided in the Utility Building. An emergency generator will be provided by the Indonesian side.

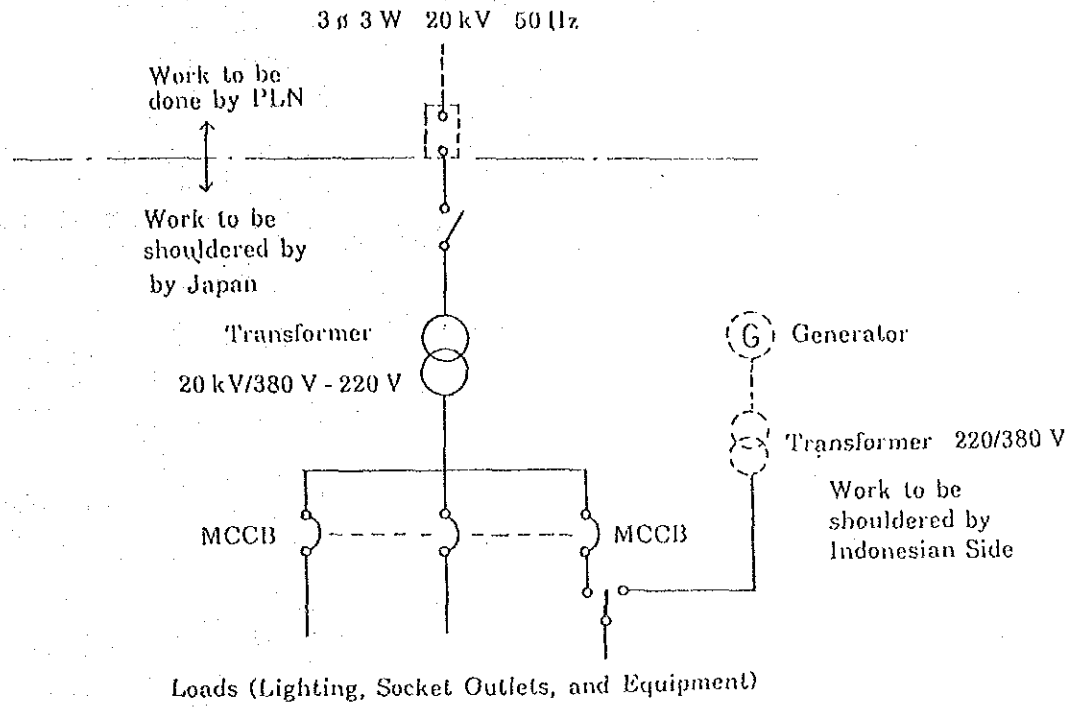


Fig. 4.12 Skeleton Diagram of Power Receiving/Transforming System

The loads for equipment in the facilities are estimated approximately as follows, and can be considered to attain a total amount of 740 kW.

Lighting and socket outlet	220 kW
Ventilation and sanitary equipment	120 kW
Research and experiment equipment	400 kW
Total	740 kW

b. Main Lines

The power of 3 ø 4 W 380/220 V will be supplied from the power source in the low voltage power switchboards in the electrical room to electrical panelboards and power control panels set at each position in the buildings (Fig. 4.13).

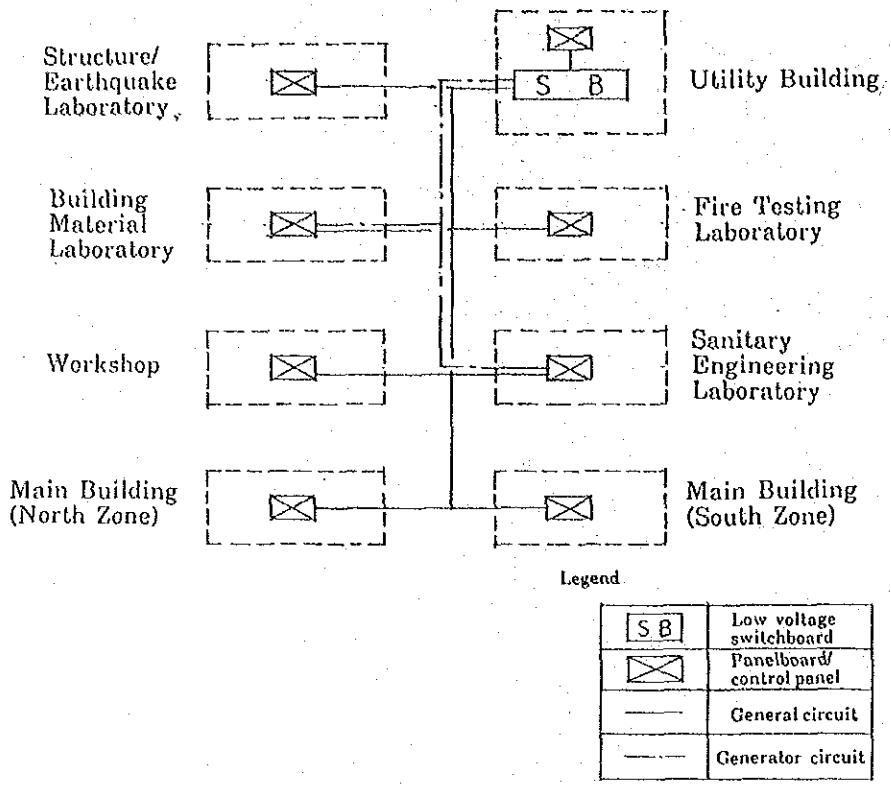


Fig. 4.13 Main Line Diagram

c. Power Circuit

A power panel board will be provided in each building to supply power for water supply, ventilation, and research and experiment equipment, via conduiting and wiring to each equipment.

