(4) Functional, Easy to Use Facilities

Efficient flow lines for administrative staff, teaching staff, trainees and visitors should be clearly identified, allowing good communication between them and ensuring the fully functioning and ease of use of each building.

(5) Environment-Friendly Facilities

Given the prospective activities of the CETRAC, there will be a lot of noise, vibration and dust. As houses are scattered around the planned site, special care should be taken to minimise the adverse impacts of the unavoidable but undesirable consequences of training activities vis-a-vis these houses. A proper waste water treatment facility should be established to meet the water quality standards for waste water drainage.

(6) Facilities for Implementation of Effective Technology Cooperation Activities

Using the results of the preliminary and long-term surveys as a basis, the efficiency of technology cooperation activities will be ensured by providing suitable facilities.

4.2 Examination of Design Conditions

4.2.1 Facility Configuration

The CETRAC's facilities will consist of those blocks described in 3.2.5. The necessary rooms for each block have been identified and located in a functional manner to give each block integrity with all related functions being grouped based on the site conditions and requirements of a training facility for construction equipment mechanics. The resulting configuration of the CETRAC consists of 4 buildings and auxiliary facilities as described below.

(1) Administration Building

The Administration Building will have the following rooms and offices related to the administration of the CETRAC.

manager's office, deputy manager's office, instructors' rooms, senior consultants' office, demonstrators' room, reception room, conference room, administration office, curriculum development office, lecture hall, library, machine room, power room, others

(2) Training Building

The Training Building will have the following rooms related to practical training and lectures.

training rooms (2), lecture rooms (4), cutaway model room, computer room, test rooms, workshops, parts storage, others

(3) Canteen Building

The Canteen Building will have the following rooms.

trainee dining room (75 seats), staff dining room (20 seats), kitchen, kiosk, canteen office, pump room, others

(4) Dormitory Building

The Dormitory Building will have the following rooms.

twin bedrooms (30), single bedrooms (8), dormitory office, living room, study room, others

In addition to the above, corridors, connecting corridors, garage and elevated water tank will be constructed.

4.2.2 Facility Size

The following size of each room has been decided based on the number of people using the rooms, the objectives of the rooms, comparison with similar facilities in Sri Lanka and Sri Lankan and Japanese data to estimate the necessary floor area.

- Administration Office/Assistant Staffs' Room/Janitor's Room

Based on Japanese data to estimate the floor area and the customary furniture setting in Sri Lanka (independent setting), the floor area per person is set at 6.5 m^2 for the administration office, 5.5 m^2 for the assistant staff room and 5.0 m^2 for the janitor's room.

- Instructors' Room/Demonstrators' Room/Consultants' Room

Based on Japanese data to estimate the floor area and the customary furniture setting in Sri Lanka (independent setting), the floor area per person is set at 8.0 m^2 for the instructors'

room, 6.5 m^2 for the demonstrators' room and 12.0 m^2 for the senior instructor's room and consultants' room.

- Conference Room/Lecture Hall

Based on Japanese data to estimate the floor area, the floor area per person is set at 3.5 m^2 for the conference room and 1.5 m^2 for the lecture hall.

- Lecture Rooms/Training Rooms

Based on a class size of 20 trainees/course, the floor area is set at 40 m^2 for the lecture rooms and 50 m^2 for the training rooms, taking the necessary desk and chair layout for the respective activities into consideration.

- Workshops

Based on the workshop size of similar facilities, the floor area of each workshop has been determined to permit a good equipment layout and high level of training.

(1) Administration Building

Room/Office	Planned Floor Area (m^2)	Remarks
Manager's Office	40	
Deputy Manager's Office	26	
Reception Room	36	
Senior Consultants' Office	40	
Consultant's Room	48	12 $m^2 \times 4$
Senior Instructors' Room	24	12 $m^2 \times 2$
Instructors' Room	48	8 $m^2 \times 6$
Visiting Instructors' Room	24	8 $m^2 \times 3$ (plus reserve space for additional instructor)
Curriculum Development Office	52	8 $m^2 \times 5$ plus work space (12 m^2)
Editing Room	26	
Reference Room	26	
Administration Office	78	6.5 $m^2 \times 12$
Conference Room	132	53 $m^2 \times 2$ Rms.(3.5 $m^2 \times 15$) 26$m^2 \times$ 1 Rm (3.6$m^2 \times 8$)
Lecture Hall	113	1.5 $m^2 \times 75$
Preparation Room for the Above	30	
Library	106	
Assistant Staff Room	22	5.5 $m^2 \times 4$
Janitor's Room	25	5 $m^2 \times 5$
First Aid Room	20	
Printing Room	20	
Locker Room	52	
Power Room	80	
Machine Room	35	
Storage	20	
Sub-Total	1,098	
Toilets/Corridors/Hallways	703	
Total	1,801	

(2) Training Building

Room/Office	Planned Floor Area (m^2)	Remarks
Lecture Room	120	40 m^2 × 3 Rms
Training Room	100	50 m^2 × 2 Rms
Preparation Room for the Above	26	
Computer Room	106	16 seats
Preparation Room for the Above	26	
Locker Room	35	
Demonstrators' Room	26	
Helpers' Room	26	
Drivers' Room	24	
Cutaway Model Room	77	
Parts Storage	148	
Tool Storage	30	
Mechatronic Training Room	120	80m^2× 1 Rm 40m^2 × 1Rm
Chassis Workshop	400	
Transmission Workshop	200	
Engine Workshop	300	
Tyre Workshop	100	
Under-Carriage Workshop	200	
Electric Workshop	80	
Fuel Injection Workshop	52	
Hydraulic Workshop	80	
Machine Workshop	50	
Welding Workshop	50	
Engine Test Room	72	Including instrumentation room
Hydraulic Test Room	52	
Battery Room	26	
Compressor Room	26	
Storage	56	
Sub-Total	2,608	
Toilets/Corridors/Hallways	743	
Total	3,351	

(3) Canteen Building

Room/Office	Planned Floor Area (m^2)	Remarks
Trainee Dining Room	150	2 m^2 × 75
Staff Dining Room	50	2.5 m^2 × 20
Kitchen	100	
Canteen Office	10	
Kiosk	20	
Pump Room	12	
Sub-Total	342	
Toilets/Corridors/Hallways	82	
Total	424	

(4) Dormitory Building

Room/Office	Planned Floor Area (m^2)	Remarks
Twin Bedrooms	480	16 m^2 × 30 Rms
Single Bedrooms	96	12 m^2 × 8 Rms
Dormitory Office	28	Including reception area
Living Room	84	42 m^2 × 2
Study Room	50	
Storage	20	
Toilets	120	60 m^2 × 2
Sub-Total	878	
Toilets/Corridors/Hallways	422	
Total	1,300	

Total of (1) - (4)	:	6,876 m^2
Garage	:	166 m^2
Connecting Corridors	:	97 m^2
Elevated Water Tank	:	42 m^2
Grand Total	:	7,181 m^2

4.3 Basic Design for Project Components

4.3.1 Site Layout Plan

The project site has a land area of some 15,700 m^2 and is some 120m long in the east-west direction and some 130m long in the north-south direction. Three sides of the site are bordered by a 6m wide road to the east, north and west. Approach to the site will be made from the 15m wide trunk road to the south.

The site is not sufficiently large enough for the proposed training centre for construction equipment mechanics and its northeastern corner is dented by some 30m in the east-west direction and some 40m in the north-south direction. The site also continuously slopes upwards from south to north with an elevation difference of approximately 10m. The site conditions are, therefore, quite difficult in terms of the facility layout plan. The surrounding area is a good residential area with houses scattered to the east, north and west. To the northwest, the Overseas Children's School (OCS), a well-known international school for the children of foreign diplomats and businessmen stationed in Colombo, is situated nearby. The main building of the Ministry of Education is also situated nearby to the south of the site. Given its planned functions, the CETRAC could become an undesirable source of noise,

vibration and dust and, therefore, proper care must be taken in the layout plan and architectural plan to minimising adverse impacts on the area's currently good environment.

A big problem of the layout plan is the location of the Training Building which requires wide frontage and the test yard which should be in front of the Training Building. In view of minimising adverse impacts on the surrounding area while maintaining good communications with the other buildings, the Training Building has been located slightly to the north of the site's centre with the building axis running from east to west. Having calculated a good balance between the required cutting and banking work, the elevation of the Training Building and test yard to the south of the building has been set at GL+17m. The Administration Building will be constructed on the same level to the south of the Training Building and to the west of the test yard.

The Dormitory Building and Canteen Building which will provide daily living space for the trainees have been placed to the north of the Training Building with an elevation of GL+22m. Although the distance between the 2 buildings is only approximately 10m, the elevation difference of 5m should provide these 2 buildings with a comfortable living environment.

The garage and car wash with a high wall behind them have been placed to the west of the test yard so that the high wall and garage will minimise adverse environmental impacts on the area behind the wall.

Vehicle and pedestrian access to the site will be from the front road at an elevation of approximately GL+13m and following a sloping access road (gradient of approximately 1:10) to a driveway located between the Administration Building and Training Building. In view of the efficient use of the available land, parking spaces will be provided around the driveway. The same route can be used by heavy construction machinery to the test yard to reduce the land earmarked for premise roads.

The delivery of foodstuffs to the kitchen of the Canteen Building and furniture and fixtures to the Dormitory Building can be made directly from the 6m road to the north via the service yard located between the Canteen Building and Dormitory Building. The flow line which runs right across the Administration Building, Training Building, Canteen Building and Dormitory Building from south to north will systematically and clearly combine the functions of each building.

4.3.2 Architectural Plan

The project site is subject to high temperatures and high humidity throughout the year with strong sunlight and occasional strong squalls. Such architectural design arrangements as side corridors for good natural ventilation and wide eaves are required to achieve energy saving and good maintenance.

The layout of the rooms and offices, etc. has been decided taking their functions and characteristics, prospective relationship between them and their efficient use into consideration. The architectural design of the buildings is intended to provide them with individual characters in terms of both the planning and cross-section.

(1) Administration Building

The Administration Building will be both the face and brain of the CETRAC. The lobby situated at the end of the entrance hall can be used for exhibitions or as a place for communication between staff and visitors. The offices and rooms of the teaching staff are all located on the first floor and a connecting corridor is provided for easy access to the neighbouring Training Building to facilitate efficient training.

Basement : power room, machine room

Ground Floor : administration office, lobby, lecture hall, conference room, first aid room, janitor's room, locker room

First Floor : manager's office, deputy manager's office, reception room, senior instructors' room, instructors' room, visiting instructors' room, senior consultants' office, consultants' room, curriculum development office, editing room, reference room, library, assistant staff room

(2) Training Building

The main features of the Training Building are a flexible layout of the main workshops with other related workshops and test rooms being placed adjacent to them to achieve efficient practical training and insulated training and lecture rooms to create quiet space despite their proximity to the workshops.

Ground Floor : workshops, test rooms, parts storage, tool storage, training rooms, training preparation room, demonstrators' room, helpers' room, drivers' room, locker room

First Floor : lecture rooms, cut model room, computer room, computer preparation room, training room

(3) Canteen Building

The Canteen Building will have a terrace with wide eaves in front of the dining rooms for various functions.

Ground Floor : trainee dining room, staff dining room, kitchen, canteen office, kiosk, pump room

(4) Dormitory Building

The side corridor bedrooms surrounding a courtyard can expect good natural ventilation to provide comfortable living space. The living rooms also face the courtyard and are designed to be places of relaxation and communication between trainees.

Ground Floor : bedrooms, toilets, living room, dormitory office

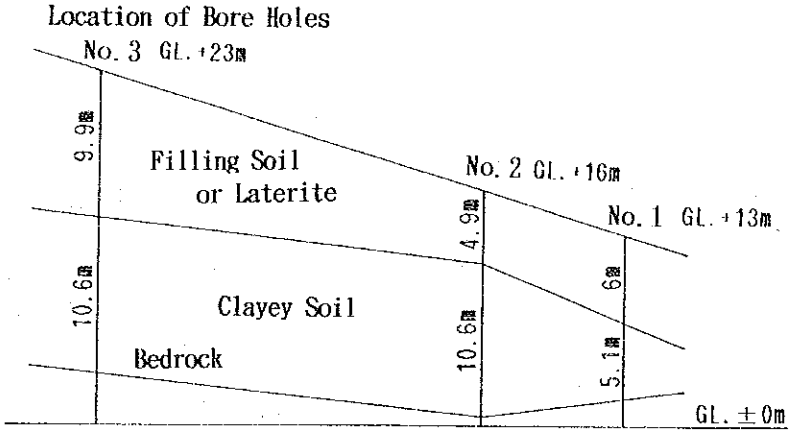
First Floor : bedrooms, toilets, living room, study room

4.3.3 Structural Plan

The structural plan for the CETRAC facilities is designed to emphasise rationalisation and economy with proper consideration given to the purposes, functions and scale of the buildings. In principle, a reinforced concrete structure which is the most popular structure in Sri Lanka will be used for the main structure although a steel structure will be partially used for the long span frame.

(1) Soil Conditions and Type of Foundation

The geological survey conducted at the project site found the strong bedrock formation illustrated below regardless of the ground being sloping. This bedrock is covered with clayey soil with a N value of some 15 and the surface soil is either filling soil or laterite.



Considering the building scale and design bearing strength estimated based on the N value, direct foundations are planned for the Canteen Building and Dormitory Building while concrete pile foundations supported by the bedrock are planned for the Administration Building and Training Building.

(2) Building Structure and Design Standards

The basic structure for all the buildings is a RC rigid frame structure with a steel structure partially used for the Training Building. A steel structure will also be used for the roof of the driveway for the Administration Building. External walls and partitions will be constructed using concrete blocks.

Expansion joints will be used between the Training Building and Administration Building to suggest an explicit structural concept to reflect the different characters of the 2 buildings and to prevent the buildings from becoming too long.

As Sri Lanka usually uses British Standards for building design, the following latest standards are used for the present purposes.

- Dead Load, Live Load : BS 6399 Part 1
- Wind Load : BS CP 3 Chapter V
- RC Structure : BS CP 110
- Steel Structure : Architectural Institute of Japan Design Standards

The live load for the main rooms will be as follows.

Room	Live Load: kg/m^2
Staff Office/Room	306
Training Room	306
Laboratory	306
Administration Office	225

(3) Construction Materials

Construction materials will be procured locally where possible. However, those local materials which are in short supply or of poor quality will be imported from Japan or a third country. Any procurement from a third country must satisfy 2 criteria, i.e. (i) lower price than the Japanese equivalent and (ii) proven good quality control.

Cement	:	ordinary Portland cement
Coarse Aggregate	:	locally procured crushed stone
Fine Aggregate	:	locally procured river sand
Steel Bars	:	Japanese (deformed reinforcing) bars
		D16 or under : SD 295A (JIS G3112)
		D19 or over : SD 345 (JIS G3112)
Structural Steel	:	Japanese H-section steel and light gauge steel
		SS 400 (JIS G3101)
		SSC 400 (JIS G3350)

4.3.4 Building Services Plan

(1) Basic Principles

The following principles apply to the basic design of the building services for the planned CETRAC facilities.

- Close linkage with planned building functions
- Appropriateness vis-a-vis natural conditions and daily lives of building users
- Selection of systems and equipment which are easy to inspect and maintain
- Low running cost and high energy saving

(2) Electrical Facilities

1) Power Extension to Site and Substation

① Voltage and Frequency

An aerial distribution line (3 phase, 3 wire, 11 KV, 50 Hz) of the CEB runs along Akuragoda Road to the south of the project site. A power pole will be erected on the site to extend power supply to the site by an aerial line. The work to change the height of the aerial high and low voltage distribution lines along the southern perimeter of the site will be conducted by the CEB (this work is, therefore, classified as work to be undertaken by the Sri Lankan side). (Fig. 4-1)

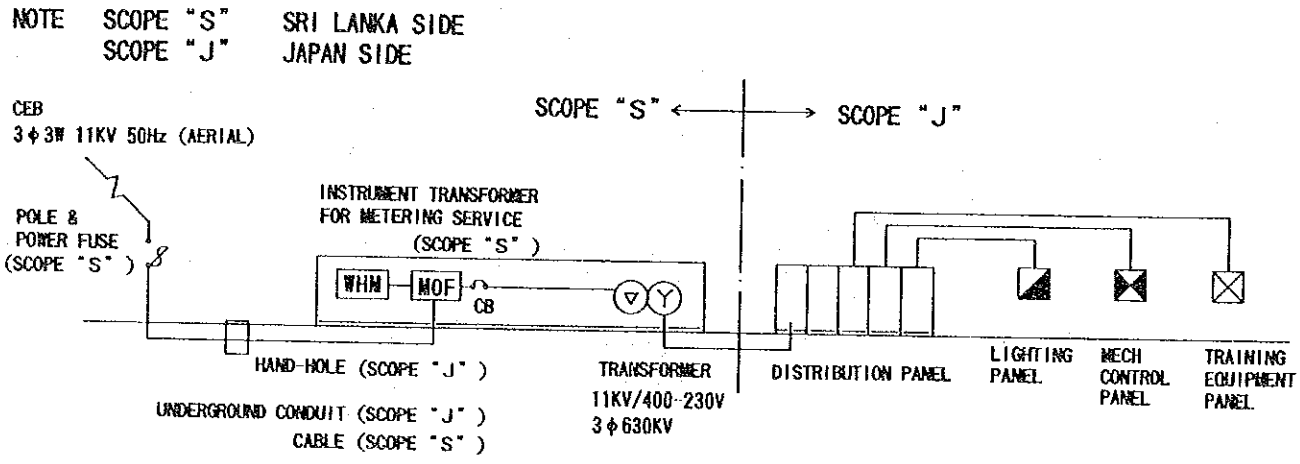


Fig. 4-1 Electrical Power Supply

② Substation

The substation will consist of a power room belonging to the CEB, in which a high voltage circuit breaker, transformer and electricity meter, etc. will be installed, and a power room belonging to the CETRAC, in which a low voltage distribution panel dealing with the secondary side of the transformer and a condensor panel will be installed.

③ Division of Work

The extension of high voltage power distribution to the site will be conducted by the Sri Lankan side. The demarcation point of the work will be the secondary side terminal of the transformer. Therefore, the Japanese side will be responsible for electrical installation from the secondary side of the transformer onwards.

2) Trunk Power Line

The low voltage power (3 phase, 4 wire, 400/230V) achieved by the transformer will be distributed to a switchboard and power control board in each building via the MCB of the low voltage distribution panel in the power room. The specifications and power load of the main trunk power line and others are as follows.

Main Power Line	:	3 phase, 4 wire, 400/230V
Lighting and Plug Sockets	:	single phase, 2 wire, 230V
Power for Fans and Pumps, etc.	:	3 phase, 3 wire, 400V
Training Equipment	:	3 phase, 4 wire, 400/230V

3) Lighting Installation

① Lighting Equipment

Fluorescent lamps will mainly be used as the light sources to achieve a low running cost and energy saving while incandescent lamps will be used in those places where they are required for architectural reasons. Emergency lamps will be installed at the evacuation exits from the buildings. The wiring inside the plenum above the suspended ceiling will use conduit upto the first box from the distribution panel and will then change to simple wiring between lighting equipment. The vertical wiring to wall switches will be protected by conduit. Small switching compartments will be introduced to minimise the running cost with a thinned-out operation mode available for corridor lighting. The luminous intensity for the different types of facilities is approximately as follows.

Administration Office/Lecture Rooms/Conference Room	:	400 - 500 lux
Workshops/Dining Rooms	:	300 - 400 lux
Hallways	:	100 - 200 lux
Toilets/Corridors/Storages	:	50 - 100 lux

② Plug Sockets

In addition to ordinary plug sockets in the administration office and lecture rooms, plug sockets with the appropriate capacities will be provided in such rooms as the computer room, workshops and kitchen, etc. where the extensive use of electrical equipment is planned. Earthing will be provided for equipment requiring special earth arrangements.