Specifications for the power sources are the following two kinds. Also, abnormality in water level and so on will be indicated in the Alarm Panel in the Main Building.

3 ø 3 W 380 V 50 Hz

1 ø 2 W 220 V 50 Hz

d. Lighting and Socket Outlets

- Lighting

The illumination will be mainly by fluorescent lamps which are effective light sources. The power source will be 1 ø 2 W 220 V 50 Hz, and an emergency directional lamp (with a built-in type battery) will be appropriately provided. The standards of illumination are as follows:

Offices	200 to 300 lx
Researcher's rooms	200 to 300 lx
Laboratories	200 to 300 lx
Storage	50 to 100 lx
Water treatment room etc.	50 to 100 lx

Many switches for lighting will be provided to save energy.

- Socket Outlets

Socket outlets will be provided in each of the laboratories, offices and researcher's rooms.

e. Telephone System

From the telephone cables of the Telecommunication Government Enterprize (PERUMTEL) which are predetermined to be set on the west side of the site, the telephone wire will be drawn in by PERUMTEL to the main distribution frame for the telephone use. Thereafter, conduiting and wiring from the main distribution frame to the telephone outlet via the terminal boards set in each building will be shouldered by Japan. A private branch exchanger will be provided in the Alarm Panel Room in the Main Building, and about 90 telephone sets will be provided at selected positions (Fig. 4.14).

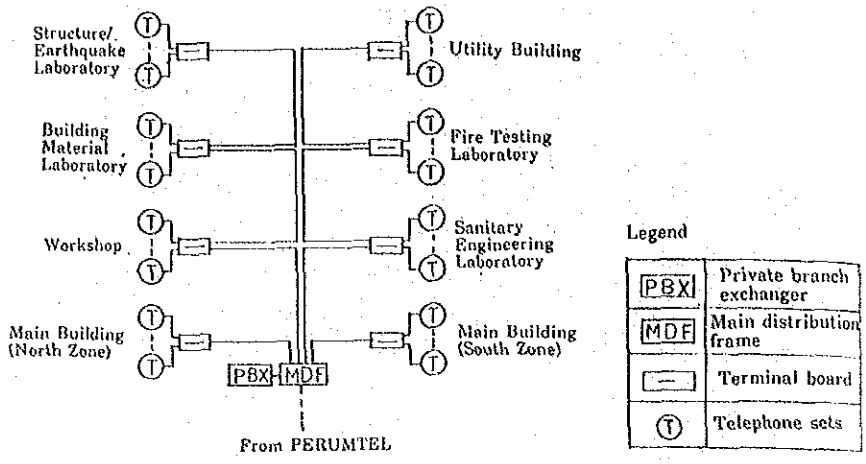


Fig. 4.14 Telephone System Diagram

f) Public Address System

Loud speakers will be provided in each building for paging and announcement of the start or finish of work. An amplifier for the system will be provided in the Reception Room of Administration Division in the Main Building (Fig.4.15).

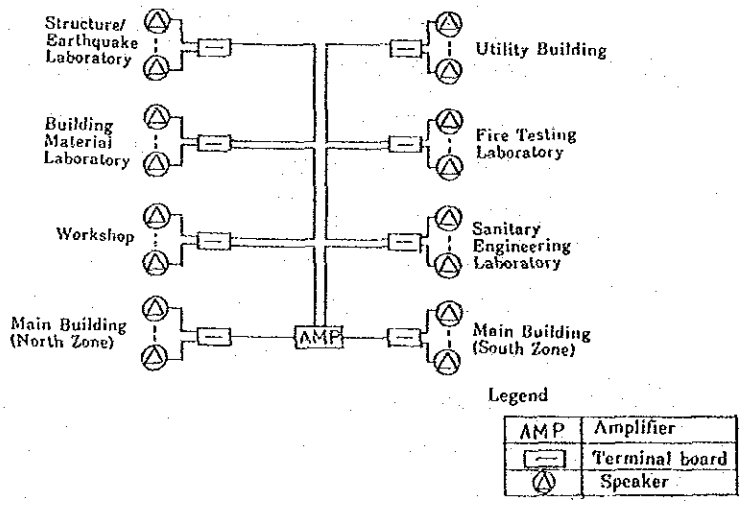


Fig. 4.15 Public Address System

g. Master Antenna TV System

A master antenna TV system will be provided, and receiving terminals will be provided to make TV be received in the Studio, Canteen, and so on. The receiving terminals will be set at five places.

h. Fire Alarm System

Fire detectors will be provided in each building to automatically detect fire, and automatically inform the occurrence of a five by ringing alarm bells. The main fire alarm panel will be provided in the Alarm Panel Room in the Main Building.

i. Lightning Protection System

A lightning protection system will be provided in each building to protect it from damage due to lightning.

2) Cooling and Ventilation System

a. Design Conditions

The planning has been carried out, adopting the outdoor and indoor air conditions as shown below:

i. Outdoor air conditions:
Dry bulb temperature 34°C DB, Relative humidity 75 % RH

ii. Indoor air conditions:

Zone	Dry Bulb Temperature	Wet Bulb Temperature
Computer Room	23 to 25°C DB	Not controlled
Studio	25 to 27°C DB	Not controlled

b. Cooling Zones and Cooling System

Zones to be serviced with a cooling system and the cooling method has been planned as follows:

Main Building	Studio	Air-cooled Package System
	Alarm Panel Room	Air-cooled Package System
	Computer Room	Air-cooled Package System
Structure/ Earthquake Laboratoary	Measuring Equipment/ Data Room	Air-cooled Package System
	Illumination Accoustics Testing Room	Air-cooled Package System
Sanitary Engineering Laboratory	Microbiological Laboratory	Air-cooled Package System
	Chemical Laboratoary	Air-cooled Package System

Rooms other than those described above will be left to be of natural or mechanical ventilation, and no cooling system will be provided.

c. Ventilation System

Mechanical ventilation will be carried out for the rooms in which high temperature, odor, gases or the like will occur. In the other rooms, natural ventilation system will be adopted. Rooms to be ventilated by mechanical ventilation will be as follows:

Common to each Building	Toilet	Ventilation Fan Type
	Laboratories	Ventilation Fan Type
Dormitory	Bathroom	Ceiling Ventilation Fan Type
Canteen	Kitchen	Exhausting Fan Type
Utility Building	Electrical Room	Ventilation Fan Type

3) Plumbing System

a. Water Supply System

From two wells to be provided in the site by the Indonesian side, water will be received in a well water source tank. According to the quality of the well water, filtering treatment or sterilizing treatment will be effected, and then, the water will be stored in a water receiving tank. The water will be raised by a pump into an elevated water tank. Supply of water will be made by means of gravity to necessary points in each building. Provision of wells equipped with a pump will be included in the work shouldered by the Indonesian side

The capacity of water supply is estimated as follows:

Water for domestic use	36 m^3/day
Water for laboratories	40 m^3/day
Total	76 m^3/day

The water supply flow system has been planned as shown in Fig. 4.16 below.

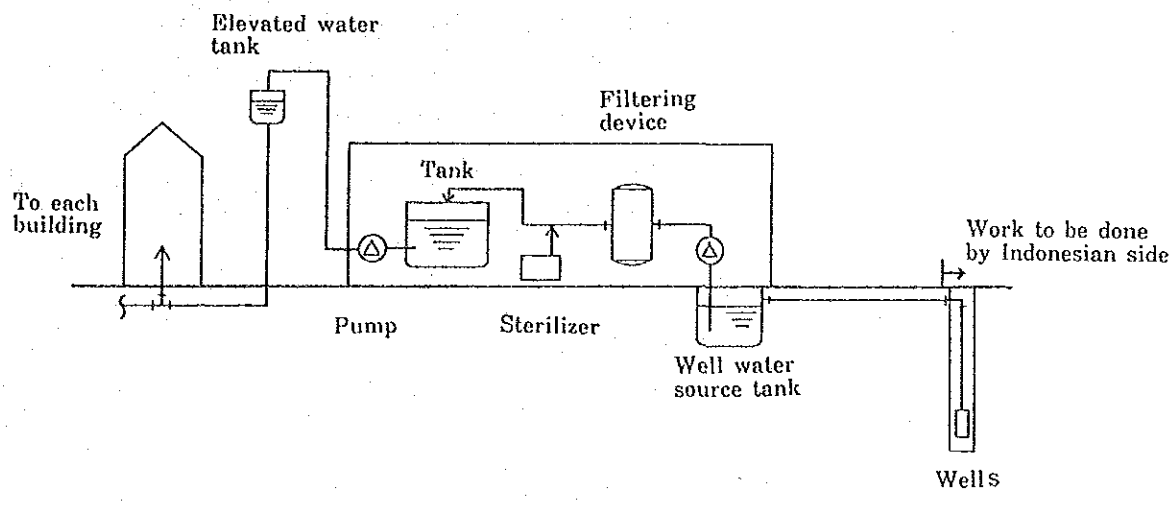


Fig. 4.16 Water Supply Flow System Diagram

b. Drainage and Sewerage System

The following four drainage and sewerage systems will be provided according to the quality of effluents. A treatment facility will be provided as necessary.

i. Domestic Sewerage

Soil water, and miscellaneous kinds of sewage	These will be treated in a domestic waste water treatment tank. Quality of discharged water: BOD not more than 80 ppm

ii. Biological Laboratory Waste

Sanitary Engineering Laboratory	Waste will be discharged through the domestic sewerage system.

iii. Physical Laboratory Waste

Structure/Earthquake Laborataory	Waste will be discharged through the storm water drainage system.

iv. Chemical Laboratory Waste

Building Material Laboratory, and drainage Sanitary Engineerinvg Laboratory	Waste will be discharged through the storm water system after neutralization treatment.

v. Building Material Laboratory Waste

Building Material Laboratory	After precipitation, waste will be discharged through the storm water drainage system.

The drainage flow system has been planned as shown in Fig. 4.17 below.