③ Ceiling Fans

Ceiling fans will be installed in the lecture rooms, conference room and administration office, etc.

4) Power Facility

A power control board will be installed in each machine room to operate the fan pump, etc. Power will also be supplied to the manual switches for the practical training equipment in each workshop. Warning systems for abnormal power load, abnormality of the septic tank and abnormal water level of the elevated water tank, etc. will be installed to signal the relevant warning on the warning panel in the administration office.

5) Telephone

① Extension to Site

Extension of the telephone line to the site currently appears difficult due to the lack of any surplus capacity at the telephone exchange serving the area. However, the number of lines required by the CETRAC will be available in the future with the planned completion of the work to add new switchboards and to lay a new trunk line in the Kotte District in March, 1995. The installation of approximately 10 lines is planned. The extension work upto the MDF will be conducted by the Sri Lankan side while the installation of a switchboard and wiring on the premises will be conducted by the Japanese side. (Fig. 4-2)

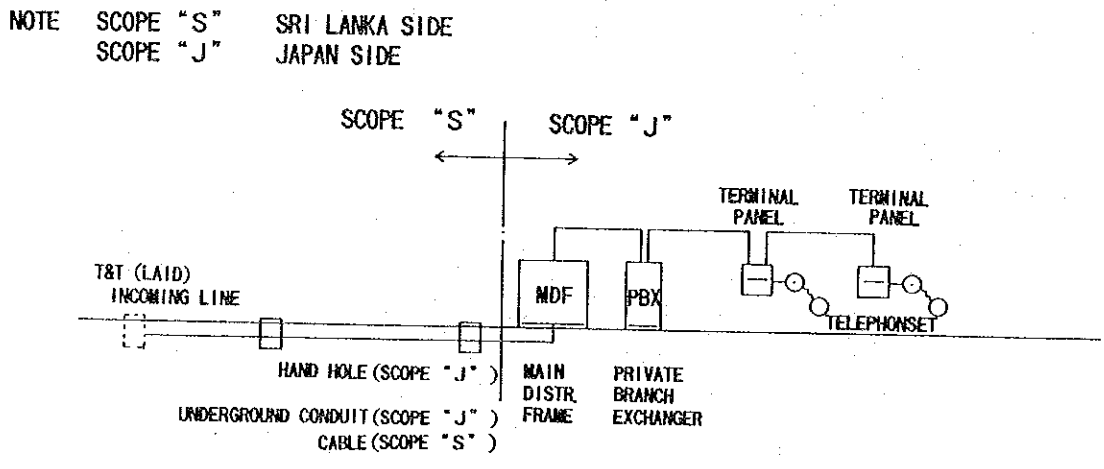


Fig. 4-2 Telephone Main Line

② Telephone Cabling

Telephone cable will be laid to the extension terminal board, relay terminal board in each building and telephone outlets in the main offices/rooms to that an internal telephone network as well as external connections can be installed.

③ Switchboard

A push-button telephone will be provided in the administration office and some 30 extension phones will be provided in the main offices/rooms.

6) Public Address System

① Public Address System for Buildings

A public address system consisting of speakers in the main offices/room and an amplifier and microphone in the administration office will be installed for internal communication, addresses and paging and for broadcasting the chime to signal the commencement and ending of lecture/training hours, etc. The system will be controlled by the administration office and independent broadcasting for each building or each floor of each building will be made possible.

② AV Equipment

Such AV equipment as a video projector, OHP and screen, etc. will be provided in the lecture hall and conference room. A video cassette recorder, monitor and OHP will also be provided in each lecture room.

7) Interphone System

An interphone system will be installed in the power and machine rooms and administration office for maintenance purposes.

8) Fire Alarm System

The fire alarm will be manually operated by pushing a fire button to ensure the swift detection and reporting of fires and safe evacuation. The alarm will be shown on the emergency alarm board in the administration office and the building from which the warning is made will be identified to start the pump for the fire plugs.

9) Common TV Reception System

A VHF-UHF-CS antenna will be installed with TV outlets for common TV reception in the administration office, lecture rooms, hallways and conference room, etc.

10) Lightning Rod

Due to the frequency of lightning in the area, a lightning rod will be installed to protect both people and buildings.

11) Outdoor Lighting

Outdoor lighting will be installed to ensure the security of the premises at night. Mercury lamps will be used with a photo-switch and timer to enable both manual and automatic operation.

(3) Air-Conditioning and Ventilation Facilities

In principle, natural ventilation will be adopted. However, mechanical air-conditioning and ventilation systems will be installed in those rooms whose functions or purpose of use justify such installation.

1) Air-Conditioning System

The following offices and rooms will be provided with air-conditioning.

Administration Building

conference room, conference preparation room, library, instructors' room, visiting instructors' room, consultants' room, senior consultants' room, reception room, manager's office, deputy manager's office, curriculum development office, editing room, reference room

Training Building

fuel injection workshop, computer room, computer preparation room, lecture rooms

An air-cooled, separate-type air-conditioner will be provided for each of the above rooms/office with a temperature control function introduced where necessary.

2) Ventilation System

The power rooms, battery room, printing room, kitchen and toilets will be provided with mechanical ventilation.

(4) Plumbing Services

1) Water Supply

The work to lay a 300mm main water supply line along the roads to the south and west of the site will be completed in January, 1996 and the water supply line to the CETRAC will branch out from this trunk line to the FRP water tank (30 m^3) which will be placed on the ground for easy maintenance and hygiene. It is estimated that the CETRAC will have a daily water consumption of approximately 40 m^3. Water will be pumped from the outdoor tank to an elevated water tank (4 m^3 to meet one hour's water consumption) and will then be distributed to each building using the gravity system. Two water pumps (one as a reserve) will be installed for alternate automatic operation. A chlorination unit will be linked to the water pumps to sterilise municipal water.

2) Waste Water Drainage

There will be 2 lines for waste water drainage from the buildings. One of these lines will be used for soil water and miscellaneous waste water while the another will be used for storm water. Soil water and miscellaneous water will be discharged into separate channels inside the buildings but will be merged together outside for drainage to the waste water treatment facility.

The waste water treatment facility will be located under the Administration Building, utilising the building structure in view of the lower elevation of the said building compared to the other buildings, for gravity drainage. The treated waste water will then be discharged to a nearby open ditch. All the drainage pipes will be hard vinyl chloride pipes due to the area's acid soil.

① Waste Water Treatment

As there is no sewer system in the area, the waste water treatment facility will be introduced to treat soil water and miscellaneous waste water. A water volume of some 40 m^3/day will be treated to a BOD level of 20 ppm to meet the industrial standard for waste water discharge. the waste water treatment facility will consist of a sand basin, regulating tank, disinfection tank and sludge condensation and storage tank. The treated water will be discharged to an open ditch after disinfection.

② Storm Water Drainage

Storm water will be discharged from the building roofs and ground via an independent drainage channel to a nearby open ditch for drainage outside the premises.

Estimated Waste Water Drainage

Waste Water by Staff	: 50 × 120 litres/person/day	=	6,000 litres/day
Waste Water by Trainees	: 100 × 200 litres/person/day	=	20,000 litres/day
Waste Water by Visitors	: 50 × 30 litres/person/day	=	1,500 litres/day
Miscellaneous		=	10,000 litres/day
Total			37,500 litres/day

The design waste water treatment volume is 40 m^3/day.

Waste Water Quality After Treatment (Standards for Septic Tank Construction, Ministry of Construction in Japan)

	Incoming Waste Water Quality	Treated Water Quality
BOD	220 ppm	20 ppm
SS	250 ppm	60 ppm
pH	5.8 - 8.6	5.8 - 8.6

3) Sanitary Fixtures

Such sanitary fixtures as closets, urinals, wash basins, mirrors, slop sinks and showers, etc. will be provided in the appropriate locations indicated in the architectural plan. Both Western and local closets will be provided.

4) Fire Extinguishing System

The fire extinguishing system for the CETRAC will be based on the Fire Services Act in both Sri Lanka and Japan. Indoor fire plugs will be installed every 100 feet. A fixed insertion-type hose will be used for both automatic and manual operation. Water inlets and outlets will also be installed.

5) LPG Supply

LPG will be used for cooking in the kitchen. A cylinder storage will be erected outside the Canteen Building to supply LPG to the kitchen.

6) Hot Water Supply

A storage-type electric water heater will be installed in the kitchenette of the Administration Building.

7) Kitchen

The necessary kitchen equipment to serve 25 staff members and 75 trainees will be provided for the kitchen of the Canteen Building.

4.3.5 Construction Materials Plan

Special emphasis must be given to the selection of those materials and construction methods which are appropriate for the local climate and which are familiar to the local construction workers. The following materials have been selected in view of their appropriateness vis-a-vis the purposes of each building and taking economy, durability and ease of maintenance into consideration.

(1) Main Structural Materials

Pillars/Beams/Floors	:	reinforced concrete is the rational choice in view of its wide use in Sri Lanka
Walls	:	concrete blocks with a mortar finish or extrusion moulded cement boards for the workshops (RC walls are difficult to employ in view of the local technical standard of form work and also in view of their cost; concrete blocks which are normally used are the most rational choice unless RC walls are required because of structural reasons; extrusion moulded cement boards will be used for the workshop walls in view of their easy workability vis-a-vis the high floor height requirement)
Roof Structure	:	steel and light steel (the roof structure for those workshops with a large span will be a steel truss structure)

(2) Exterior Finishing Materials

Sloping Roofs	:	single (with emphasis on durability, attractiveness and originality)
Flat Roofs	:	ventilation blocks on top of waterproof underlying felt or coloured corrugated sheeting for the workshops

Exterior Walls : resin sprayed onto mortar or extrusion moulded cement boards (it is essential that repairs or respraying can be conducted locally)

Doors and Window Frames: wood, steel, aluminium or stainless steel (in principle, wood doors except for some steel doors leading to the outside or in places where good sound insulation is required; aluminium window frames will be used in view of durability; some entrance doors will be made of stainless steel)

(3) Main Interior Finishing Materials

Office/Room	Floor	Walls	Ceiling	Emphasis	Air-Conditioning
Manager's Office, Deputy Manager's Office & Senior Instructors' Room	carpet tiles	paint on mortar	rockwool acoustic boards		o
Consultants' Room	"	"	"		o
Conference Room	"	"	"		o
Administration Office	terrazzo tiles	"	paint on mortar		
Lecture Hall	carpet tiles	steel panels with baking paint; partially perforated	rockwool acoustic boards	sound absorption	o
Library	"	wood panels with paint on mortar	"	silence	o
Curriculum Development Office	"	paint on mortar	"		o
Training Rooms	terrazzo tiles	"	"		
Workshops	concrete	" (semi-porcelain tiles for skirting)	paint on heat insulation boards	durability	
Lecture Rooms	terrazzo tiles	paint on mortar	rockwool acoustic boards	silence	o
Computer Room	carpet tiles	"	"	silence	o
Dining Room	terrazzo tiles	"	paint on mortar		
Kitchen	porcelain tiles	" (semi-porcelain tiles for skirting)	paint on calcium silicate boards	functionality	
Bedrooms	terrazzo tiles	paint on mortar	paint on mortar		
Common Space					
Entrance Hall Lobby	granite	paint on mortar (granite for skirting)	rockwool acoustic board		
Corridor/Staircase A	"	paint on mortar	paint on mortar		
Corridor/Staircase B	terrazzo tiles	"	"		
Toilets	ceramic tiles	" (semi-porcelain tiles for skirting)	paint on silicate calcium boards		

* Corridor/Staircase A: Administration Building, Training Building, Corridor/Staircase B: Dormitory Building

4.3.6 Equipment Plan

(1) Equipment Selection Criteria

The equipment required by the CETRAC is grouped into 3 categories, i.e. construction equipment, workshop equipment and training/educational equipment, and the following selection criteria are adopted for each equipment group.

1) Construction Equipment

- The scope of the construction equipment will be limited to equipment used for common civil engineering work (road work, river improvement work, water supply and sewer work and port development work, etc.) and equipment used for special purposes and equipment of which the use in Sri Lanka is very limited will not be included in the equipment to be provided under the Project.

- The most representative equipment will be provided in each of the following categories: excavation, loading, transportation, levelling, compacting, hoisting and general purpose.

- The equipment specifications will be equivalent to those of the most popularly used equipment. The equipment size should be determined in view of providing efficient maintenance training at the CETRAC.

- In principle, one piece of equipment will be provided for each type of equipment. However, the number will be 2 each in the case of bulldozers and excavators as these comprise the most basic construction equipment and are frequently used for practical training.

2) Workshop Equipment

- Based on all the necessary maintenance processes for various construction equipment in an actual workshop, the scope of the workshop equipment will be planned to permit the systematic learning of the necessary maintenance skills.

- The workshop equipment will include equipment to diagnose the nature of breakdowns and to conduct performance testing following the completion of repair work in order that trainees can learn proper maintenance techniques and skills based on theory.

- In addition to general purpose workshop equipment and tools, the provision of special tools for specific types of construction equipment will be considered to assist trainees to master safe and efficient maintenance skills in accordance with set procedures.

- Careful consideration will be given to the selection of such auxiliary fixtures as work tables, work shelves and parts shelves, etc. to maintain a tidy training environment.

- The equipment quantity and layout will be determined to ensure effective and efficient use in view of the planned training curriculum and methods.

- Due to the strong emphasis on the maintenance of the workshop equipment after its provision, easy to handle and easy to maintain equipment will be selected.

3) Educational/Training Equipment

- From among the many construction equipment components, real components will be selected for engines, electrical installation, fuel injection pumps, hydraulic systems and transmissions, etc. so that their structures and mechanisms can be properly studied.

- The extensive use of slides, video cassettes and films, etc. is planned for classroom use to enhance the educational effects of theoretical teaching.

- Given the recent progress of construction equipment which incorporate hydraulic and mechatronic mechanisms, the introduction of cut models, simulators and system boards will be installed to facilitate the study of such mechanisms and corresponding maintenance skills by trainees.

- The introduction of personal-computers will be installed for the training of parts control and work process control, etc.

(2) List of Main Equipment

The specifications and number of pieces of the main equipment, the procurement of which is deemed necessary for the CETRAC, have been determined and are given in the equipment list in the attached appendix..

(3) Spare Parts

While some spare parts for the various equipment to be used at the CETRAC are available in the local market, most of the required spare parts will require importation in view of the limited stock level of such spare parts. The spare parts import process usually requires 3 months and possibly more than 6 months in some cases. Given this prospect, the vital spare parts for each piece of equipment will be examined for their inclusion in the procurement plan.

The quantity of spare parts will be estimated as follows. The total cost is estimated to be some 15% of the original construction equipment procurement cost due to the high wear of parts resulting from frequent overhaul training. In the case of workshop equipment and educational/training equipment, 10% and 5% of the original procurement cost is judged to be appropriate.