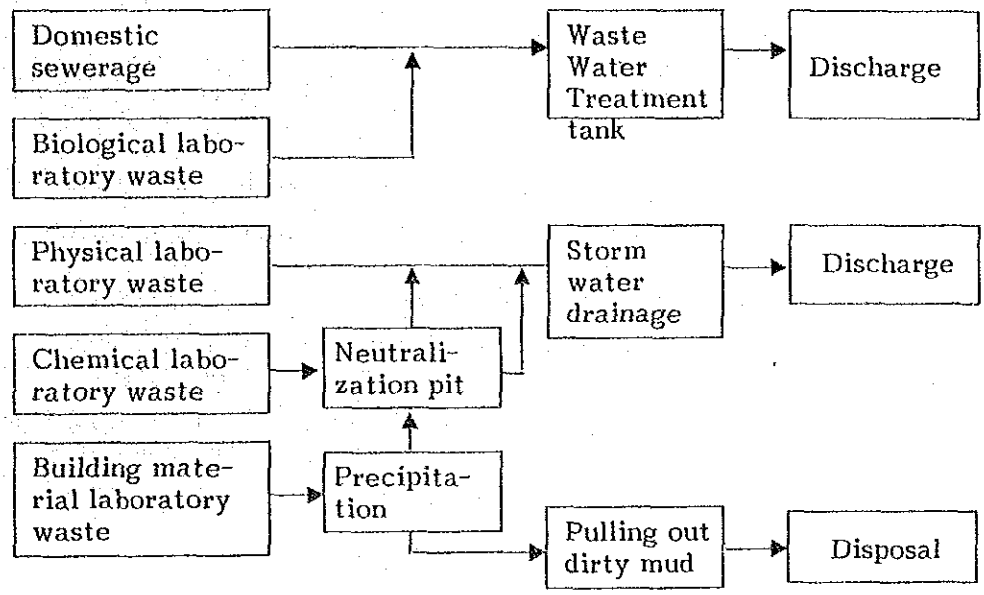


Fig. 4.17 Drainage Flow System Diagram

c. Gas Supply System

Gas will be supplied to the kitchenettes, the kitchen, the dormitory, the shower room in the Utility Building and the laboratories. Gas supply will be made by a piping system with storage of LPG gas cylinders.

d. Hot Water Supply System

Hot water will be supplied to the kitchen, kitchenettes the dormitory and shower room in the Utility Building. The hot water supply system has been planned as follows:

Kitchen	Locally-located Type	Gas water heater
Kitchenettes	Locally-located Type	Gas water heater
Dormitory	Centralized Type	Gas water heater
Shower Room (Utility Building)	Locally-located Type	Gas water heater

e. Fire Fighting System

According to the conditions of each building and each room, the fire fighting system described as follows will be provided:

Outdoor Fire Hydrant	:	Covering all the buildings. A fire extinguishing pump will be provided in the Utility Building
Fire Extinguishers	:	Within each building

f. Oil Supply System

An oil tank, an oil gear pump, and piping will be provided in order to supply oil to the oil burner for the Fire Testing Furnace.

(5) Building Materials

In view of operation and maintenance after the completion of the construction work, local materials are advantageous.

In Indonesia, conditions for supply of building materials are also much improved, and almost all materials can be acquired locally. However, those which require high precision or high technology such as doors and windows, structural steel members, water-proofing materials, paints, metal hardware, skylight, power distribution boards, and telephone switchboards, should be partially procured in Japan.

4.3.3 Equipment Plan

IHS has focused on applied research. The goal of the Institute has been to further research and development leading to realistic and effective improvements in human settlement conditions. Since the strengthening plan for IHS has extended these activities, the new IHS will be involved in planning housing improvement policy, giving scientific support and conducting testing and inspection commissioned by governmental organizations and private enterprises.

As most of the Institute's equipment was installed in the 1960s and has been in service for a long time, many devices cannot be used due to deterioration or malfunction. Usable equipment has limited capabilities and measurement

precision is poor, so only simple, small-scale experiments can be performed. The equipment plan was formulated with the above conditions in mind and according to the following guidelines.

a. To relocate all pieces of the existing equipment, excluding those which are deteriorated, malfunctioning or impossible to use or move. (*Indonesia is responsible for relocating the equipment.*)

b. To replace the equipment which is unusable or has poor measurement precision with equipment suitable to the proposed level of research.

c. Not to install wherever possible, automatic or sophisticated equipment and to select equipment with simple mechanisms.

d. To select durable equipment which does not easily break down when misoperated, which is easily repairable even if it breaks down, and which is easy to maintain and manage.

e. To select equipment enabling adaptation to future expansion in research and testing, improvements in the institute's technical level and expansion and automation of accessory equipment.

f. To select equipment which is sufficiently durable mechanically to endure high temperatures and humidity in Indonesia.

g. To select equipment for which spare parts are easy to obtain through apropriate channels.

h. For information dissemination equipment, to select only those devices which are compatible with the ones already possessed by the organizations to which teaching materials prepared by IHS will be distributed.

The following are the major items of equipment to be newly provided and to be relocated.

List of Equipment

(1) Main Building

(Equipment for Housing Environment)

1) Computer Room

(Newly provided equipment)

- Housing Environment
  (Equipment for statistical analysis)

  Personal computer system with fixed disks, a printer, etc.

  - High level 1 set
  - Standard 4 sets

- Building Material Laboratory
  (Equipment for data analyzing)

  Personal computer system with fixed disks, a printer, etc.

  - Standard 4 sets

- Structure/Earthquake Laboratory
  (Equipment for data processing)

  Personal computer system with fixed disks, a printer, etc.

  - High level 1 set
  - Standard 3 sets

- Sanitary Engineering Laboratory
  (Equipment for data processing)

  Personal computer system with fixed disks, a printer, etc.

  - Standard 1 set

- Fire Testing Laboratory
  (Equipment for data processing)

  Personal computer system with fixed disks, a printer, etc.

  - Standard 1 set

2) Researcher's Room

(Newly provided equipment)

- Equipment for Analyzing Aerial Photography

  a. Stereo Viewer
     - Twin scope 1 set
     - Single scope 4 sets

  b. Optical Pantograph 1 set

  c. Large-size camera with a motor drive 1 set

- Equipment for Map Analysis

  a. Planimeter (electric, portable) 1 set

  b. Digitizer (A0) 1 set

  c. X-Y plotter (A3) 2 sets

3) Junior Researcher's Room

(Newly provided equipment)

- Equipment for Survey Data Collection

  a. Camera
     - 35 mm 1 set
     - 6 cm × 6 cm 4 sets

  b. Tape Recorder 5 sets

4) Technician's Room

(Relocated equipment by the Indonesian side)

- Drafting Machine 5 sets

(Information Dissemination Equipment)

5) Printing Room

- Printing Equipment

  (Newly provided equipment

  - Offset Printing Machine for Double Folio — 1 set
  - Cutting Machine — 1 set
  - Text Making Machine — 1 set
  - Binding Machines Adhesive — 1 set
  - Platemaker — 1 set

  (Relocated Equipment by the Indonesian side)

  - Offset Printing Machine — 1 set
  - Scanning Machine — 1 set
  - Sorter Machine — 1 set

6) Film Preparation Room

(Newly provided equipment)

- Reprographic Camera — 1 set
- Slides Drawer — 1 set
- Micrographics Reader — 1 set

7) Printing Preparation Room

(Newly provided equipment)

- Word Processor — 1 set
- Computer Printer — 1 set
- Photo Copying Machine — 1 set
- Drafting Table for Layout and Mounting — 1 set

(Relocated equipment by the Indonesian side)

- Typewriter — 1 set

8) Studio

(Newly provided equipment)

- Lighting Fixtures

- Broad Light	2 sets
- Spot Light (650 W)	2 sets
- Spot Light (1,000 W)	1 set
- Focus Light	5 sets
- Upper Horizon Light	4 sets
- Stand for Studio/Light	2 sets
- Lamp for Broad Light and Horizon Light	12 package
- Lamp for Spot Light (650 W)	4 package
- Lamp for Spot Light (1,000 W)	2 package
- Lamp for Focus Light	10 package
- Cables	L.S.
- Switch Console	1 set

9) Studio Preparation Room

(Newly provided equipment)

- Studio System

- CCD Video Camera (PAL)	2 sets
- Monochrome Electronic View Finder	3 sets
- Flexible Cable Unit (Servo Zoom Control Unit)	3 sets
- Tripod With/Dolly	3 sets
- Color Video Monitor (21")	1 set
- Connecting Cables etc.	L.S.

- Video Control Equipment

- Special Effect Generator	1 set
- Universal Chromakeyer	1 set
- Camera Control Unit for PAL	3 sets
- AC Power Adaptor	3 sets
- Color Video Monitor 9" (PAL/SECAM)	3 sets
- Color Video Monitor 13" (PAL)	2 sets
- Vector Scope PAL System	1 set
- Waveform Monitor PAL System	1 set
- Video/Audio Distributor	1 set

- Main Power Switch Unit	1 set
- Video Control Console	1 set
- Connecting Cables etc.	L.S.

- Telop System

- CCD B/W Video Camera	1 set
- AC Adaptor	1 set
- Monochrome Video Monitor	1 set
- Manual Zoom Lens	1 set
- Close Up Lens	1 set
- Telop Console	1 set
- Connecting Cables etc.	L.S.

- Editing System Equipment

- U-Matic Video Cassette Recorder	2 sets
- Color Video Monitor (13", 4 System)	2 sets
- Automatic Editing Control Unit	1 set
- Main Power Switch Unit	1 set
- Editing Console	1 set
- Connecting Cables etc.	L.S.

- Audio Control System Equipment

- 8-channel Audio Mixer	1 set
- Cassette Tape Deck	1 set
- Open Reel Tape Deck	1 set
- Stereo Power Amplifier	2 sets
- Monitor Speaker	4 sets
- Stereo Headphone	1 set
- Main Power Switch Unit	1 set
- Audio Master Console	1 set
- Connecting Cables etc.	L.S.

(Relocated equipment by the Indonesian side)

• Camera	2 sets
• Color Video Monitor	1 set
• VTR (PAL)	1 set
• Telop Stand	1 set
• Remote Control Unit	1 set

- Automatic Editing Control Unit — 1 set
- Connecting Cables etc. — L.S.

10) Seminar Preparation Room

(Newly provided equipment)

- Overhead Projector — 3 sets
- Slide Projector — 3 sets

(Relocated equipment by the Indonesian side)

- Color Video Camera (PAL) — 1 set
- Camera — 1 set
- Video Camera (NTSC) — 1 set
- AC Power Adaptor — 1 set
- Color Video Monitor — 1 set
- Color Monitor — 1 set
- U-Matic Video Cassette Recorder — 1 set
- VTR (NTSC) — 1 set
- Others — L.S.