4.4 Basic Design Drawings

01 SITE PLAN

02 PLAN-1

03 PLAN-2

04 PLAN-3

05 PLAN-4

06 ELEVATION-1

07 ELEVATION-2

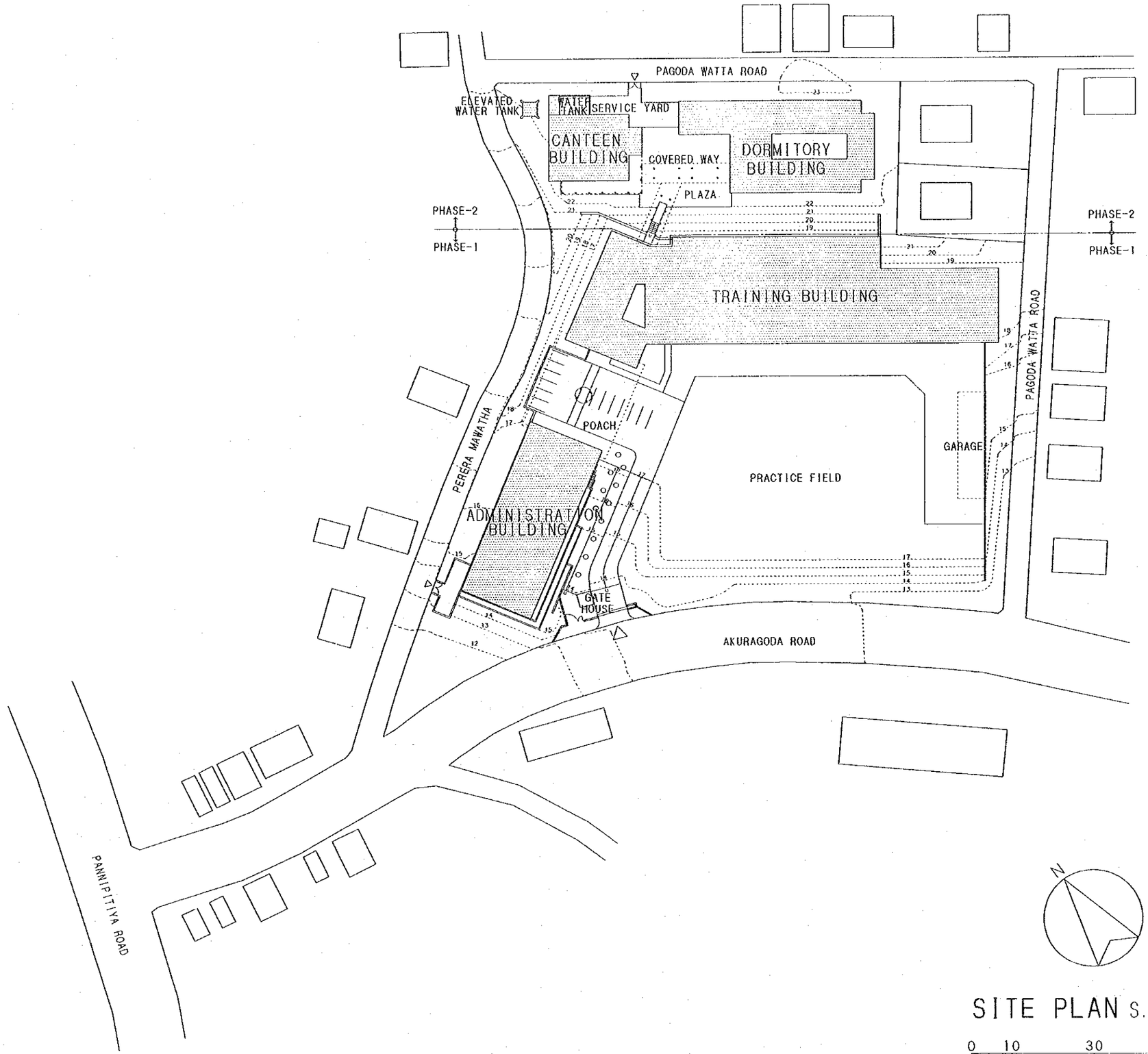
08 SECTION-1

09 SECTION-2

10 WATER SUPPLY, DRAINAGE SYSTEM PLAN

11 ELEC., TEL. SUPPLYING PLAN

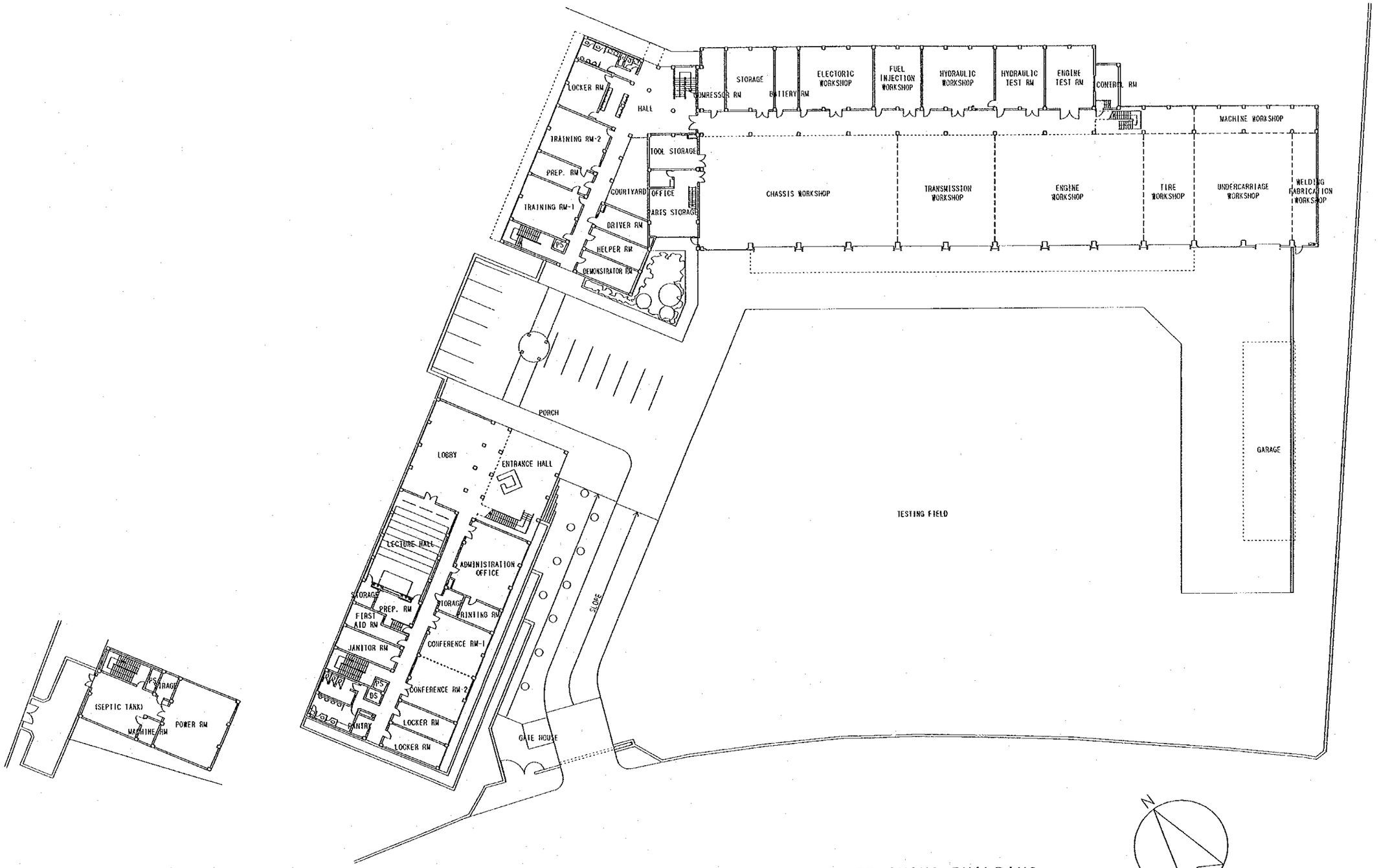
12 TRAINING EQUIPMENT LAYOUT PLAN



SITE PLAN S. 1:1000

0 10 30 50M

01



ADMINISTRATION BUILDING
BASEMENT FLOOR

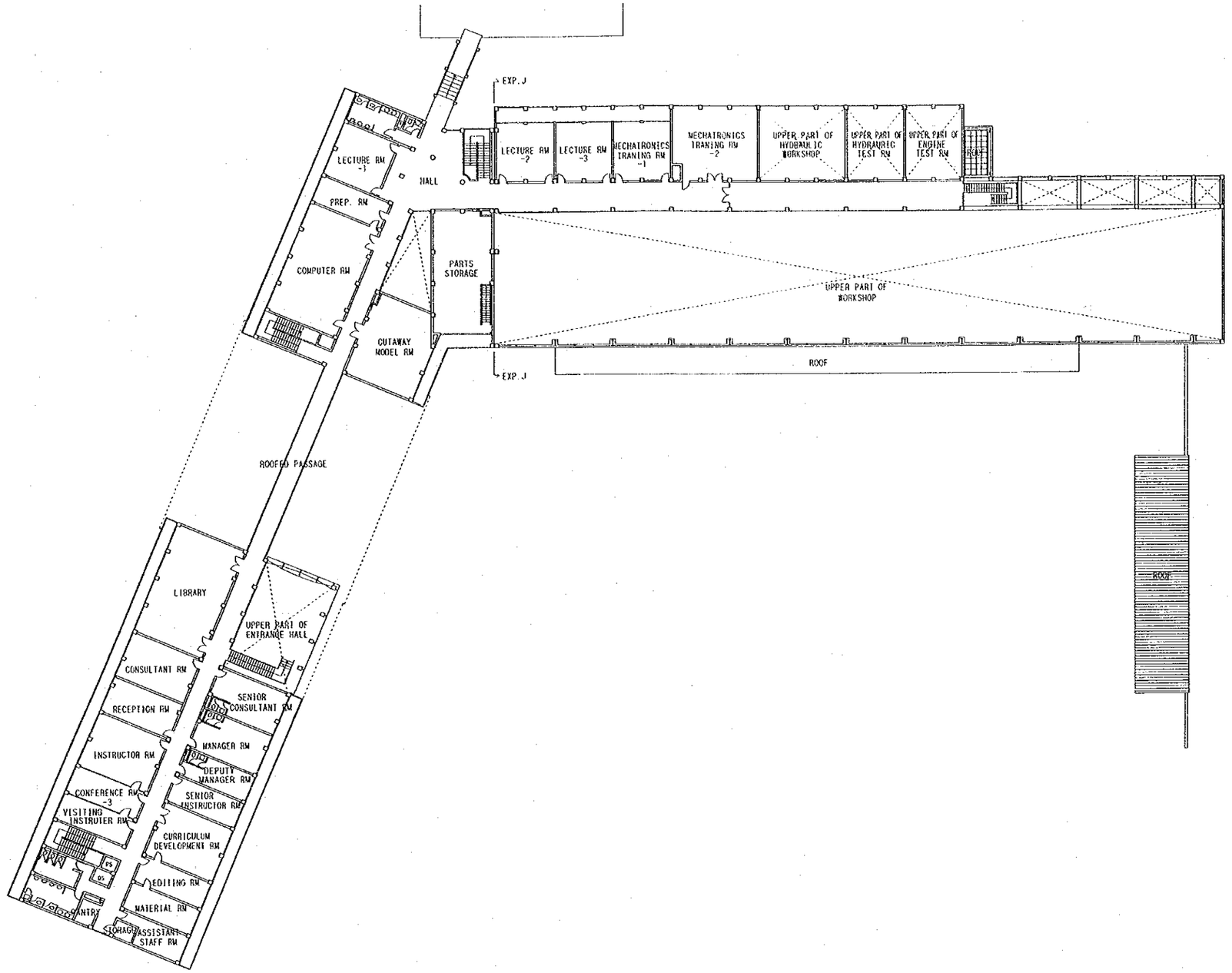
ADMINISTRATION BUILDING
GROUND FLOOR

TRAINING BUILDING
GROUND FLOOR

PLAN-1 S.1:500

0 5 10 20 30M

02



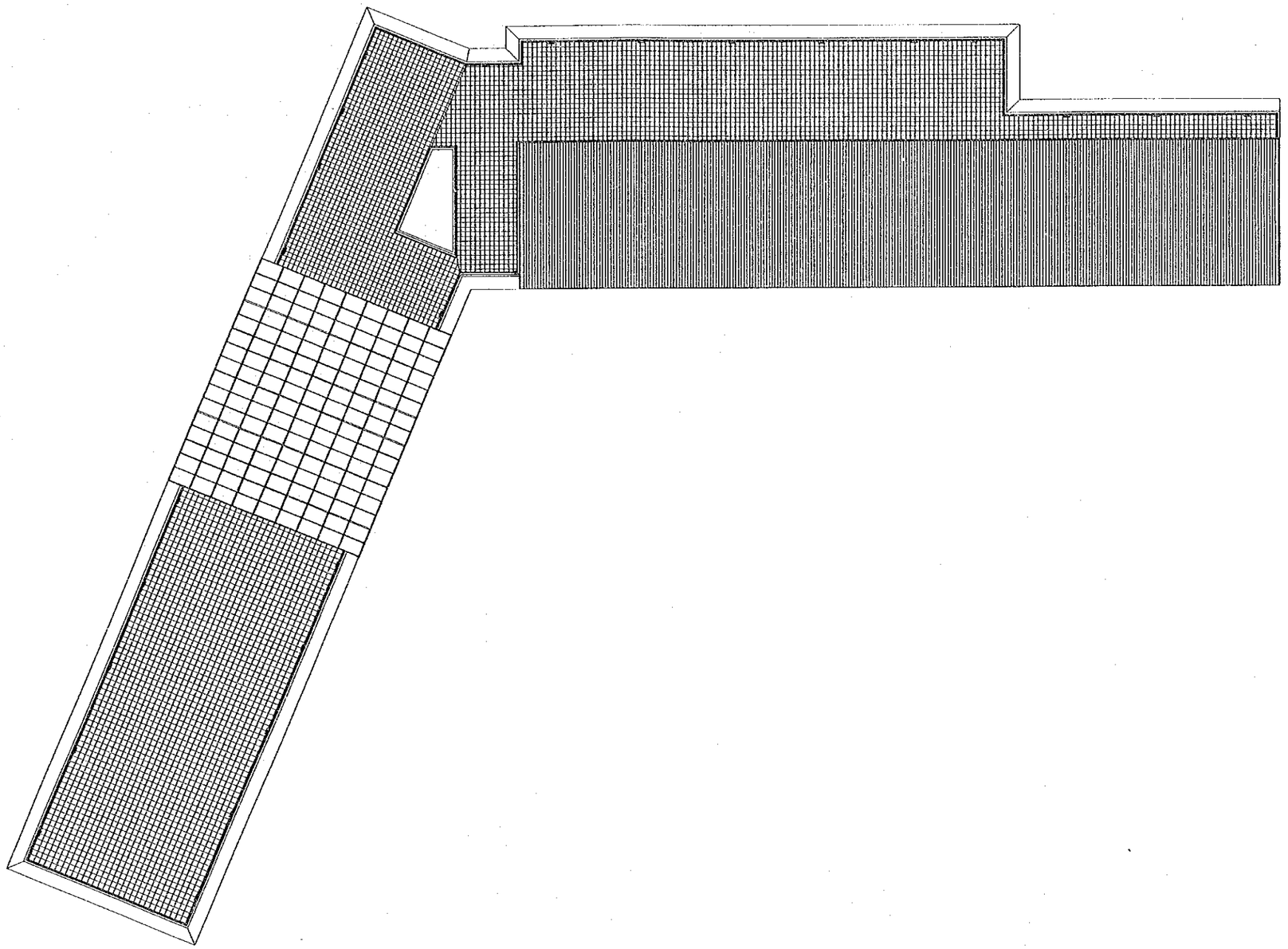
ADMINISTRATION BUILDING
1ST FLOOR

TRAINING BUILDING
1ST FLOOR

PLAN-2 S.1:500

0 5 10 20 30M

03



ADMINISTRATION BUILDING
ROOF PLAN

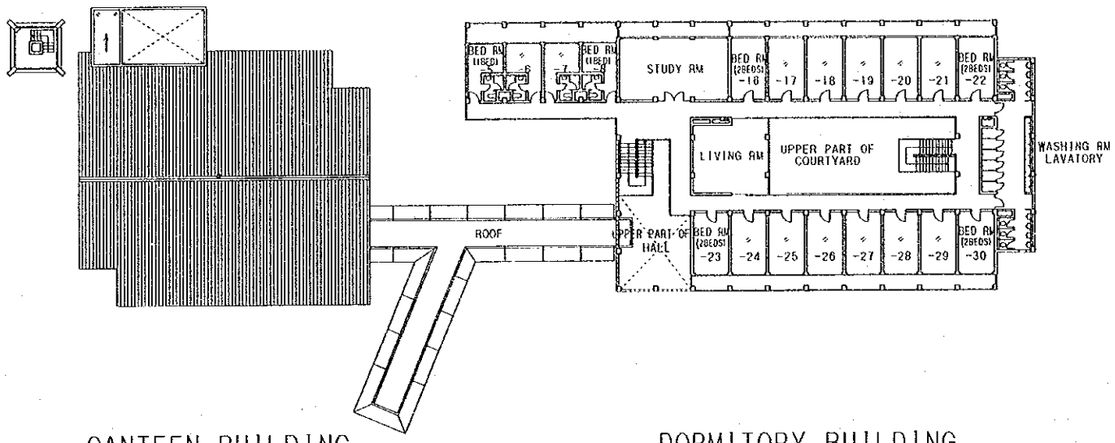
TRANING BUILDING
ROOF PLAN

N

PLAN-3 S.1:500

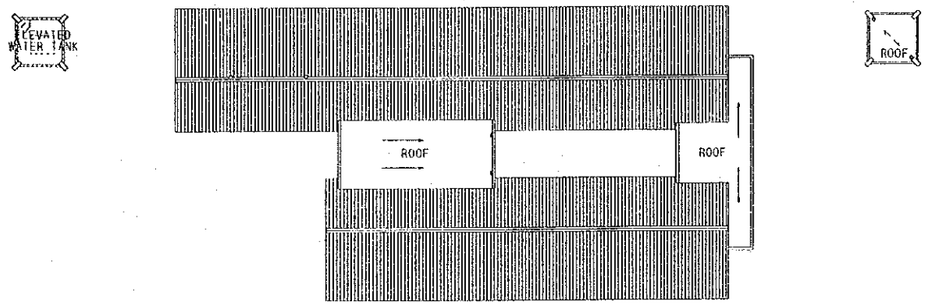
0 5 10 20 30M

04

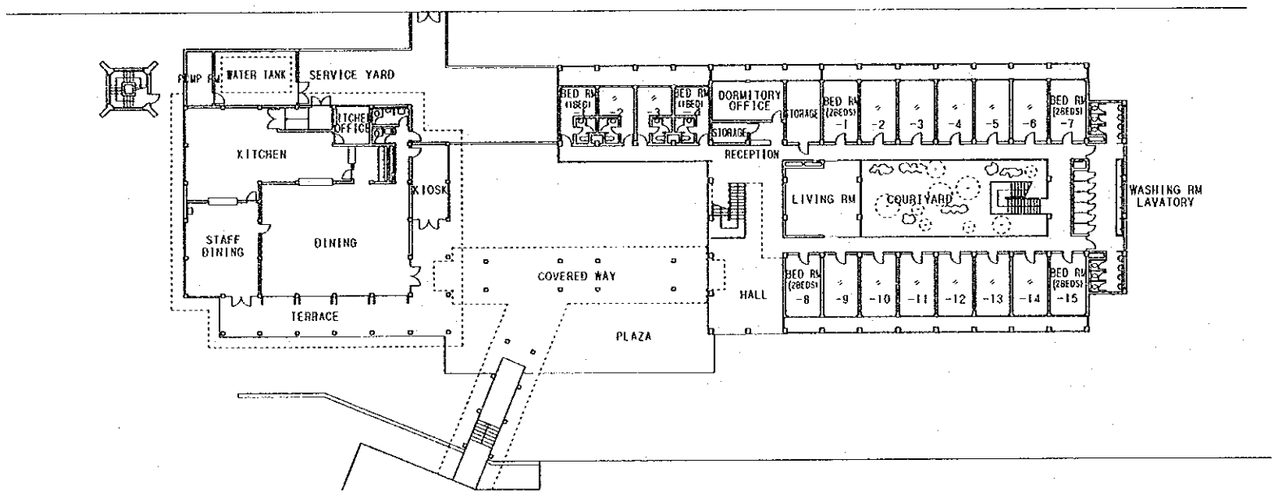


CANTEEN BUILDING
ROOF PLAN

DORMITORY BUILDING
1ST FLOOR

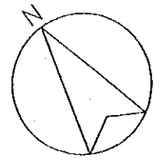


DORMITORY BUILDING
ROOF PLAN



CANTEEN BUILDING
GROUND FLOOR

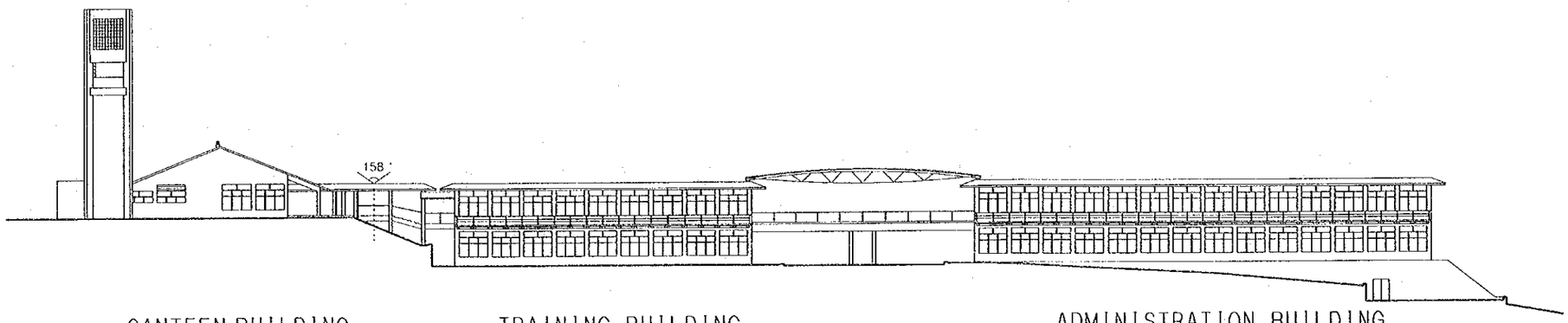
DORMITORY BUILDING
GROUND FLOOR



PLAN-4 S.1:500

0 5 10 20 30M

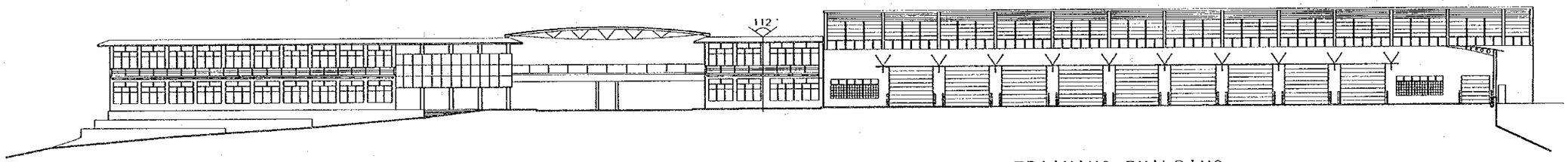
05



CANTEEN BUILDING
WEST

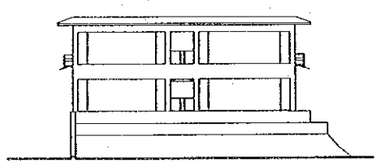
TRAINING BUILDING
WEST

ADMINISTRATION BUILDING
WEST

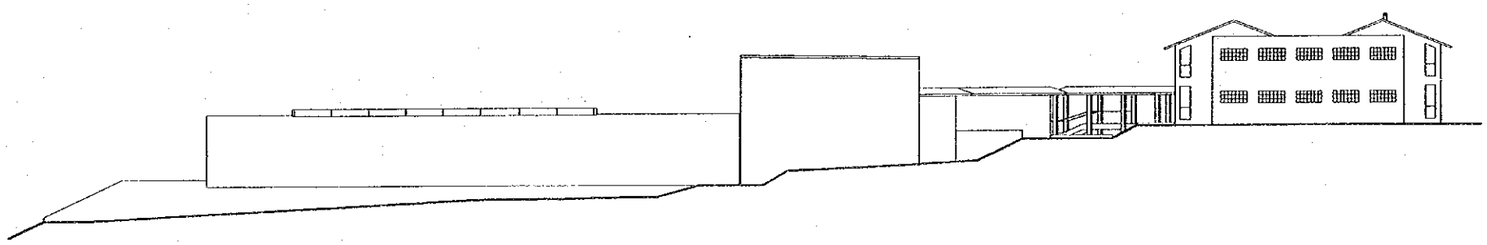


ADMINISTRATION BUILDING
EAST

TRAINING BUILDING
SOUTH



ADMINISTRATION BUILDING
SOUTH



GARAGE