11) Preparation Room for Conference Hall

(Newly provided equipment)

- Slide Projector with built-in Synchrocoder — 1 set
- Slide Projector — 1 set
- Sinchrocoder — 1 set
- Disolve Control — 1 set
- Remote Control — 1 set
- Silver Screen (60 cm × 60 cm) — 1 set
- Color Video Projector — 1 set
- Carrying Case for Video Projector — 1 set
- 100" Flat Screen for Video Projector — 1 set
- Screen with a Tripod for OHP — 1 set
- Copy Camera Console etc. — 1 set

(Relocated equipment by the Indonesian side)

- TV Color Monitor 14" — 1 set
- TV Color Monitor 20" — 1 set
- Video Tape Recorder — 1 set
- Remote Editing Unit — 1 set

• U-Matic Camera	1 set
• Car Battery Adaptor	1 set
• Others	L.S.

12) Exhibition Preparation Room

(Newly provided equipment)

• Photo Camera & Other Equipment	
- Echtachrome slide duplicator	1 set
- Photo camera	1 set
- Reprostands to reproduce pictures to film	1 set
- Color video monitor 21"	1 set
- VHS video cassette tape recorder (4 systems)	1 set
- Beta video cassette tape recorder (4 systems)	1 set
• Portable VTR System for Outdoor	
- Portable video cassette recorder	2 sets
- Battery charger	1 set
- Battery	6 pcs.
- AC power adaptor	1 set
- Camera cable	2 sets
• Audio System for outdoor	
- Condenser microphone	5 sets
- Portable stereo cassette deck	1 set
- Stereo headphone	2 sets
- Cables etc.	L.S.

(Relocated equipment by the Indonesian side)

• Camera and Other Similar Items	
- Video camera (PAL)	1 set
- Battery charger	1 set
- Battery	1 set
- Video cassette recorder	2 sets
- AC power adaptor	1 set
- Others	L.S.

13) Outdoor Transportation

- Standard van	1
- Bus	1

(2) Structure/Earthquake Laboratory

1) Test Hall

(Newly provided equipment)

- Seismic Loading System
  - One way ultra-small shaking table — 1 set
  - Reaction wall (15 m width × 10 m height) — 1 unit
  - Reaction floor (15 m width × 15 m length) — 1 unit

- Permanent Loading System
  - 500 tf compression testing machine — 1 set
  - Movable hydraulic jack (center-hole type) capacity 10, 50 and 100 tf — 4 units/each
  - Manual hydraulic pump — 4 units

- Others
  - Travelling crane (10 ton) — 1 unit
  - Forklift (3 ton) — 1 unit

(Relocated equipment by the Indonesian side)

- Electric hydraulic pump — 2 sets
- Manual hydraulic pump — 1 set
- Hydraulic jack (100 tf) — 2 sets
- Hydraulic jack (50 tf) — 2 sets
- Hydraulic jack (40 tf) — 2 sets
- Hydraulic jack (20 tf) — 1 set
- Hydraulic jack (10 tf) — 3 sets
- Tilting table unit — 1 unit
- Reaction frame — 1 unit
- Hydraulic control unit — 1 unit

2) Soil Testing Room

(Newly provided equipment)

- Static Soil Testing System
  - Static triaxial compression apparatus — 1 set
  - Permeability testing apparatus — 1 set
  - Consolidation testing apparatus — 1 set
  - Mechanical soil compactor — 1 set
  - C.B.R. testing apparatus for indoor — 1 set

3) Storage for Outdoor Soil Testing Apparatus

(Newly provided equipment)

- Static Soil Testing System
  - Standard penetration testing units — 1 set
  - C.B.R testing apparatus for outdoor — 1 set
  - Dutch cone penetrometer (capacity 2 tf) — 1 set

4) Illumination/Acoustics Testing Room

(Newly provided equipment)

- Equipment for Testing on Acoustics
  - Precision sound level meter & recorder — 1 set
  - Noise generator — 1 set
  - Band pass filter sets — 1 set
  - Acoustic absorption coefficient measuring apparatus — 1 set

- Equipment for Testing on Illumination
  - Photo elastic stress experiment apparatus — 1 set
  - Lumen meter — 1 set
  - Digital lux meter — 1 set

5) Measuring Equipment/Data Room

(Newly provided equipment)

- Data Acquisition System
  - Load cell (Center-hole type) capacity 10, 50, 100 tf — 4 sets
  - Dial-gauge (10 cm length) — 15 sets
  - Magnet stand — 15 sets
  - Displacement transducer (10 cm length) — 15 sets
  - Multi channel scanners (100 channels) — 2 sets
  - PI gauge — 10 pcs.
  - Standard personal computer — 2 sets

(Relocated equipment by the Indonesian side)

- Data Acquisition System
  - Load cell (100 tf, 50 tf) — 2 sets/each
  - Displacement transducer — 14 sets
  - Dial gauge — 20 sets
  - Magnet stand — 28 sets
  - Clamp — 30 pcs.