EAST

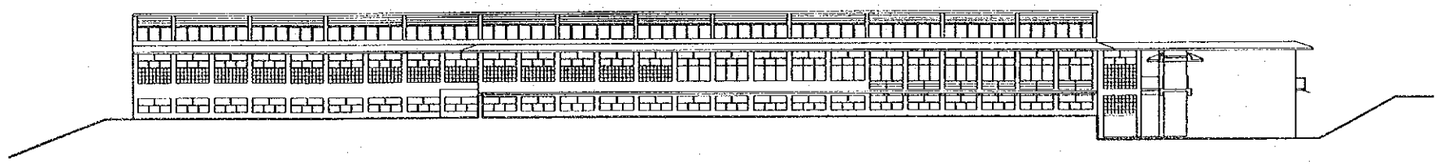
TRAINING BUILDING
EAST

DORMITORY BUILDING
EAST

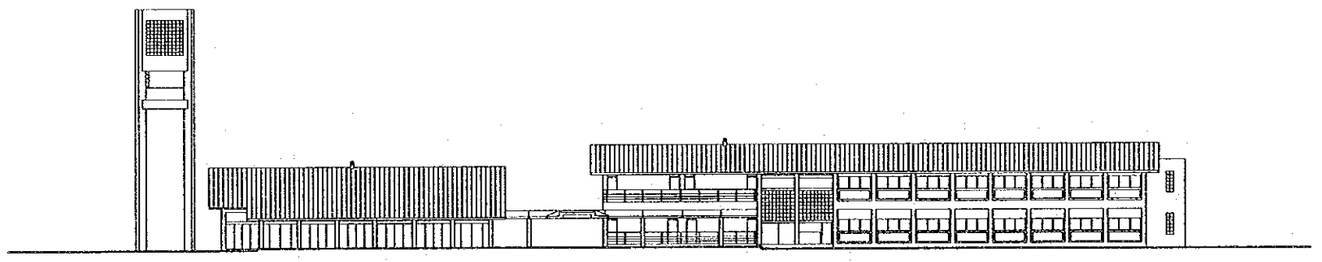
ELEVATION-1 S.1:500

0 5 10 20 30M

06

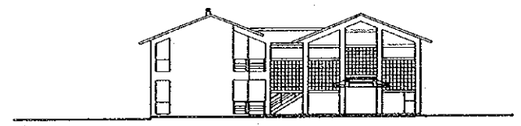


TRAINING BUILDING
NORTH

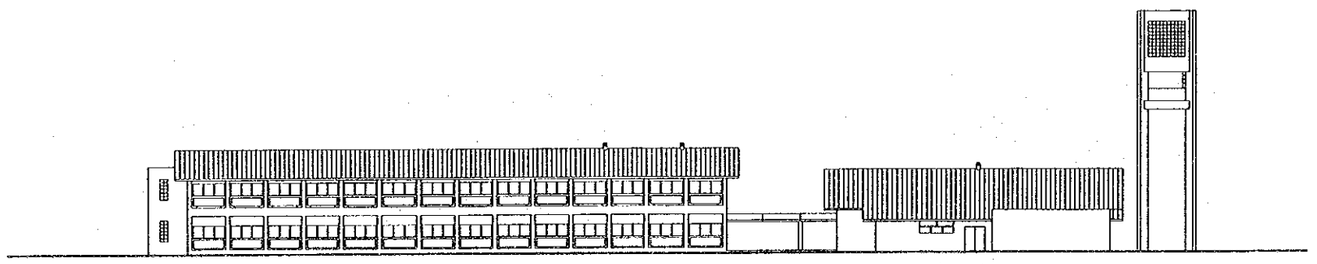


CANTEEN BUILDING
SOUTH

DORMITORY BUILDING
SOUTH

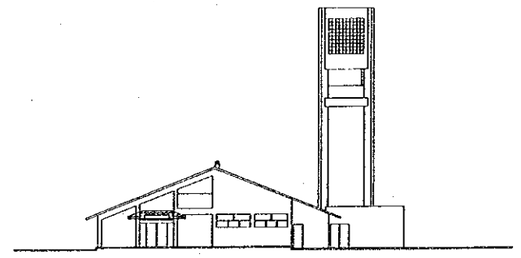


DORMITORY BUILDING
WEST



DORMITORY BUILDING
NORTH

CANTEEN BUILDING
NORTH

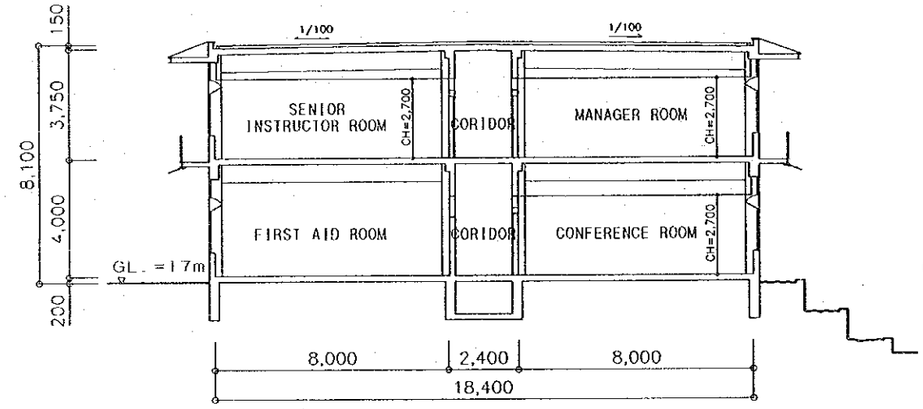


CANTEEN BUILDING
EAST

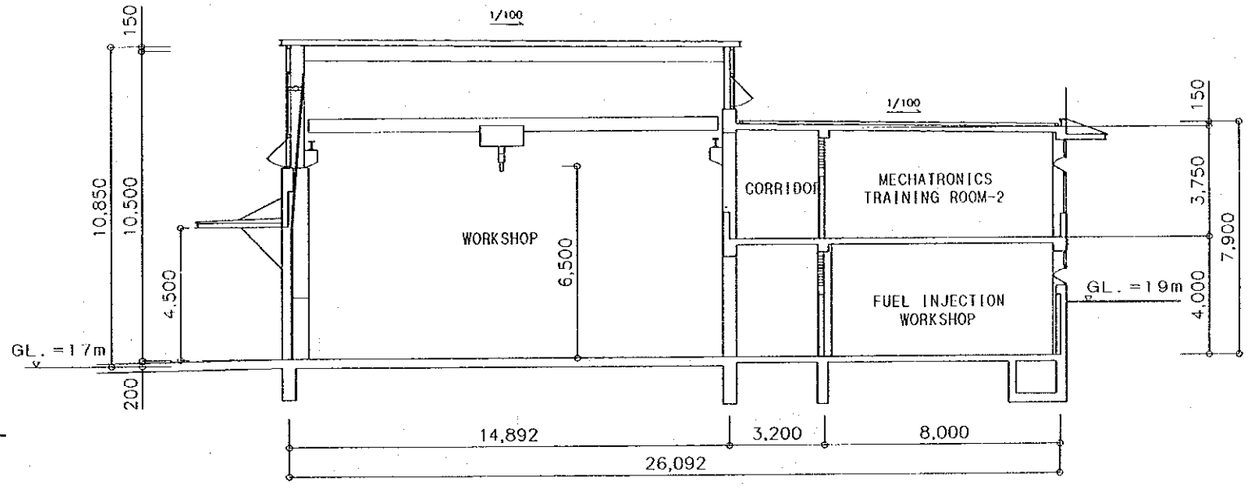
ELEVATION-2 S.1:500

0 5 10 20 30M

07



ADMINISTRATION BUILDING

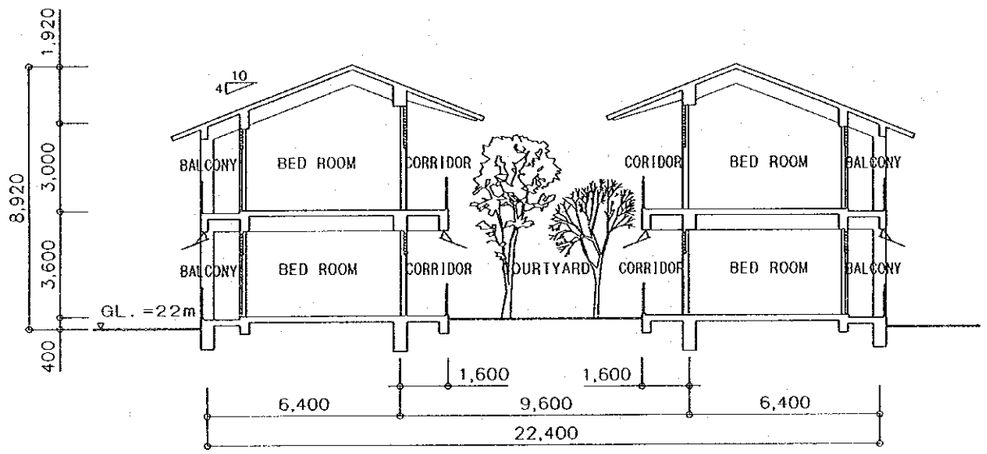


TRAINING BUILDING

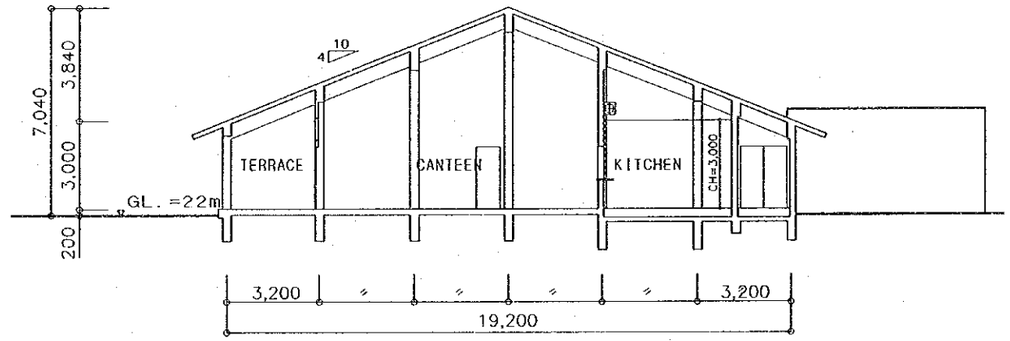
SECTION-1 S.1:200

0 1 3 5 10M

08



DORMITORY BUILDING

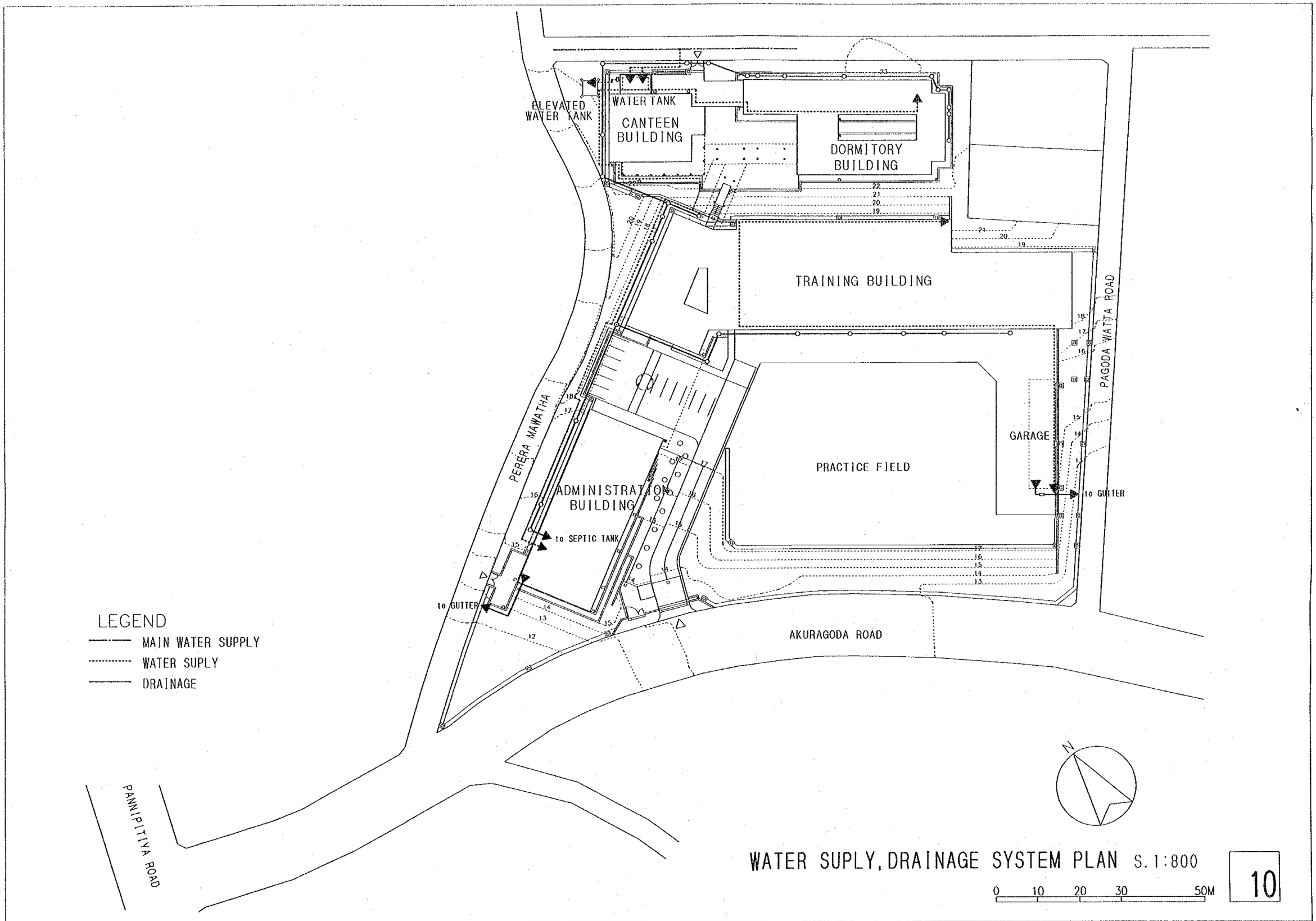


CANTEEN BUILDING

SECTION-2 S.1:200

0 1 3 5 10M

09


ELEVATED WATER TANK
WATER TANK
CANTEEN BUILDING
DORMITORY BUILDING
TRAINING BUILDING
PAGODA WATTA ROAD
PERERA MAWATHA
ADMINISTRATION BUILDING
to SEPTIC TANK
to GUTTER
PRACTICE FIELD
GARAGE
to GUTTER
AKURAGODA ROAD
PANNIPITIYA ROAD
LEGEND
MAIN WATER SUPPLY
WATER SUPLY
DRAINAGE
N
WATER SUPLY, DRAINAGE SYSTEM PLAN S.1:800
0 10 20 30 50M
10

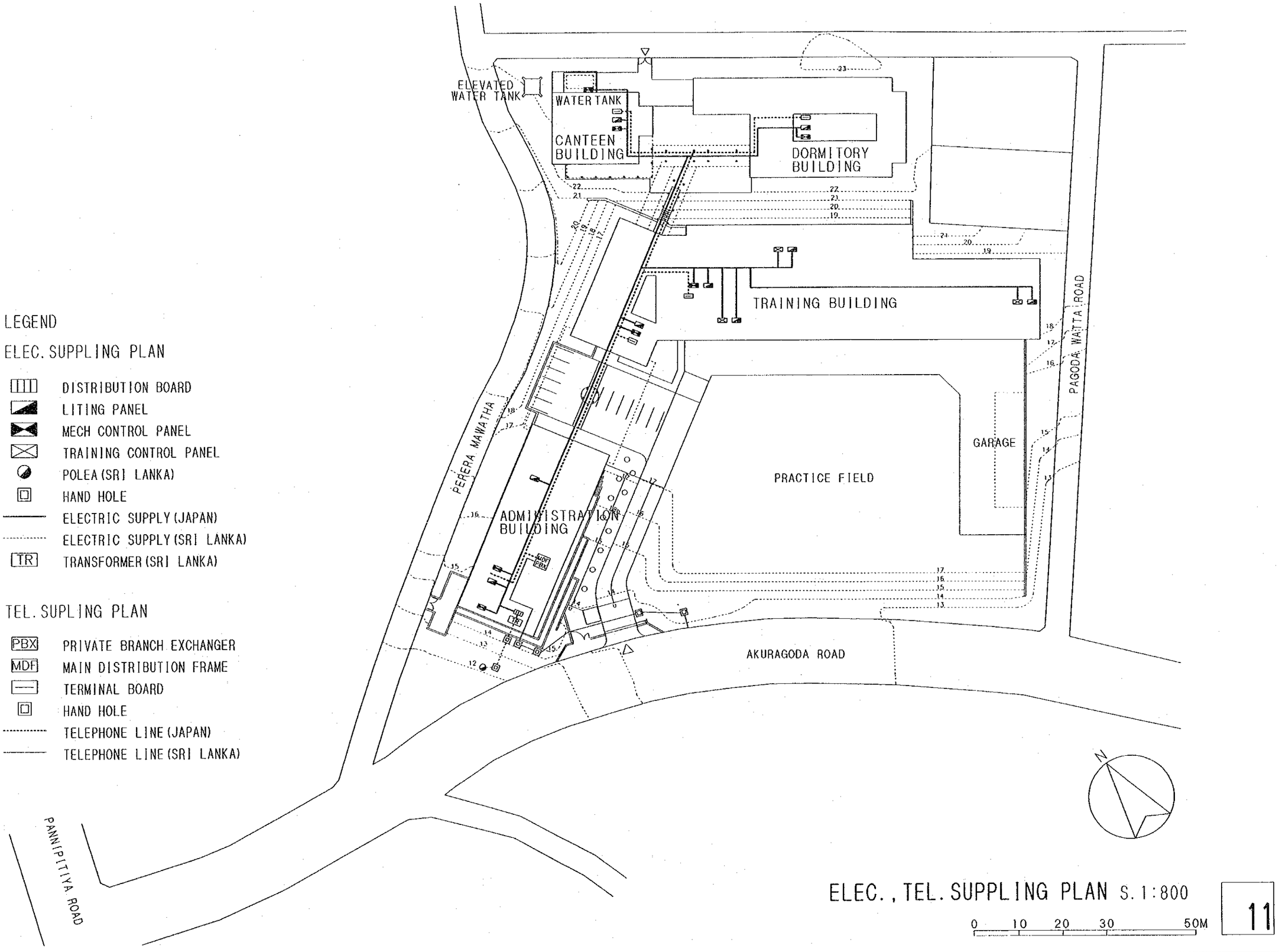
LEGEND

ELEC. SUPPLING PLAN

- DISTRIBUTION BOARD
- LITING PANEL
- MECH CONTROL PANEL
- TRAINING CONTROL PANEL
- POLEA (SRI LANKA)
- HAND HOLE
- ELECTRIC SUPPLY (JAPAN)
- ELECTRIC SUPPLY (SRI LANKA)
- TR — TRANSFORMER (SRI LANKA)

TEL. SUPLING PLAN

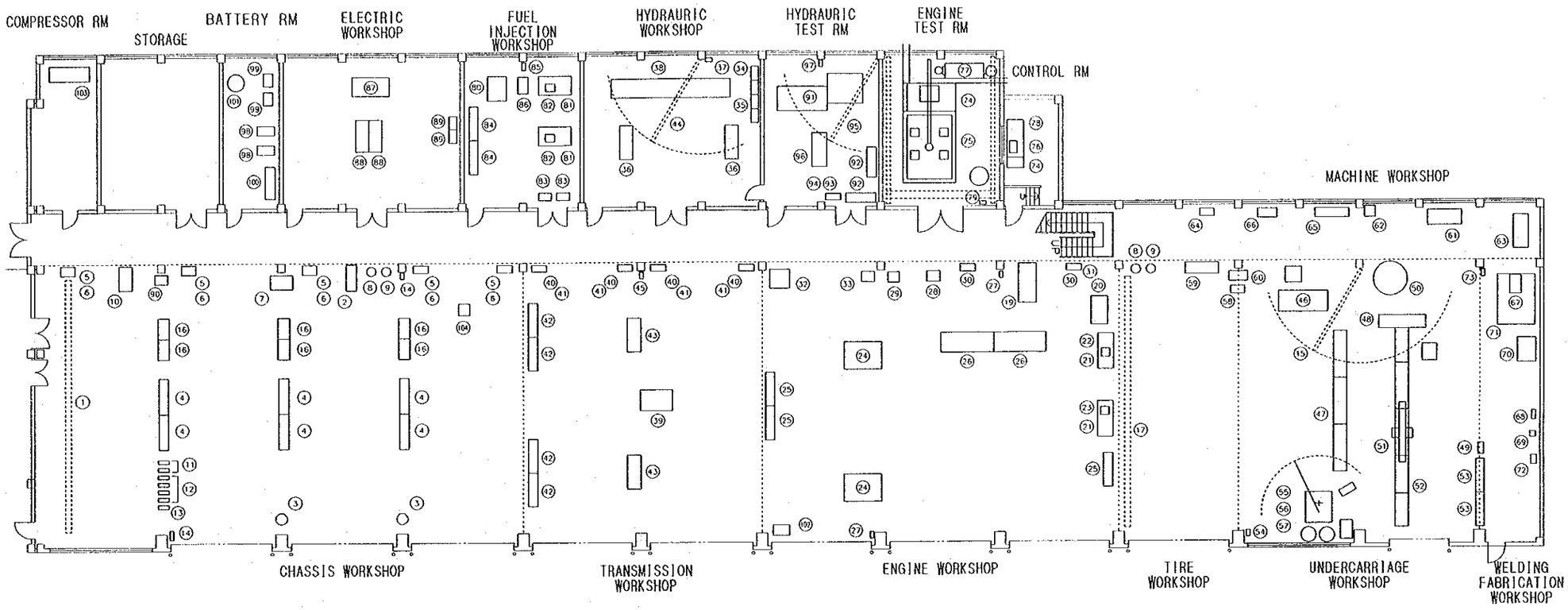
- PBX — PRIVATE BRANCH EXCHANGER
- MDF — MAIN DISTRIBUTION FRAME
- TERMINAL BOARD
- HAND HOLE
- TELEPHONE LINE (JAPAN)
- TELEPHONE LINE (SRI LANKA)



ELEC., TEL. SUPPLING PLAN S. 1:800

0 10 20 30 50M

11



No	Description	No	Description	No	Description	No	Description
1	Overhead Crane (5ton)	28	Valve Refacer	55	Roller Welder	82	Work Bench
2	Pallet Truck	29	Piston Heater (Bearing Heater)	56	Vacum Flux Recovery	83	Machine Tool Set
3	Sling Chain Kit with Cart	30	Tool Cabinet	57	1/2ton Electric Chain Block	84	Parts Rack
4	Parts Rack	31	Mechanical Tool Set	58	Thermopress	85	Air Hose Reel
5	Mechanic Tool Kit	32	Parts Washer	59	Tool Locker	86	PT Pump Test Stand
6	Tool Cabinet	33	Cylinder Boring Machine	60	Air Compressor	87	Starter Generator Test Bench
7	Parts Cleaner	34	Mechanic Tool Set	61	Lathe	88	Work Bench
8	Portable Lubricater	35	Tool Cabinet	62	Bench Electric Grinder	89	Tool Cabinet
9	Portable Rubricater	36	Work Bench	63	Work Bench	90	Head Light Tester
10	Transmission Jack	37	Air Hose Reel	64	Tool Locker Cabinet	91	Hydraulic Component Universal Tester
11	Tractor Support (Front)	38	Hydraulic Cylinder Service Stand	65	Parts Rack	92	Parts Rack
12	Tractor Support (Rear)	39	Engine Positioner	66	Upright Drilling Machine	93	Mehcanic Tool Set
13	Tractor Lift & Cart	40	Mechanic Tool Set	67	AC Arc Welder	94	Tool Cabinet
14	Air Hose Reel	41	Tool Cabinet	68	Iron Anvil .Cast Iron	95	Jib Crane .Wall Type (1ton-5m)
15	Jib Crane (2ton-5m)	42	Parts Rack	69	Cast Iron Swage Block	96	Work Bench
16	Mobile Work Bench	43	Work Bench	70	Hydraulic Shop Press (100ton)	97	Air Hose Reel
17	Overhead Crane (3ton)	44	Jib Crane .Wall Type (1ton-5m)	71	Partition For Welding	98	Hand Truck
18	Jib Crane .Wall Type (2ton-5m)	45	Air Hose Reel	72	Hand Lever Shear	99	Silicon Quick Charger
19	Mobile Floor Crane (1ton)	46	Roller & Idler Press	73	Air Hose Reel	100	Parts Rack
20	Hydraulic Shop Press (55ton)	47	Coveyor Stand for Roller Line	74	Engine Dynamometer	101	Water Purifier
21	Work Bench with Cabinet and Locker	48	Track Press with Hydraulic Winch	75	Special Accessories for Engine Dynamometer	102	Air ComPressor
22	Bench Electric Grinder	49	SALT Lubricator & Tester Kit	76	Weight Type Fuel Comsumption Meter	103	Air Compressor
23	Bench Drill Press	50	Turn Table for Disassenbled Links	77	Non resistance Silencer	104	Head Truck
24	Engine Positioner	51	Shoe Blot Impact Wrench	78	Work Bench with Cabinet and Locker		
25	Parts Rack	52	Conveyors and Shoot	79	Air Hose Reel		
26	Cylinder Head Work Bench	53	Tool Locker	80	Fuel Injection Pump Tester		
27	Air Hose Reel	54	Air Hose Reel	81	Nozzle Tester		

TRAINING EQUIPMENT LAYOUT PLAN S.1:250

0 5 10 15M

12

4.5 Construction Plan

4.5.1 Basic Principles

The Project will be implemented in accordance with the grant aid system of the Government of Japan and will officially commence after the signing of the E/N upon approval by the Governments of Sri Lanka and Japan. The Government of Sri Lanka will subsequently select the Consultant (Japanese company) to conduct the detailed design work for the planned facilities and equipment. Following the completion of the detailed design documents and tender process, the Contractor and Equipment Supplier (Japanese companies which are the successful bidders) will conduct their respective work, i.e. construction of the buildings and supply and installation of the equipment. The contracts for the consultancy service, building construction and equipment supply/installation will only become valid when verified by the Government of Japan.

In conducting the construction work, the Japanese Contractor and Sri Lankan counterparts will jointly examine the desirable construction schedule and will decide upon the scope of work to be undertaken by each side and the preferable timing for each type of the envisaged work, etc. The resulting schedule should incorporate the detailed timing of construction material procurement, the delivery of construction materials to the construction site, equipment installation and the test operation of the equipment and building services to be attended by Sri Lankan engineers/technicians.

All earth work, foundation work and structural work will be planned during Sri Lanka's dry season while all interior work will be planned during the rainy season to adapt the construction schedule to the local climate as much as possible.

The construction processes should be well balanced in terms of the material and manpower inputs, taking the time required to transport the equipment and materials to be procured in Japan to the construction site, the smooth implementation of the work and the well-timed dispatch of technical supervisors and others into consideration in order to avoid any idle time of the manpower, equipment and materials as well as repetition of the same work.

4.5.2 Conditions of Local Construction Industry and Points to Note in Construction Work

Sri Lanka is a democratic socialist country and either the Building Department or State Engineering Corporation is predominantly responsible for all processes involved in large public projects, from planning, design, supervision and equipment procurement to actual

construction work. As a result, the private construction sector is not fully developed and most private construction companies are treated as sub-contractors providing labour.

Unlike sub-contractors in Japan, sub-contractors in the construction sector in Sri Lanka do not specialize in any particular field and conduct all types of construction work. As many of them are small, it will be necessary to divided the work for each process or zone on the site and to sub-contract smaller work volumes to individual companies.

Although there is an abundant labour force, few sub-contractors have a diverse range of skilled workers. Many highly skilled workers tend to work in Singapore, Middle Eastern countries and other foreign countries for better wages and the technical level of the workers remaining in Sri Lanka is generally in need of improvement.

- Material and Labour Control Ability

  With regard to various tools, the standard practice is for the required quantity to be loaned to sub-contractors at the beginning of construction work with these sub-contractors being responsible for their safe keeping. However, the loss and breakage rates are fairly high, suggesting a need for tighter control and supervision. In the case of labour management, the self-control system has so far caused no serious problems.

- Quality and Schedule Control Ability

  The self-control ability is still not yet quite adequate in these fields, necessitating the provision of guidance by Japanese staff. With appropriate guidance and carefully planned staff assignments, however, the local staff are capable of proper quality and schedule control.

- Technical Ability

  In general, the number of skilled workers is small and many do not have their own tools. While their technical ability can be improved with the provision of appropriate guidance by Japanese supervisors, they may be unable to use their newly acquired skills for their next jobs as sub-contractors find it financially difficult to retain these workers once the work has been completed. The fact that sub-contractors do not permanently employ skilled workers makes it difficult to find enough skilled workers when required.

In view of the characteristics of the construction work under the Project, particular attention should be paid to the following points.

- As the construction work under the Project will involve many factors which do not necessarily exist in ordinary construction work, such as building construction work, building services work, equipment work, local procurement, import of the required equipment and materials and the dispatch of supervisory experts, etc., the construction plan must take care to observe the given schedule without causing any waiting time or repetition.

- The piling and foundation work will be particularly vulnerable to heavy rain. Although dry weather can generally be expected between July and September and between December and February, the unstable weather conditions in recent years have made the commencement of the rainy season unpredictable, necessitating careful planning of the work schedule.

- As a stable supply of sand and aggregate for concrete is essential for schedule control, it is desirable that the Contractor have a concrete plant.

- The scheduled relocation of the existing house on the Project site by the Sri Lankan side must be completed prior to the commencement of the construction work under the Project to avoid any adverse effects on the Project implementation schedule.

- Protective measures for the buildings to be constructed in the first phase should be included in the temporary structure plan in view of their proper functioning during the second phase of construction work.

- As the Project counterparts have requested that water supply, power supply, telephone and other service facilities for the new buildings also be provided for the temporary buildings, the Sri Lankan side should urgently proceed with the necessary procedures to extend these services to the site.

4.5.3 Construction Supervision Plan

Supervision of the construction work under the Project will involve the project implementation agency, Consultant, Contractor and Equipment Supplier under the control of the related ministries of both governments. The work assignments of each of the aforegoing are as follows.

(1) Project Implementation Agency

The organization responsible for the Project on the Sri Lankan side will be the MHC and the ICTAD, which is part of the MHC, will be the project implementation agency. The Project will be controlled by the Joint Committee, chaired by the Under-Secretary for

MHC projects, and all other related organizations will participate in the Committee in view of the smooth implementation of the Project. The ICTAD will be party to such agreements as the design and supervision agreement, construction and equipment contracts and banking agreements as required by the grant aid system of the Government of Japan and will also be responsible for the work to be undertaken by the Sri Lankan side which is described in 4.5.6.

The Department of External Resources (DER) of the Ministry of Finance and Planning (MFP) will be responsible for any work relating to the agreement for Japanese grant aid for the Project, acting as the competent agency for foreign assistance on behalf of the Government of Sri Lanka.

(2) Consultant

From among the many Japanese consulting companies capable of handling the Project, the Government of Sri Lanka will select the Consultant to conduct the detailed design work for the facilities and equipment and to prepare the tender documents through consultations with the Government of Sri Lanka, based on the contents of the Basic Design into consideration. The Consultant will dispatch a full-time supervisor to the Project site at the construction and equipment installation stage to supervise the Contractor and to report on the work progress to the project implementation agency and other related organizations. The Consultant will also dispatch engineers to inspect the work in accordance with the work progress. The Consultant will be responsible for the following work.

- Detailed Design

  Preparation of the tender documents for construction and equipment work (detailed design drawings, specifications and cost estimate, etc.)

- Assistance for Tender and Contracts

  Decision on the contract procedures, preparation of draft contracts, examination of detailed break-downs and selection of the Contractor (announcement of tender, preliminary qualification, tender opening and evaluation, contract negotiations and witnessing of contracts).

- Inspection and Confirmation of Work Drawings

  Inspection and approval of the working drawings, construction plans, samples of materials and finishings and building services and other equipment provided by the Contractor.

- Construction Supervision

  Examination of work plans and schedules and instruct to the Contractor.

- Work Progress Reporting

  Reporting of work progress to the project implementation agency and other related organizations.

- Assistance for Payment Procedure

  Examination of requisition notes payable interim and on completion submitted by the Contractor.

- Inspection of Completed Work

  Inspection of the work at various stages throughout the construction period.

(3) Contractor

The Contractor will be a qualified Japanese construction company selected through the open tender procedure. The Contractor will complete the construction of the planned buildings on schedule based on the detailed design drawings prepared by the Consultant and will hand the buildings over to the Sri Lankan side.

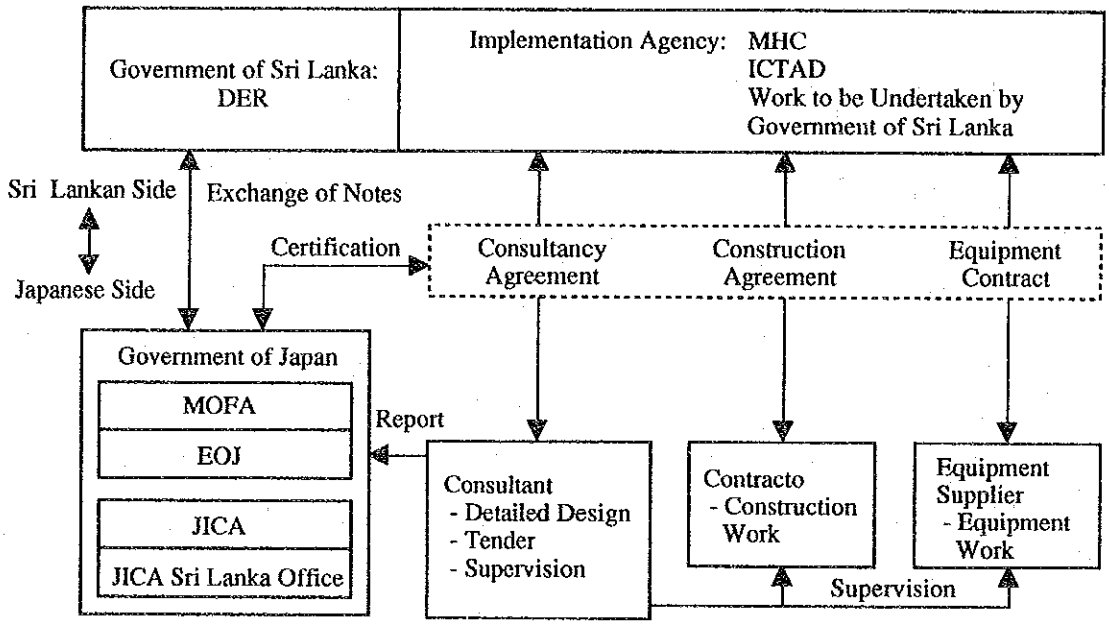
The construction work for which the Contractor will be responsible will mainly consist of the building, air-conditioning and ventilation, plumbing, electrical and exterior work and the Contractor will sub-contract the work to Sri Lankan or Japanese sub-contractors, technicians and workers as required. Some 6 full-time on-site staff will be required to supervise the construction work in view of the size of the Project and its contents.

(4) Equipment Supplier

The Equipment Supplier will be a qualified Japanese trading company selected through the open tender procedure. The Equipment Supplier will procure and install the equipment, which will satisfy the specifications provided by the Consultant, on schedule. The Equipment Supplier will also dispatch expert engineers to the Project site to assist

with the installation of the equipment and to provide the Sri Lankan side with explanations of the equipment handling methods.

Based on the above work assignments, the construction supervision system is shown below.



4.5.4 Equipment and Materials Procurement Plan

(1) Construction Materials

In principle, priority should be given to the use of local products for the construction work. However, the use of local products must be carefully examined in terms of the planned construction schedule, supply capacity, durability, workability, cost and maintenance. Based on the results of the construction materials survey conducted as part of the Basic Design Study, the procurement of the following materials is planned for the Project.

Building Construction Work

* To be procured from a third country.

Equipment and Materials	Procurement in Sri Lanka	Procurement in Japan or Third Country	Remarks
Cement	O	-	Regular local supply is questionable as the cement mill in Twincomaly has stopped operating. Imported cement is also available in the local market.
Sand	O	-	River sand from the catchment basin of Kelaniya River will be used. Supply runs short, however, at the time of flooding during the rainy season.
Gravel	O	-	Crushed stone will be used.
Reinforcing Bars	-	O	As Sri Lanka depends on imported products, reinforcing bars made in Japan will be used.
Structural Steel	-	O	as above
Forms for Concrete	-	O	Plywood forms are not produced locally.
Concrete Blocks	O	-	While light weight blocks are unavailable, no difficult problems are anticipated. To be used for partition walls.
Bricks	O	-	Mainly sun-dried bricks. Unsuitable for face finishing. Some procurement problems during the rainy season. To be used for partition walls.
Stone	O	-	Supply capacity is somewhat limited but is considered the best locally available material.
Terrazzo Tiles	O	-	Few in variety and small in tip stone size but popular as a local flooring material. Durability and workability are good.
Ceramic Tiles	O	-	Manufactured by a public corporation. Few in number and product types.
Plywood	-	O	Quality is questionable. Local products are expensive.
Asbestos Cement Boards	-	O	as above
Lumber	-	*	Supply availability is questionable as felling is currently restricted. Difficult to obtain well seasoned and dried lumber.
Metal Sashes	-	O	Not manufactured locally.
Wooden Sashes	-	*	Procurement of timber and local manufacture are difficult.
Metal Fixtures/Hardware	-	O	Problems in terms of quality and available types
Glass	O	O	Depends on size and thickness.
Paint	O	-	High price but local products will be used due to future maintenance needs.
Asphalt Water-Proofing	-	O	Work experience is inadequate as only simple water-proofing has been conducted.
Corrugated Asbestos Slates	O	-	No problems in terms of quality and local supply capacity.
Roof Tiles	O	-	Brittle as the baking temperature is low but is the traditional roofing material in Sri Lanka.
Furniture	O	O	Depends on quality, use and delivery conditions.

Air-Conditioning and Plumbing Work

Equipment and Materials	Procurement in Sri Lanka	Procurement in Japan or Third Country	Remarks
Vinyl Pipes	-	O	Not manufactured locally. Locally available pipes are too thin in wall thickness and are not strong.
Steel Pipes	-	O	Local cast iron pipes are questionable in terms of measurement accuracy.
Valves and Pipe Fittings	-	O	Large discrepancies in quality and measurement accuracy.
Pumps	O	-	Procurement and maintenance are locally possible.
Sanitary Fixtures	-	O	Pose problems in terms of maintenance as pipe jointing sections are inaccurate.
Air-Conditioners	-	O	Not manufactured locally.

Electrical Work

Equipment and Materials	Procurement in Sri Lanka	Procurement in Japan or Third Country	Remarks
Transformer	-	O	Not manufactured locally. (Scope of Sri Lanka side)
Power Panel Board	-	O	Not manufactured locally.
Telephone Exchange	-	O	Not manufactured locally.
Wires and Cables	-	O	Not manufactured locally.
Lighting Fixtures	-	O	Not manufactured locally.
Electrical Appliances	-	O	Not manufactured locally.