- Accelerometer 2 sets
- X-Y recorder 2 sets
- Cassette data recorder 1 set
- Strain meter 1 set
- Switch & balancing box 1 set
- Digital strain meter 2 sets

6) Drafting Room

(Newly provided equipment)

• Drafting machine 7 sets

(3) Building Material Laboratory

1) Concrete Mixer Room

(Newly provided equipment)

• Cement Testing Apparatus
- Cube mould 5 sets

• Fresh Concrete Testing Apparatus
- Concrete mixer 1 set
- Forced stirring mixer 1 set
- Slump test apparatus 3 sets
- Washing analysis test set for fresh concrete 1 set
- Washington type air meter 2 sets
- Bleeding test set 1 set
- Concrete flow apparatus 1 set
- Compaction factor tester 1 set
- Proctor penetration resistance apparatus 1 set
- Concrete curing box 1 set

• Hardened Concrete Testing Apparatus
- Cylinder mould (10 × 20 cm) 40 sets
- Beam mold 20 sets
- Internal vibrator 2 sets
- Capping Apparatus (ø5, ø10, ø15) 1 set/each
- Grouting concrete pump 1 set
- Concrete abrasion testing machine 1 set
- Sand bag for impact test of wall panel 1 set
- Diamond bit 1 set

- Core drill 1 set
- Forklift (1.5 ton) 1 unit
- Movable pallet 3 sets

• General Physical Testing Apparatus
- 20tf mortar compression testing machine 1 set
- 100tf concrete compression testing machine 1 set
- 200tf universal testing machine 1 set
- 10tf wood universal testing machine 1 set

(Relocated equipment by the Indonesian side)
- Core drill 1 set
- Concrete masonry saw 1 set
- Cube mould 30 sets
- Beam mould 10 sets
- Table vibrator 1 set
- Capping apparatus 1 set
- Concrete abrasion testing machine 1 set

2) Cement & Concrete Testing Room

(Newly provided equipment)

• General Physical Testing Apparatus
- Blain air-permeability apparatus 1 sets
- Vicat apparatus with dumper 2 sets

• General Chemical Testing Apparatus
- Electric balance 2 sets

• Cement Testing Apparatus
- Briquet cement tensile strength tester 1 set
- Three gang cube mortar mould 10 sets
- Mortar flow apparatus 1 set
- Mortar mixer 1 set
- Cement length comparator 1 set
- Autoclave 1 set
- Concrete length comparator 1 set
- ASTM briquet mould 3 sets
- Comparator mould 5 sets

- Hardened Concrete Testing Apparatus
  - Motorized mortar permeability test apparatus — 1 set
  - Schmidt test hammer (type N, L) — 1 set/each
  - Concrete permeability apparatus — 1 set
  - Cylinder mould (ø5 cm × 10 cm) — 20 sets

- Testing Apparatus for Cement and Cement-Based Materials
  - Ultrasonic non-destructive meter — 1 set
  - Non-destructive bar detection meter — 1 set

- Fresh Concrete Testing Apparatus
  - Constant humidity cabinet — 1 set

(Relocated equipment by the Indonesian side)

- Testing Apparatus for Cement Based Materials
  - Ultrasonic non-destructive meter — 1 set
  - Non-destructive bar detection meter — 1 set

- Cement Testing Apparatus
  - Three gang cube mould — 10 sets
  - Mortar flow apparatus — 1 set
  - Mortar mixer — 1 set
  - Vicat apparatus — 1 set
  - Drying oven — 1 set
  - ASTM mould — 5 sets
  - Mortar grinder — 1 set

3) Aggregate Testing Room

(Newly provided equipment)

- Hardened Concrete Testing Apparatus
  - Concrete crasher — 1 set
  - Concrete mill — 1 set

- Aggregate Testing Apparatus
  - Aggregate test sieve set — 2 sets
  - Ro-Tap sieves shaker — 1 set
  - Sample splitter — 1 set
  - Sand absorption cone — 1 set
  - Coarse aggregate specific gravity test set — 1 set

- Scratch hardness tester — 1 set
- Unit weight of aggregate determination test set — 1 set
- Planimeter — 1 set

(Relocated equipment by the Indonesian side)

• Aggregate Testing Apparatus
- Aggregate test sieve set — 2 sets
- Sieve shaker — 3 sets
- Sand absorption cone — 1 set
- Los Angeles testing machine — 1 set
- Aggregate impact test machine — 1 set
- Sample splitter — 1 set

4) Wood Testing Room

(Newly provided equipment)

• Testing Apparatus for Wood & Wood-based Materials
- Wood moisture content meter — 1 set
- Small-scale wood drying chamber — 1 set
- Small-scale vacuum pressure wood preservation chamber — 1 set
- Pesticide retention analyzer — 2 sets
- Laboratories flaker machine — 1 set
- Coating machine — 1 set
- Glue spreader — 1 set

5) Plastics/Coating Testing Room

(Newly provided equipment)

• Testing Apparatus for Plastics and Coating Materials
- Electromagnetic thickness meter for high precision measurement — 1 set
- Paint abrasion test apparatus — 1 set
- Paint refraction tester — 1 set
- 10 tf universal testing machine — 1 set

6) Chemical Testing Room

(Newly provided equipment)

- General Chemical Testing Apparatus
  - pH meter 1 set
  - Analytical balance 1 set
  - Spectrophotometer 1 set
  - Drying oven 1 set
  - Water bath 2 sets
  - Water still 1 set
  - Magnetic stirrer 2 sets
  - Thermometer 1 set
  - Vacuum pump 1 set
  - Centrifuge 1 set
  - Shaker 1 set
  - Muffle furnace 1 set
  - Hot plate 1 set
  - Auto titrator 1 set
- Aggregate testing apparatus
  - Polarizing microscope and camera 1 set

(Relocated equipment by the Indonesian side)

- General Chemical Testing Apparatus
  - Analytical balance 2 sets
  - Hot plate 1 set