(2) Equipment

In principle, all the planned equipment will be procured in Japan. The procurement of the following equipment in Sri Lanka is, however, desirable in view of the supply of spare parts and the maintenance service requirements, etc. No procurement from a third country is currently planned.

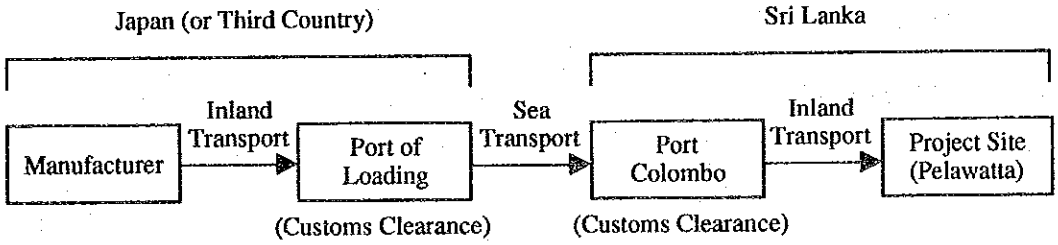
- copiers
- micro-computers
- electric typewriters

As some equipment is vulnerable to impact, high humidity and high temperatures, care must be taken in the packing and transportation of this equipment. The use of special

waterproof packaging is planned for some equipment in view of the high humidity and high temperatures during its transportation in the tropics.

(3) Procurement in Japan and Third Countries

Sri Lanka has no special import regulations for products for government organizations. While the imported equipment and materials for the Project will not be exempt from customs duties due to the Sri Lankan system in this regard, such duties will be actually paid by the project implementation agency and will not constitute a financial burden on the Japanese side. It is necessary for the ICTAD to appropriate the necessary amount to pay these customs duties in its annual budget for the smooth customs clearance of the imported equipment and materials. The equipment and materials to be imported from abroad will be transported to the Project site as shown below.



4.5.5 Implementation Schedule

If the implementation of the Project with the grant assistance of the Government of Japan is decided, the actual construction and equipment supply work will be conducted in 3 stages, i.e. (i) preparation of detailed design documents following the conclusion of the E/N by the two countries, (ii) tender and contracts and (iii) actual construction and equipment supply work. The sizes and contents of the facilities and equipment relating to the Project suggest that the period required to complete the Project will be fairly long and, therefore, it will be reasonable to divide the construction period into 2 phases for the smooth completion of the Project.

Phase 1: Administration Building and Training Building

Phase 2: Canteen Building and Dormitory Building

(1) Detailed Design

The tender documents will be prepared based on the Basic Design and will include detailed design drawings, specifications, calculation sheet and cost estimate, etc. Close consultations will be held between the Consultant and the Government of Sri Lanka at the key stages of the detailed design work and the tender process will commence following the approval of the final detailed design by the Sri Lankan side. The period required to complete the detailed design is expected to be approximately 4.0 months.

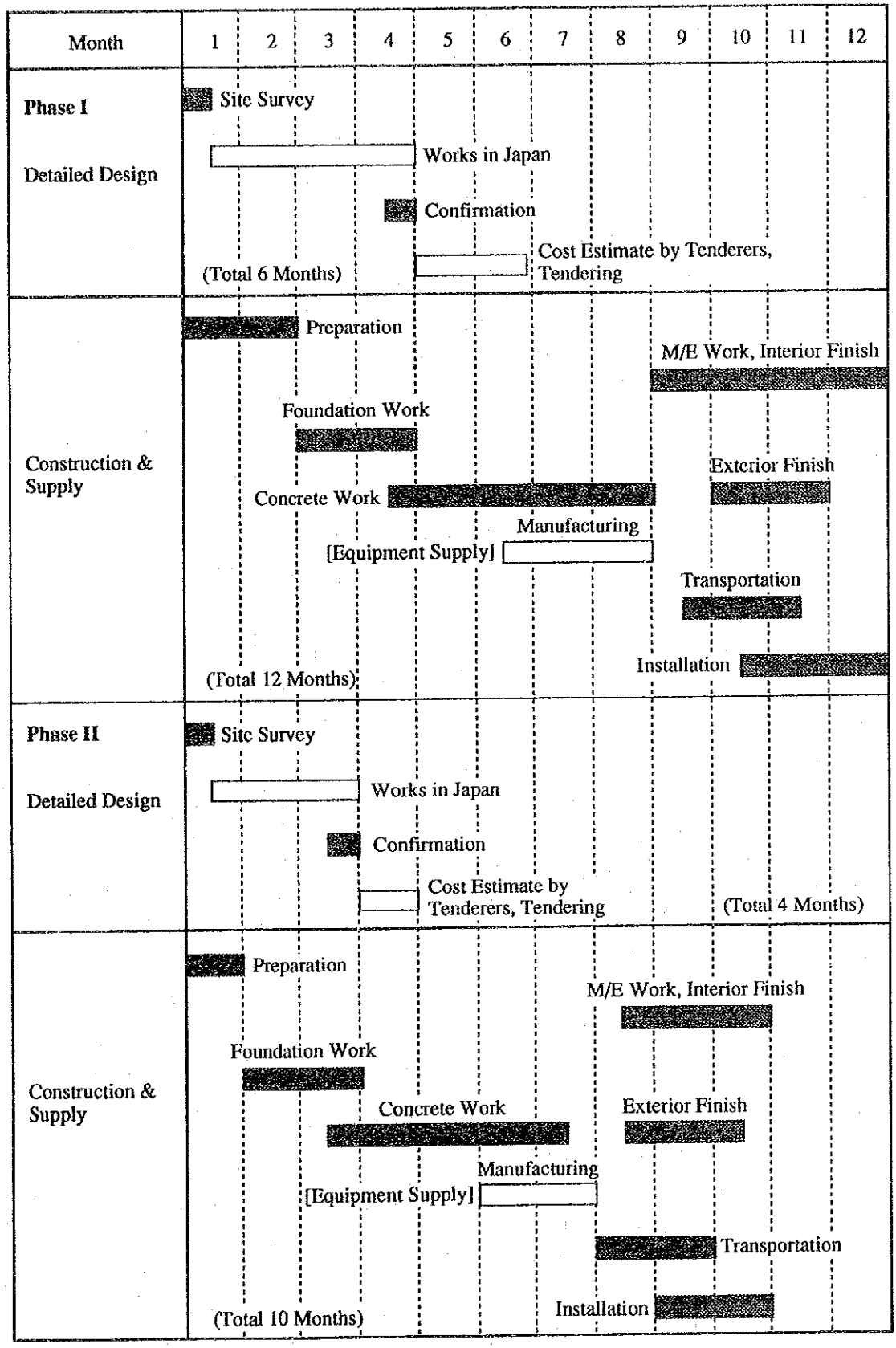
(2) Tender

Following the completion of the detailed design, applications for the preliminary qualification examination will be invited in Japan. Based on these examination results, the project implementation agency will invite the qualified tenderers for the open tender with the attendance of all related parties. If the contents of the tender with the lowest price are assessed as appropriate, the tender will be announced successful and will conclude the contract with the Government of Sri Lanka. The period required to complete the process from tender announcement to the signing of the contract is expected to be approximately 2 months.

(3) Construction and Equipment Supply Work

Following the signing of the construction contract and equipment supply contract, the Contractor will commence the work on receipt of verification by the Government of Japan. In view of the sizes and contents of the facilities to be constructed, the period required to complete the work is expected to be 12 months for the first phase and 10 months for the second phase provided that the procurement of the construction materials and the work to be undertaken by the Sri Lankan side are smooth conducted. (Table 4-1)

Table 4-1 Implementation Schedule



4.5.6 Project Cost Estimate

(1) Division of Work

The following division of the Project-related work between the Government of Japan and the Government of Sri Lanka is deemed appropriate.

1) Work to be Undertaken by Government of Japan

- Buildings

  - Administration Building
  - Training Building
  - Dormitory Building
  - Canteen Building

- Building Services

  - Water supply system
  - Waste water drainage facility and waste water treatment facility
  - Storm water drainage facility
  - Sanitary fixtures
  - Fire extinguishing system
  - LPG supply system
  - Hot water supply system
  - Air-conditioning and ventilation systems
  - Power receiving and transforming system and emergency power supply system
  - Electrical facilities
  - Telephone system

- Outdoor Work

  - Paving of premise roads and car park
  - Outdoor lighting
  - Retaining walls

- Provision of Equipment

  - Construction equipment for training purposes
  - Educational/training equipment
  - AV equipment
  - Office equipment

2) Work to be Undertaken by the Government of Sri Lanka

a) To secure a lot of land necessary for the execution of the Project.

b) To clear the site prior to commencement of the construction.

c) To undertake incidental outdoor works such as gardening, fencing and gates in and around the site.

d) To provide facilities for distribution of electricity, water supply, telephone, drainage, sewage, and other incidental facilities to and from the site.

e) To provide general furniture for the project.

f) To bear the following commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement.

- Advising commission of Authorization to Pay
- Payment commission

g) To ensure prompt unloading and customs clearance at ports of disembarkation in Sri Lanka and internal transportation therein of the products purchased under the Grant.

h) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Sri Lanka with respect to the supply of the products and services under the verified contracts.

i) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contract such facilities as may be necessary for their entry into Sri Lanka and stay therein for the performance of their work.

j) To maintain and use properly and effectively the facilities constructed and equipment purchased under the Grant.

k) To bear all the expenses, other than those to be borne by the Grant, necessary for the execution of the Project.

l) To coordinate and solve any issues related to the project which may arise with third parties and inhabitants living around the site during implementation of the Project.

(2) Cost to be borne by the Government of Sri Lanka

Based on the contents of the basic design, the total cost to be borne by the Government of Sri Lanka is estimated below.

• Estimated Cost to be Borne by Government of Sri Lanka

- Relocation of existing private house on the site	Rs 1,000,000.-
- Removal of obstacles from the site and ground preparation	Rs 500,000.-
- Outdoor work (including landscaping)	Rs 750,000.-
- Extension of power line to the site	Rs 300,000.-
- Extension of telephone line to the site	Rs 200,000.-
- Provision of furniture and fixtures (those not included in the grant aid)	Rs 1,300,000.-
Total	Rs 4,050,000.-

In addition to the above, the following expenses must be met by the Government of Sri Lanka. It is hoped that the necessary funds will be appropriated in the budget for fiscal 1995 and fiscal 1996 as soon as the grant aid for the Project has been confirmed by the Government of Japan.

- Bank Commission (approximately 0.025% of amount listed in E/N)
- Import Tax (based on CIF prices)

CHAPTER 5
PROJECT EFFECTS AND CONCLUSIONS

CHAPTER 5 PROJECT EFFECTS AND CONCLUSIONS

(1) Positive Effects of the Project

The establishment of the CETRAC will strengthen the operation and maintenance system for construction equipment, standardise techniques and skills, foster private businesses, enlighten the construction sector and promote job security, all of which will help to improve the productivity of the construction sector and other sectors. The anticipated positive effects of the Project are described below.

1) Strengthening of Operation and Management System for Construction Equipment

The expected improvement of the social infrastructure and progress of economic development in Sri Lanka mean an increased demand for construction equipment, making the effective operation and management of existing construction equipment essential. The improved capability of managers responsible for the operation and maintenance of such equipment and supervisors with similar responsibilities on-site through training at the CETRAC will prevent the unnecessary damage or loss of construction equipment through unjustifiable operation plans and will make the planning and implementation of highly efficient construction equipment operation and maintenance plans possible. Consequently, the productivity of each type of equipment will improve with a profound effect on the construction's sector pursuit of higher productivity.

2) Strengthening of Maintenance System for Construction Equipment

The Government of Sri Lanka is currently proceeding with a high level of procurement of the latest construction equipment for the NEMO using its own funds and for the RDA using an OECF loan. The full utilisation of this new equipment is of the utmost importance together with an improved operation rate of existing equipment. The intensive training at the CETRAC will improve the skills and techniques of those mechanics which lack an official technical training background to prevent damage to construction equipment caused by inadequate maintenance, in turn originating from the lack of basic understanding and skills. The level of construction equipment maintenance in Sri Lanka will, therefore, significantly improve, achieving a higher operation rate and higher productivity of individual equipment. The entire construction sector will also benefit in the form of higher productivity.

3) Correction of Technical Gap and Standardisation of Skills/Techniques

The mechanisation of the construction sector is an inevitable step in the process of economic and social development and progress in this regard can only be ensured by reliable construction equipment. There is, therefore, a strong case for establishing an appropriate maintenance system. Through the systematic provision of training curriculum and equipment with the latest technologies and techniques to meet the social demands, the CETRAC will act as the central training institute for construction equipment mechanics, standardising the skills and techniques of these mechanics, correcting the technical gap between regions and workshops and introducing standard technologies and techniques for construction equipment maintenance. Consequently, all workshops should be able to provide standard maintenance services, contributing to the achievement of a higher construction equipment operation rate.

4) Fostering of Private Businesses

The expected intensification of economic activities in the coming years will certainly increase the number of various construction projects in Sri Lanka. The implementation of these projects without delay requires construction companies with sufficient capability and experience. By providing technical guidance through the training of managers or supervisors of small companies or local companies who generally find it difficult to improve their technical abilities without external assistance and the provision of a consultancy service for larger construction companies, the CETRAC will prevent those companies with inadequate experience from being involved in work which is beyond their capability with poor results. The CETRAC will also foster capable private businesses. As a result, construction companies capable of supporting social development in Sri Lanka in both a qualitative and quantitative sense will be nurtured, contributing to the vitalisation and improved productivity of the construction sector.

5) Enlightenment of Construction Sector

The increased number of pieces of construction equipment in use due to the progress of the mechanisation of the construction sector demands efficient maintenance which means improved mechanic skills and an improved work environment. By presenting its operating workshops as model workshops, the CETRAC will appeal to owners and managers to improve the conditions of their own workshops, resulting in improved work efficiency and improved workplace hygiene and safety. This improved workability and safety will increase the productivity of each worker as well as the productivity of the entire construction sector.

6) Job Security

The increased demand for construction equipment operation and maintenance inevitably means a strong demand for capable personnel in terms of equipment management and maintenance. By officially certifying the skills learnt through its training courses, the CETRAC will assist the establishment of job status and job security. The subsequent increased number of qualified managers, supervisors and mechanics will meet the growing demand for capable personnel, thus contributing to the vitalisation and productivity improvement of the construction sector.

(2) Suitability of the Project

The contents of Chapter 3 of the present report have been compiled based on the requested project components of the Government of Sri Lanka which were confirmed by the ICTAD, the results of consultations on the project management system with the ICTAD and the findings of the analysis in Japan of data and information collected through the field survey. The suitability of the Project as a grant aid project of the Government of Japan is now examined from the viewpoints of finance, maintenance system and management system.

1) Finance

Following the finalisation of the Project, 6 million Rs will be appropriated as the CETRAC's budget for the first year. The funds required to cover the cost of the work to be undertaken by the Government of Sri Lanka prior to the commencement of the Project will be accounted for in the special budget for fiscal 1994, ensuring adequate budgetary appropriation for the Project by the Sri Lankan side.

While the CETRAC's budget will be included in the overall budget of the ICTAD, it is highly desirable that a sufficient amount be accounted for in the CETRAC's budget for the operation and maintenance of its facilities. As the operation cost of the CETRAC will largely depend on the actual progress of training and use of facilities, the budget plan from the second year onwards will be based on the actual results in the first year. Any shortage of the first year budget will be met by the government's special budget for the same fiscal year, ensuring a reliable financial situation for the operation of the CETRAC.

2) Maintenance System

The facilities and equipment planned under the Project are designed to minimise the maintenance requirement and the main spare parts will be provided at a cost of 5 -

15% of the building/equipment cost to make early maintenance work less hazardous for the CETRAC. Where possible, equipment is selected based on the feasibility of repair or maintenance in Sri Lanka.

The ICTAD has accumulated rich experience over the years through the maintenance of its own construction and training equipment. Given the high technical level of the ICTAD staff, an efficient maintenance system for the new equipment to be provided under the Project should be quickly established to meet all maintenance requirements.

3) Management System

The CETRAC will be managed by 46 staff members, in principle selected from those currently working at the ICTAD. In particular, the appointment of well experienced persons is planned for the instructor and demonstrator positions. Through the management of the OTC and MES, the ICTAD has excellent management experience in the running of a technical training centre and training programmes which should reflect on the management of the CETRAC. The appointment of the senior positions will have been completed by the time of the handing over of the facilities and equipment to the Sri Lankan side, making it possibly for them to be directly briefed on the handling and maintenance of the facilities and equipment. This will ensure the good management of the CETRAC, posing no foreseeable problems in this regard.

(3) Conclusions

The CETRAC (Construction Equipment Training Centre) will be established within the administrative framework of the ICTAD (Institute for Construction Training and Development) with the purpose of improving the productivity of the construction sector, which is directly responsible for the improvement of the socioeconomic infrastructure, in line with the development policy of the Government of Sri Lanka through improvement of the present poor construction equipment operation rate due to inadequate operation and maintenance and also through fostering of the capable personnel essential for the efficient operation of construction equipment. The ICTAD has been attempting to improve the technical level of mechanics and to spread the relevant technologies and techniques through OJT based on the MES (Modules of Employable Skills) Programme but is convinced that the further standardisation of technologies/techniques and the improvement of skills demand a training centre to act as the core institute for mechanic training.

The implementation of the Project will certainly result in the expansion and consolidation of training and research activities in the fields of construction equipment operation and maintenance which the ICTAD has been trying to achieve and will also produce capable personnel through efficient and effective training courses. The CETRAC will contribute to not only the vitalisation of the construction sector but also to general economic development in Sri Lanka, playing a significant role in Sri Lanka's pursuit of sound social development.

The Project will significantly contribute to general socioeconomic development in Sri Lanka, and thus it is suitable to implement as a grant aid project of the Government of Japan. The Project will be properly staffed by the Sri Lankan side for its efficient management and, together with the sound financial arrangements for the Project, no problems are anticipated on the Sri Lankan side in regard to the implementation of the Project.

(4) Recommendations

The smooth and successful implementation of the Project will be further assured if the following recommendations for improvement in specific areas are heeded.

1) Systematic Management of CETRAC

- Although the CETRAC will act as an independent institution within the ICTAD, it is desirable that its management plan incorporate systematic cooperation/linkage with such related organizations/programmes as the OTC and MES to stimulate the overall activities of the ICTAD for better results on the part of all organizations/programmes involved.

- The continuous development and introduction of a realistic curriculum is highly desirable to ensure a swift and flexible response to changing social demands and the application of new technologies for the latest construction equipment. The preparation of a curriculum improvement plan based on the evaluation results of the completed training is also important.

- Depending on the actual training activities, some of the CETRAC's facilities and equipment could be used more extensively than others. The preparation of a management plan to ensure the effective and fair use of the facilities and equipment is desirable even though a certain degree of disproportionate use may be inevitable.

2) Maintenance

- For the effective operation and maintenance of the CETRAC's building services and equipment, arrangements should be made for the CETRAC or ICTAD engineers/technicians responsible for such building services and equipment to receive practical instructions and training at the time of their installation so that they can obtain the necessary knowledge and skills by the time of their handing over to the Sri Lankan side.

- The maintenance conditions of the facilities and equipment will have serious implications in regard to the functions and training efficiency of the CETRAC. It is essential that the CETRAC secure the necessary budgetary appropriation for maintenance every year in view of the proper use and maintenance of its training facilities.

3) Measures and Work to be Undertaken by Sri Lankan Side

- Such necessary steps as the tender arrangements, signing of agreements, banking agreement arrangements and customs clearance procedures, etc. must be promptly completed for the smooth progress of the Project. It is essential that the Sri Lankan side establish a system to allow the quick completion of each step of the Project while closely liaising with the Japanese side.

- The completion of the relocation of the existing house on the site and ground preparation prior to the commencement of the Project is highly desirable. In addition, the equipment to be procured by the Japanese side should be procured and delivered to the site by the time of building completion.

4) Budget

While the budget planning for the CETRAC is closely related to the budget planning for the ICTAD, it is desirable for the CETRAC to prepare a rational budget to effectively run the CETRAC with a firm funding prospect.

5) Technical Cooperation

Japanese technical cooperation will be desirable in the CETRAC's early years in order for the CETRAC to fully achieve its planned functions and to promote the effective and efficient use of its facilities and equipment.

APPENDIX

1. Member of the Study Team
2. Interviewed Persons
3. Minutes of Discussions
4. Equipment List
5. Conditions of the Project Site
6. Estimate of Operation and Maintenance Cost

1. Member of the Study Team

1-1. The Basic Design Study Team
(October 23 ~ November 13, 1993)

1-2. The Draft Final Report Explanation Team
(March 10 ~ March 20 , 1994)

1. Member of the Study Team

1-1. The Basic Design Study Team (October 23~November 13, 1993)

Team Leader	Mr. Toshimitsu MURAMATSU Deputy Director Construction Equipment Division Economic Cooperation Bureau Ministry of Construction
Project Coordinator / Grant Aid Planner	Mr. Yasuhiro MORIMOTO Grant Aid Division Economic Cooperation Bureau Ministry of Foreign Affair
Chief Consultant / Architecture Planner	Mr. Tadashi MATSUBARA Kume Sekkei Co., Ltd.
Facilities Planner 1 /	Mr. Nobuhiro YOKOI Kume Sekkei Co., Ltd.
Facilities Planner 2 /	Mr. Mitsuo MIMOTO Kume Sekkei Co., Ltd.
Equipment Planner	Mr. Hiyoshi HOSHINO Japan Construction Mechanization Association

1-2. The Draft Final Report Explanation Team of the Basic Design Study (March 10~March 20, 1994)

Team Leader	Mr. Isamu GOTO Counselor of Engineering Construction Method & Machinery Research Institute Japan Construction Mechanization Association
Project Coordinator	Dr. Toshinobu Kato Staff Second Basic Design Study Division Grant Aid Study & Design Department Japan International Cooperation Agency
Construction Equipment Training Planner	Mr. Toshimitsu MURAMATSU Deputy Director Construction Equipment Division Economic Affairs Bureau Ministry of Construction
Chief Consultant / Architecture Planner	Mr. Tadashi MATSUBARA Kume Sekkei Co., Ltd.
Equipment Planner	Mr. Hiyoshi HOSHINO Japan Construction Mechanization Association

2. Interviewed Persons

2. Interviewed Persons

- Concerned Persons on the Sri Lankan Side

☐ Ministry of Finance and Planning, Department of External Resources

Mrs. D. D. J. Kudarigama	Director of External Resources
Mr. J. H. J. Jayamaha	Deputy Director of External Resources

☐ Ministry of Housing, Construction and Urban Development (MHC & UD)

Mr. W. D. Ailapperuma	Secretary for Ministry of Housing, Construction and Urban Development
Dr. M. E. Joachim	Secretary for Construction and Building Materials

☐ Institute for Construction Training and Development (ICTAD)

Mr. E. I. Munashinha	Chairman / Managing Director Institute for Construction Training and Development
Mr. K. M. D. Perera	Advisor Institute for Construction Training and Development
Mr. G. A. K. Gajaweera	Director (Training) Institute for Construction Training and Development
Mr. W. D. K. Fernando	Deputy Director (Operator & Mechanic Training) Institute for Construction Training and Development
Mr. G. Neelaratna	Assistant Director (Mechanic Training) Institute for construction Training and Development
Mr. A. P. Samarasekara	Assistant Director (Operator Training Centre, OTC) Institute for Construction Training and Development

☐ Authorities

Mr. A. De Z. Gunasekera	Secretary Ministry of Posts & Telecommunications
Mr. J. Kannangara	Chief Fire Office Fire Service Department, Colombo Municipal Council
Mr. Prasanna Silva	Director (Development Regulations) Urban Development Authority
Mr. Tissa M. Herat	Deputy General Manager (Western Province, South) Ceylon Electricity Board
Mr. A. P. Chandraratne	General Manager National Water Supply & Drainage Board
Mr. K. G. D. Bandaratilaka	Deputy Director General (Technical) Central Environmental Authority

☐ Others

Mr. Sarath Ilukkumbure	Deputy Director Ceylon German Technical Training Institute
Mr. Majella Abeyesinhe	General Manager Construction Machinery Division DIMO
Mr. Gamini Seneviratne	Chief Engineer Machinery & Equipment SENOK

● Concerned Persons on the Japanese Side

☐ Embassy of Japan

Mr. Kunihiro Doi	First Secretary
Mr. Hiroyuki Kinomoto	Second Secretary (at B/D mission)
Mr. Yasuhiro Morimoto	Second Secretary (at F/D mission)

☐ JICA Colombo Office

Mr. Yoshiaki Sakamaki	Resident Representative (at B/D mission)
Mr. Kinkoh Nakamura	Resident Representative (at F/D mission)
Mr. Akira Suzuki	Deputy Resident Representative
Mr. Mitsuyoshi Kawasaki	Assistant Resident Representative

☐ The Overseas Economic Fund (OECF)

Mr. Hiroshi Kayaku	Chief Representative
Mr. Masayuki Karasawa	Representative

☐ Road Development Authority (RDA)

Mr. Masayoshi Nakashiro	Road Maintenance & Rehabilitation Project Consultancy Team / Team Leader (International Engineering Consultants Association)

3. Minutes of Discussions

3-1. The Basic Design Study (November 5, 1993 signed)

3-2. The Draft Final Report of the Basic Design Study (March 17, 1994, signed)

3-1. The Basic Design Study (November 5, 1993 signed)

MINUTES OF DISCUSSIONS
BASIC DESIGN STUDY
ON
THE PROJECT FOR ESTABLISHMENT OF
CONSTRUCTION EQUIPMENT TRAINING CENTRE (CETRAC)
IN
THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

In response to the request from the Government of the Democratic Socialist Republic of Sri Lanka, the Government of Japan decided to conduct a Basic Design Study on the Project for Establishment of the Construction Equipment Training Centre (hereinafter referred to as "the Project"), and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Sri Lanka a study team, which is headed by Mr.Toshimitsu Muramatsu, Deputy Director of Construction Equipment Division, Economic Affairs Bureau, Ministry of Construction, and is scheduled to stay in the country from October 24 to November 12, 1993. The Team held discussions with the officials concerned of the Government of Sri Lanka and conducted field surveys at the study area.

In the course of discussions and field surveys, both parties have confirmed the main items described on the attached sheets. The Team will proceed to further works and prepare the Basic Design Study Report.

Colombo, November 5, 1993

Mr. Toshimitsu Muramatsu
Leader,
Basic Design Study Team,
JICA

村松敏光

Dr. M.E. Joachim
Acting Secretary
for Mr. W.D. Ailapperuma
Secretary, Ministry of
Housing & Construction,
Sri Lanka

ATTACHMENT

1. Objective of the Project

The objective of the Project is to improve national construction ability by establishment of the Construction Equipment Training Centre.

2. Project Site

The project site is located at Pelawatte as shown in ANNEX- I (A). The site map submitted by the Government of Sri Lanka is shown in ANNEX-I (B).

3. Executing Organization

Responsible Ministry : Ministry of Housing and Construction

Executing Organization : Institute of Construction Training and Development

4. Items requested by the Government of Sri Lanka

After discussions with the Basic Design Study Team, the following items were requested by the Government of Sri Lanka, which is shown in ANNEX- II.

However, the final components of the Project will be decided after further studies.

5. Grant Aid System

(1) The Government of Sri Lanka has understood the system of Japan's Grant Aid explained by the Team.

(2) The Government of Sri Lanka will take necessary measures, described in ANNEX - III for smooth implementation of the Project, on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

6. Schedule of the Study

(1) The consultants will proceed to further studies in Sri Lanka until November 12, 1993.

(2) JICA prepare the draft report in English and dispatch a mission in order to explain its contents around February, 1994.

(3) In case that the contents of the report is accepted in principle by the Government of Sri Lanka, JICA will complete the final report and send it to the Government of Sri Lanka by April, 1994.

7. Technical Assistance

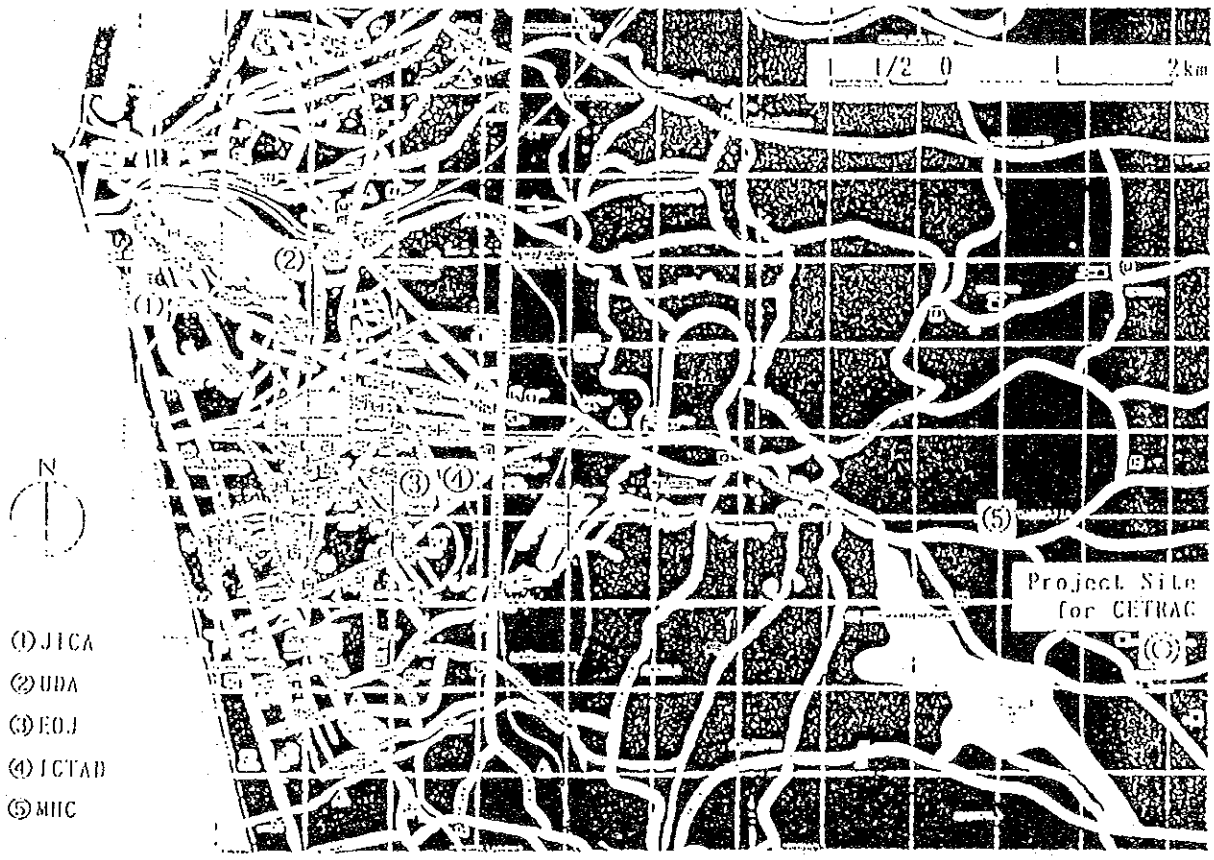
The Team will respect in principle the result of the Preliminary Survey I and Survey II on the Japanese Technical Cooperation for the Construction Equipment Training Centre(CETRAC) in preparing the Basic Design Study Report.

ANNEX- I (A)

LOCATION MAP

Address of the Site : Pagodawatte, Akuregoda Road, Battaramulla

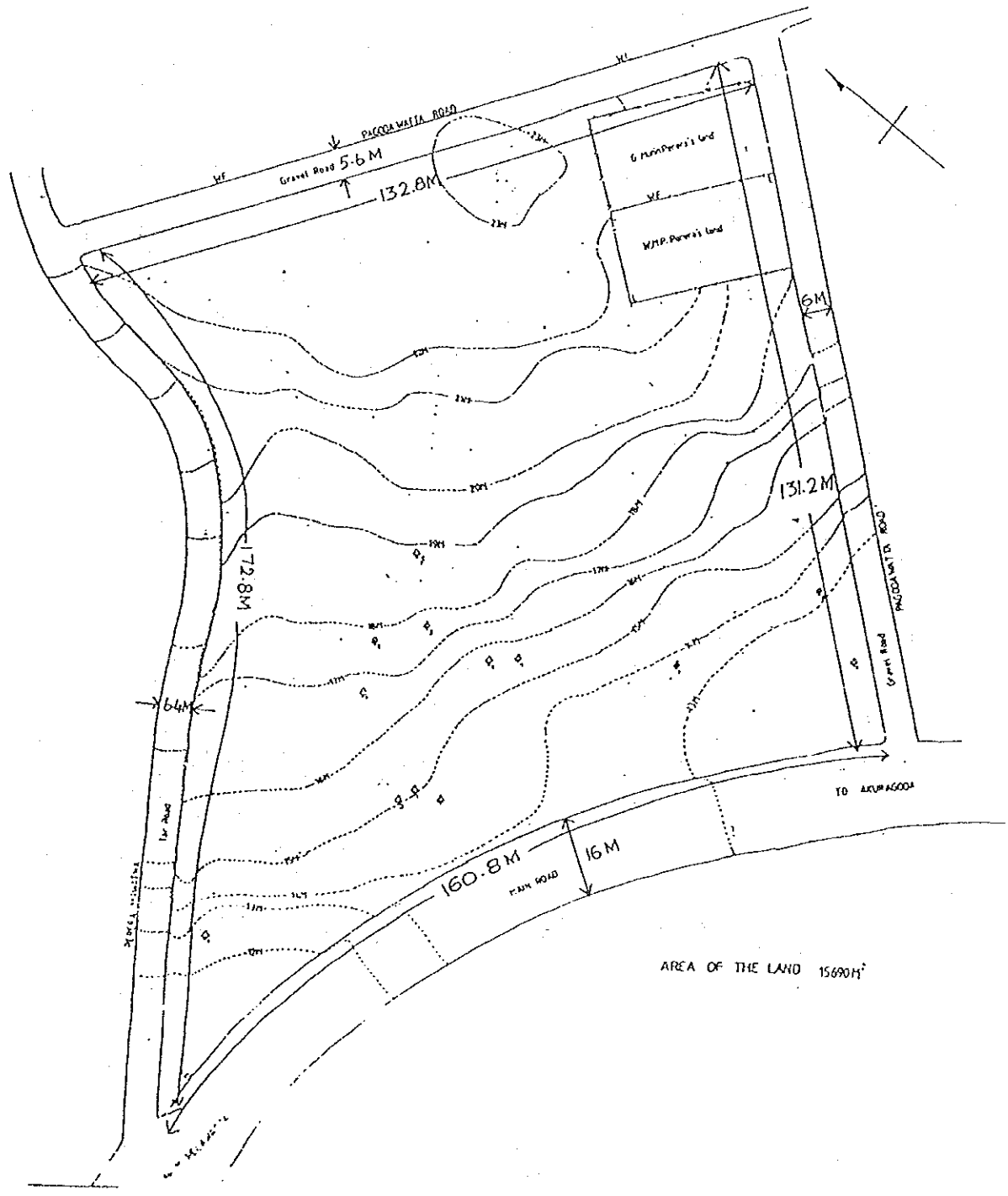
Sri Jayewardenapura Kotte



ANNEX- I (B)

SITE MAP

Submitted by the Government of Sri Lanka



ANNEX-II

The items requested by the Government of Sri Lanka are as follows;

The final components of the Project will be decided after further studies such as examination into contents of curriculum.

1. Major Facilities for the Construction Equipment Training Centre.
   * Administration Block
     - offices, reception room, conference rooms, library and incidental facilities
   * Training Block
     - class rooms, audio-visual room, workshop, testing rooms, instructors rooms and incidental facilities
   * Canteen Block
     - dining, snack stand, kitchen and incidental facilities
   * Dormitory Block
     - bed rooms, study rooms, living rooms and incidental facilities

2. Major Equipment for the Construction Equipment Training Centre.
   * Construction Equipment
     - bulldozer, wheel loader, hydraulic excavator, motor grader and others
   * Equipment and Tool for Training Workshop
     - overhead crane, jib crane, air compressor and others
   * Administration Equipment and Training Equipment
     - photocopier, personal computer, visual educational equipment, vehicles and others

ANNEX-III

Necessary measures to be taken by the Government of Sri Lanka;

1. To secure the sites for the Project.

2. To clear the site prior to commencement of the construction.

3. To undertake incidental outdoor works such as gardening, fencing and gates in and around the site.

4. To provide facilities for distribution of electricity, water supply, telephone, drainage, sewage, and other incidental facilities to the Project site.

5. To provide general furniture for the Project.

6. To bear commissions to the Japanese foreign exchange bank for the banking services based upon Banking Arrangement(B/A).

7. To ensure prompt unloading and custom clearance at port of disembarkation in Sri Lanka and internal transportation therein of the products purchased under the Grant.

8. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Sri Lanka with respect to the supply of the products and services under the verified contracts.

9. To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contract such facilities as may be necessary for their entry into Sri Lanka and stay therein for the performance of their work.

10. To maintain and use properly and effectively that the facilities constructed and equipment purchased under the Grant.

11. To bear all the expenses other than those to be borne by the Grant, necessary for the Project.

12. To coordinate and solve any issues related to the Project which may be raised from third parties and inhabitants in the Project areas during implementation of the Project.

3-2. The Draft Final Report of the Basic Design Study (March 17, 1994, signed)

MINUTES OF DISCUSSIONS
BASIC DESIGN STUDY
ON
THE PROJECT FOR ESTABLISHMENT OF
CONSTRUCTION EQUIPMENT TRAINING CENTRE (CETRAC)
(CONSULTATION OF THE DRAFT FINAL REPORT)

In October, 1993, Japan International Cooperation Agency (JICA) dispatched a Basic Design Study Team on the Project for Establishment of Construction Equipment Training Centre (hereinafter referred to as "the Project") to the Democratic Socialist Republic of Sri Lanka, and through discussions, field survey, and technical examination of the results in Japan, has prepared the draft report of the study.

In order to explain and to consult Sri Lanka on the components of the draft report, JICA sent to Sri Lanka a study team which is headed by Mr. Isamu Goto, Counselor of Engineering, Construction Method & Machinery Research Institute, Japan Construction Mechanization Association, and is scheduled to stay in the country from March 10 to 19, 1994.

As a result of discussions, both parties confirmed the main items described on the attached sheets.

Colombo, March 17, 1994

後藤 勇

Mr. Isamu GOTO
Leader,
Basic Design Study Team,
JICA

Mr. W D Ailapperuma
Secretary,
Ministry of
Housing, Construction
& Urban Development
Sri Lanka

ATTACHMENT

1. Components of the draft report

The Sri Lankan side has agreed and accepted in principle the components of the draft final report proposed by the team.

2. Organization and Personnel of the CETRAC

In order to make the CETRAC viable and effective, it is indispensable to organize the CETRAC and to secure the number of personnel as shown in the ANNEX-Ⅰ.

3. Functions of the Curriculum Development Section

Functions of the Curriculum Development Section shall include and be limited to develop and prepare the textbooks on the training courses under operation of the CETRAC.

4. Framework of the curriculum

The curriculum framework of the training course which the CETRAC would implement is described in the ANNEX-Ⅱ. However the final contents of the curriculum will be prepared before the opening of the CETRAC.

5. Japan's Grant Aid System

(1) The Government of Sri Lanka has understood the system of Japan's Grant Aid explained by the team.