7) Engineer's Room

(Newly provided equipment)

- Camera, video, etc. 1 set

(4) Fire Testing Laboratory

1) Test Hall

(Newly provided equipment)

- Furnace for Wall 1 set
  - Blower for combustor 1 set
  - Fuel supplying system 1 set

- Exhausting blower	1 set
- Temperature recorder	1 set
• Multiple Type Furnace	1 set
- Blower for combustor	1 set
- Fuel supplying system	1 set
- Exhausting blower	1 set
- Temperature recorder	1 set
• Others	
- Travelling crane (5 ton)	1 unit

(Relocated equipment by the Indonesian side)

• Small Fire Furnace for Wall	1 set
- Blower for combustor	1 set
- Fuel supplying system	1 set
- Exhausting blower	1 set
- Temperature recorder	1 set

2) Material Combustibility Room

(Newly provided equipment)

- Elementary material heating furnace	1 set
- Ignitability tester	1 set
- CO analyzer	1 set

(Relocated equipment by the Indonesian side)

- Surface test apparatus	1 set
- 2 feet flame tunnel	1 set
- Fire test cabinet	1 set
- Fire tube apparatus	1 set
- Flash point tester	1 set
- Thermal conductivity meter	1 set
- Digital balance	1 set
- Oven	1 set
- Gas leak detector	1 set
- Decicator	1 set

(5) Sanitary Engineering Laboratory

1) Test Hall (including Physical Laboratory)

(Newly provided equipment)

- Physical Test Equipment
  - Zeta-potentiometer unit 1 set
  - Ultrasonic and eddy current testing unit 1 set
  - Earth resistivity meter 1 set
  - Total dust sample 1 set
  - Digital dust indicator 1 set
  - Root growth testing unit 1 set
  - Water leakage detector 1 set
  - Digital abbe refractometer 1 set

- General Testing Apparatus for Liquid & Solid Waste
  - Monitor type muffle furnace 1 set
  - Apparatus for determination and distillation of solid waste 1 set
  - Draft chamber 1 set
  - Experiment bench L.S.
  - Working table L.S.

(Relocated equipment by the Indonesian side)

- Current meter 1 set
- Compressor 1 set
- Electrical pump 1 set
- Shelves 1 set
- Pocket compass 1 set
- Others L.S.

2) Chemical Laboratory

(Newly provided equipment)

- General Testing Apparatus for Water Quality
  - Ratio turbidmeter 1 set
  - Ternary gradient programmable high performance liquid choromatograph with microprocessor 1 set
  - Polarized zeeman atomic absorption spectrophotometer 1 set
  - Shaking incubator 1 set
  - Refrigerated incubator 1 set

- Reverse osmonis water purifier	2 sets
- High and low temperature water bath	2 sets
- COD-analyzer	1 set
- BOD-tester	1 set
- Automatic titration apparatus	1 set
- Water still	1 set

• Chemical Test Equipment

- Kjeldahl nitrogen digestion and distillation apparatus	1 set
- Automatic total organic carbon analyzer	1 set
- Draft chamber	1 set
- Testing bench	L.S.

(Relocated equipment by the Indonesian side)

- Incubator	1 set
- Oven	1 set
- Water bath	1 set
- Hot plate	1 set
- Others	L.S.

3) Microbiological Laboratory

(Newly provided equipment)

• General Microbiological Test Apparatus

- Microscope with supporting apparatus	
Attachable camera	1 set
Attachable objective projector	1 set
- Colony counter	1 set
- Draft chamber	1 set
- Testing bench	L.S.

(Relocated equipment by the Indonesian side)

- Microscope	1 set
- Glassware etc.	L.S.

4) Preparation Room

(Newly provided equipment)

· Testing Bench	L.S.

(Relocated equipment by the Indonesian side)

- Glassware etc.	L.S.

5) Storage

(Newly provided equipment)

· Portable Test Kits

- Water pollution test kit	3 sets
- Portable NOx content meter	1 set
- Portable SOx content meter	1 set
- Portable CO content meter	1 set
- Portable hydrocarbon content meter	1 set
- Portable oil content meter	1 set
- Shelf	L.S.

(Relocated equipment by the Indonesian side)

- Water pollution outfit	1 set
- Jig saw	1 set
- Portable generator	1 set
- Water piping tools	1 set
- Dish-washer machine	1 set
- Others	L.S.

(6) Workshop

1) Wood Work Shop

(Newly provided equipment)

- Surface planer	1 set
- Handy drill	1 set
- Grinder	1 set
- Belt sander	1 set
- Jig saw	1 set
- Universal profiling machine	1 set
- Dust collector	1 set

(Relocated equipment by the Indonesian side)

- Jointer machine 1 set
- Face cut machine 1 set
- Tool grinder 1 set
- Grinder 1 set
- Surface planer 1 set
- Band saw 1 set
- Mountable drill 1 set

2) Metal Workshop

(Newly provided equipment)

- Lathe machine 1 set
- Milling machine 1 set
- Shaping machine 1 set
- Panel saw 1 set
- Lever shear 1 set
- Spot welding machine 1 set
- Disc grinder 1 set

(Relocated equipment by the Indonesian side)

- Arc welding machine 1 set
- Lever shear 1 set
- Pipe bending machine 1 set
- Air compressor 1 set
- Mountable drill 1 set
- Cutting saw 1 set