(2) The Government of Sri Lanka will take necessary measures, described in the ANNEX-Ⅲ for smooth implementation of the Project, on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

6. Use of facilities and equipment of the CETRAC

The Sri Lankan side has agreed to use all the facilities and equipment of the CETRAC under Japan's Grant Aid Assistance, if it is extended to the Project;

(1) only in accordance with the activities of the CETRAC.

(2) based on the recommendations and advice of Japanese Experts under Japanese Technical Cooperation, if it is realized.

7. Further Schedule

The team will make the final report in accordance with the confirmed items, and send it to the Government of Sri Lanka by May, 1994.

ANNEX- I

1P
Manager
1P
Deputy Manager
16+(2) P
Training Section
6P
Curriculum Dvlmt. Section
22P
Administration Section
1P
Administrative Officer
7P
14P
Account Assistant 1
Store Keeper 1
Storeman 2
Warden 1
Reception 1
Nurse 1
Librarian 1
Typist(E) 1
Typist(S) 1
Drivers 4
Janitor 2
Staffs
Labourers 5
1P
Senior Instructor
1P
Training Material Writer
3P
Illustrator cum Draftman
1P
Word Processor Typist
1P
Senior Instructor
1P
Instructor Management Course
1P
Instructor Supervisor's Course
1P
Senior Instructor
1+(1)P
Instructor Mechanic- I Course
1+(1)P
Instructor Mechanic- II Course
1P
Instructor Basic Mechanic Course
1P
Instructor Record Keeping Inventory Control
4P
Demonstrator
4P
Helpers
( ) ... Visiting Instructor
CETRAC Instructor - MI ①, ② MII ①, ②, ③
Visiting Instructor - MI ③ MII ④, ⑤

ANNEX- II

Course Title	Module Code	Scheme	Contents
Management Personnel Class Size 10 Annual Output 10	MP (1)	• Repair and Maintenance Planning, Scheduling and Control • Fleet Renovation Control • Cost Management	- Repair and Maintenance Planning - Scheduling and Control - Productivity of Construction Equipment - Construction Equipment Hire Calculation Table - Items of Contracted Work Cost - Fleet Renovation Control - Methods of Safety Control
Supervisors Class Size 10 Annual Output 20	SP (1)	• Trouble Shooting	- Engine Dyname Testing - Fuel Injection Punp Testing - Diagnostic Instruments for Trouble Shooting - Inspection and Trouble Shooting of Engine - Inspection and Trouble Shooting of Power Train - Failure Analysis
	SP (2)	• Testing and Examination	- Hydrauric Testing - Electric / Mechatronic Circuit Testing - Diagnostic Instruments for Trouble Shooting - Specific Knowledge of component Unit and Sub-Assembly and Functional system of Equipment - Applicable Knowledge on Electronic/Mechatronic System - Failure Analysis
Mechanics I Class Size 20 Annual Output 60	MI (1)	• Engine Repair and O/H (including electric power device)	- Machine Failure Diagnosing Techinic and Adjusting on Engine, Fuel Injection and Electric Device - Removal and Installing Components from Specific Equipment - Disassembly and Assembly Engine, Fuel Injection and Electric Device - Checking, Adjusting, Measuring and Evaluation of Components/Parts
	MI (2)	• Chassis and Powerline Repair and O/H • Attachment Repair and O/H (including welding technic)	- Machine Failure Diagnosing Technic on Power Train, Under Cariage, Tire, Chassis and Attachment - Removal and Installing Components from Specific Equipment - Disassembly and Assmebly of Power Train, Under Cariage, Tire, Chassis and Attachment - Checking, Adjusting, Measuring and Evaluation of Components/Parts - Automatic/ Semi-Automatic Welding Methods and Technique
	MI (3)	• Hydraulic Control Repair and O/H (including Mechatronics)	- Machine Failure Diagnosing Technic and Adjusting on Hydraulic and Electronic/Mechatronics - Removal and Installing Components from Specific Equipment - Disassembly and Assembly Hydraulic Components and Electromic Components - Checking, Adjusting, Measuring and Evaluation of Components and Parts

Course Title	Module Code	Scheme	Contents
Mechanics II Class Size 20 Annual Output 100	MII (1)	• Checking Point and Maintenance Point	- Outline of Components and Funciton on the Equipment - General Knowledge of Fuel, Oil, Water and Air Line - Procedure of Daily, Periodical Maintenance - Checking and Adjustment of Engine (i.e. Linkage), Steering (i.e. Lever, Pedal, Wheel Alignment) - Checking and Adjustment of Electric/Mechatronic Components - Maintenance of Light Equipement
	MII (2)	• Structure and Function	- Overview of Structure and Function of Component - Structure and Function of Engine, Power Train, Under Cariage, Hydraulic System, Electric System and Attachment
	MII (3)	• Disassembling and Assembling • Trouble Finding	- General Information on Disassembly and Assembly - Usage of Special Tools - Disassembling and Assembling of Engine, Power Train, Hydraulic Component - Checking and Adjusting on Assembling Stage
	MII (4)	• Repair Operation by Models • Construction Method	- Repair of Under Carriage, Trucks and Tire - Repair of Steering/Brake System - Usage of Special Tools - General Knowledge on Construction Method
	MII (5)	• Preventive Maintenance	- General Knowledge on Preventive Maintenance - Introduction of Measuring Instrument - Daily/Periodical Inspection Point - Usage of Mobile Workshop/Lublicaiton Service Truck
Basic Mechanics Class Size 20 Annual Output 60	BM (1)	• Basic Knowledge of Component, etc. • Basic Practical Taining of Welding and Operation	- Basic Knowledge on Maintenance, Structure and Function by Models - Proper Usage of General Tools - Basic Knowledge on Component (Engine, Power Train, etc.) - Practical Training of Operation - Practical Training of Weldimg
Record Keeping Class Size 15 Annual Output 15	RK (1)	• Record Control and Assessment	- System of Record Keeping - Format of Record Keeping - Input of Data - Filing System - Using Method of Record Keeping
Inventory Control Class Size 15 Annual Output 15	IC (1)	• Inventory Control and Logistics of Parts	- System of Inventory Control - Format of Inventory Control - Stock House Installation - Delivery to Workshop - Cyclic Check of Stock House

ANNEX-III

Following necessary measures should be taken by the Government of Sri Lanka in case that Japan's Grant Aid Assistance is executed.

1) To secure a lot of land necessary for the execution of the Project.

2) To clear the site prior to commencement of the construction.

3) To undertake incidental outdoor works such as gardening, fencing and gates in and around the site.

4) To provide facilities for distribution of electricity, water supply, telephone, drainage, sewage, and other incidental facilities to and from the site.

5) To provide general furniture for the project.

6) To bear the following commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement.
   - Advising commission of Authorization to Pay
   - Payment commission

7) To ensure prompt unloading and customs clearance at ports of disembarkation in Sri Lanka and internal transportation therein of the products purchased under the Grant.

8) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Sri Lanka with respect to the supply of the products and services under the verified contracts.

9) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contract such facilities as may be necessary for their entry into Sri Lanka and stay therein for the performance of their work.

10) To maintain and use properly and effectively the facilities constructed and equipment purchased under the Grant.

11) To bear all the expenses, other than those to be borne by the Grant, necessary for the execution of the Project.

12) To coordinate and solve any issues related to the Project which may arise with third parties and inhabitants living around the site during implementation of the Project.

4. Equipment List

EQIPMENT LIST FOR CETRAC

Item	Description	Main Specification	Q'ty
	1 CONSTRUCTION EQUIPMENT		
1	Bulldozer with Ripper	with strait tilt dozer, ripper, and canopy. Rated horse power : approx, 170 ps Drive system : Torque converter drive	1 unit
2	Bulldozer	with strait tilt dozer and canopy Rated horse power : approx, 170 ps Drive system : Torque converter drive	1 unit
3	Hydraulic Excavator	Rated horse power : approx, 120 ps Drive system : Hydraulic drive Bucket capacity : approx, 0.7 m3 Travel system : Crawler	2 units
4	Wheel Loader	with standard bucket and canopy. Rated horse power : approx, 120 ps Drive system : Torque converter drive Bucket capacity : approx, 1.9 m3 Steering type : Articulated type	1 unit
5	Dump Truck	Max. horse power : approx, 215 ps Drive system : 4 x 2 Gross Vehicle Weight : approx, 17 ton	1 unit
6	Motor Grader	with Scarifier and canopy. Rated horse power : approx, 130 ps Drive system : Direct drive Blade length : 3.7 m	1 unit
7	Vibratory Roller	with canopy. Combined, articulated, all wheel drive type. Rated horse power : approx, 70 ps Drive system : Hydrostatic transmission Operation weight : approx, 5.5 ton	1 unit
8	Vibratory Roller	Hand guide type. Operating weight : approx, 1 ton	1 unit
9	Compaction Plate	Hand guide type. Engine : Diesel Engine, 4 ps Operating weight : approx, 100 kg	1 unit
10	Tamper	Operating weight : approx, 50 kg Rated horse power : 3 ps	1 unit

EQIPMENT LIST FOR CETRAC

Item	Description	Main Specification	Q'ty
11	Wheel Crane	Rated horse power : approx, 220 ps Drive system : Torque converter drive, 4 x 4 Max. Lifting capacity : 25 ton Max. Boom length : approx, 30 m	1 unit
12	Air Compressor	Portable, Screw, Sound-proof type. Rated horse power : approx, 100 ps Free air delivery : 11 m3/min, Air pressure: 7 kg/cm2 with Jack Hammer (2 units)	1 unit
13	Generator	Rated output : 100 kVA Rated horse power : 130 ps	1 unit
14	Water Pump	Self-priming water pump. Discharge bore diameter : 100 mm Total head : 15 m Motor capacity : 5 kW	1 unit
15	Slug Pump	Discharge bore diameter : 100 mm Total head : 25 m Motor capacity : 11 kW	1 unit
16	Submarged Pump	Discharge bore diameter : 200 mm Total head : 15 m Motor capacity : 19 kW	1 unit
17	Concreat Mixer	Mixing capacity : 0.08 m3 Motor capacity : 0.75 kW	1 unit

EQUIPMENT LIST FOR CETRAC

Item	Description	Main Specifications	Q'ty
	2. WORKSHOP EQUIPMENT		
	2-1 CHASSIS WORKSHOP		
1	Overhead Crane, with Saddle	Capacity : 5 ton, Span x Length : 14.9 x 80 m	1 set
2	Pallet Truck	Capacity : 2,000 kg	1 unit
3	Sling Chain Kit with Cart	Including sling chains and necessary parts	2 sets
4	Parts Rack	1800 x 780 x 1800 mm	6 unit
5	Mechanic Tool set	For Construction Equipment	5 set
6	Tool Cabinet	Dimensions : 740 x 400x840mm	5 unit
7	Parts Cleaner	Tank Cap.: 100 liter	1 unit
8	Portable Lubricator, Mobile type	Air Operated, for hydraulic oil.	2 unit
9	Portable Lubricator, Mobile type	Air Operated, for grease.	2 unit
10	Transmission Jack (standard)	Capacity : 1800kg	1 unit
11	Tractor Support (Front)	Capacity : 35 ton	2 set
12	Tractor Support (Rear)	Capacity : 35 ton	4 set
13	Air Hose Reel	Hose size : 9.0 mm (I.D) x 10 m	2 pcs
14	Mobile Work Bench (Wood Cover)	1,000 x 600 x 700 mm	6 units
15	Engineers Vise	Jaw width : 127 mm	6 pcs
16	Others		1 set
	2 - 2 ENGINE WORKSHOP		
1	Overhead Crane	Capacity : 3 ton, Span x Length : 14.9 x 80 m	1 set
2	Jib Crane, Wall Type	Capacity : 2 ton x 5 m	1 unit
3	Mobile Floor Crane	Capacity : 1 ton	1 set
4	Hydraulic Shop Press	Capacity : 50 ton with Hydraulic Hand Pump	1 set
5	Work Bench with Cabinet and Locker	1800 x 800 x 700 mm	2 sets
6	Bench Electric Grinder	Wheel size : 205 mm	1 unit
7	Bench Drill Press	Capacity : 13mm	1 unit
8	Engine Positioner, Electric Type	Service capacity : 3,000kg	2 units
9	Parts Rack	1850 x 780 x 1800 mm (L x W x H)	3 unit
10	Cylinder Head Work Bench	With rotary fixture : approx. 1300 x 360 mm	2 unit
11	Air Hose Reel	Hose size : 9.0mm(I.D) x 10 m	2 pcs
12	Valve Refacer	Chuck cap. : 6 - 14.5 mm dia.	1 unit
13	Piston Heater (Bearing Heater)	Power : AC 1ph, 3KW	1 unit
14	Tool Cabinet	Dimensions : 740 x 400 x 840mm	2 units
15	Mechanic Tool set	For Construction Equipment	2 sets
16	Parts Washer	Heater : 6KW, Motor : 0.75KW	1 unit
17	Cylinder Boring Machine	Boring Range : 66 - 150 mm	1 set
18	Others		1 set

EQUIPMENT LIST FOR CETRAC

Item	Description	Main Specifications	Q'ty
	2 - 3 HYDRAULIC SYSTEM WORKSHOP		
1	Mechanic Tool Set	For Construction Equipment	4 sets
2	Tool Cabinet	Dimensions : 740 x 400 x 840 mm	4 units
3	Work Bench	L x W x H : 1800 x 750 x 740	2 units
4	Air Hose Reel	Hose size : 9.0 mm (I.D) x 10 m	1 pc
5	Hydraulic Cylinder Service Stand	Max torque : 4000 kg.m	1 unit
6	Others		1 set
	2 - 4 TRANSMISSION WORKSHOP		
1	Transmission Positioner	Service cap. : 2000kg	1 unit
2	Mechanic Tool Set	For Construction Equipment	4 sets
3	Tool Cabinet	Dimensions : 740 x 400 x 840 mm	4 units
4	Parts Rack	Dimension : 1850 x 500 x 1800 mm	4 units
5	Work Bench	L x W x H : 1800 x 750 x 740	2 units
6	Jib Crane, Wall Type	Capacity : 1 ton x 5 m	1 unit
7	Air Hose Reel	Hose size : 9.0 mm (I.D) x 10 m	1 pc
8	Others		1 set
	2 - 5 UNDERCARRIAGE WORKSHOP		
1	Roller & Idler Press Power Unit	Capacity : 100 ton	1 unit
2	Conveyer Stand for Roller Line	3 Conveyors	1 set
3	Track Press with Hydraulic Winch	Capacity : 230 short ton	1 unit
4	SALT Lubricator & Tester Kit	For SALT type track links	1 unit
5	Turn Table for Disassembled Links		1 set
6	Shoe Bolt Impact Wrench with Stand	Max. Torque : 608 kg-m	1 unit
7	Conveyors and Shoot	For track press	1 set
8	Tool Locker	1000 x 450 x 800 mm	2 units
9	Air Hose Reel	Hose size : 9.0 mm (I.D) x 10 m	1 pc
10	Roller Welder (Dual head type)	DC 44V, 650 Amp x 2 units	1 unit
11	Vacuum Flux Recovery	For Roller Welder	1 unit
12	1/2 ton Electric Chain block	for Roller Welder	1 set
13	Others		1 set

EQUIPMENT LIST FOR CETRAC

Item	Description	Main Specifications	Q'ty
	2 - 6 TIRE WORKSHOP		
1	Thermo Press	For passenger car to truck	1 unit
2	Tool Locker	1100 x 450 x 800 mm	1 unit
3	Air Compressor	2.2 kW, Single stage	1 set
4	Others		1 set
	2 - 7 MACHINE WORKSHOP		
1	Lathe	460 x 1500 mm	1 set
2	Bench Electric Grinder	Wheel size : 255 x 25 x 19.05 mm	1 unit
3	Work Bench	L x W x H : 1800 x 750 x 740	1 unit
4	Tool Locker & Cabinet	6 drawers, 580 x 620 x 1000 mm	1 set
5	Parts Rack	1800 x 540 x 1800 mm	1 unit
6	Upright Drilling Machine	Capacity : Max. 40 ø mm	1 set
7	Others		1 set
	2 - 8 WELDING AND FABRICATION WORKSHOP		
1	AC Arc Welder	Secondary current range : 40 - 300 A	1 unit
2	Iron Anvil	Cast Iron, 70kg	1 pc
3	Cast Iron Swage Block	Dimensions : 315 x 315 x 115 mm	1 pc
4	Hydraulic Shop Press, 100ton	with Hydraulic Hand Pump	1 set
5	Partition for Welding	1800 x 400 x 1800 mm	4 sets
6	Hand Lever Shear		1 set
7	Air Hose Reel	Hose size : 9.0mm (I.D) x 10 m	1 pc
8	Others		1 set
	2 - 9 ENGINE DYNAMOMETER ROOM		
1	Engine Dynamometer	Max. power range : 400 PS	1 unit
2	Special Accessories for E/ D		1 set
3	Weight Type Fuel Consumption Meter	Container capacity : 2800 cc	1 unit
4	Non Resistance Silencer	Dimension : 1800 x 1130 x 480 mm	1 set
5	Work Bench with Cabinet and Locker	1800 x 800 x 740 mm	1 set
6	Air Hose Reel	Hose size : 8.0mm (I.D) x 6m	1 pc
7	Overhead Travelling Crane, 3 ton	Span : 6.4 m, Travel : 9.6 m	1 unit
8	Others		1 set

EQUIPMENT LIST FOR CETRAC

Item	Description	Main Specifications	Q'ty
	2 - 10 FUEL SYSTEM WORKSHOP		
1	Fuel Injection Pump Tester	Drive Motor : 7.5kw	1 unit
2	Nozzle Tester	Pressure Gauge : 0 - 500 kg/cm2	2 sets
3	Work Bench	L x W x H : 1800 x 750 x 740	2 unit
4	Mechanic Tool Set	For construction equipment	2 sets
5	Parts Rack	1800 x 500 x 1800 mm	2 sets
6	Air Hose Reel	Hose size : 8.0mm (I.D) x 6m	1 pc
7	PT Pump Test Stand	Drive motor : 4 kW	1 set
8	Others		1 set
	2-11 ELECTRIC SYSTEM WORKSHOP		
1	Starter Generator Test Bench	Motor : 3.7 kW	1 unit
2	Work Bench	L x W x H : 1800 x 750 x 740	2 units
3	Tool Cabinet	3 drawers and 1 shelf	2 units
4	Head Light Tester	Max scale : 40,000 Candela	1 unit
5	Others		1 set
	2 - 12 HYDRAULIC TEST ROOM		
1-1	Hydraulic Component Universal Tester	125 Hp	1 unit
2	Parts Rack	1800 x 500 x 1800 mm	2 units
3-1	Mechanic Tool Set	For Construction Equipment	1 set
3-2	Tool Cabinet	Dimensions : 740 x 400 x 840 mm	1 unit
4	Jib Crane, Wall Type	Capacity : 1 ton	1 unit
5	Work Bench	L x W x H : 1800 x 750 x 740	1 unit
6	Air Hose Reel	Hose size : 9.0 mm (I.D) x 10m	1 pc
7	Others		1 set

EQUIPMENT LIST FOR CETRAC

Item	Description	Main Specifications	Q'ty
	2 - 13 MECHATRONICS WORKSHOP		
1	Mechatronics Simulator	Hydraulic Excavator	1 set
2	MechatronicsSimulator	Rough Terrain Crane	1 set
3	Simulator, Plain type	Electronics Governor Controlling System	1 set
4	Simulator, Plain type	Automatic Idling Controlling System	1 set
5	Simulator, Plain type	Hydraulic Pump Controlling System	1 set
6	Dither Signal Controller	for Solenoid Valve	1 set
7	System Checker	Hydraulic Excavator	1 set
8	Sensor for Training Sample		2 sets
9	Controller for Training Sample	various kinds	2 sets
10	Actuator for Training Sample	various kinds	2 sets
11	Monitor for Training Sample	various kinds	2 sets
12	Connector for Training Sample		2 sets
13	Tools for Connector and Wire-Harness		2 sets
14	T-Type Adapter	Wire Connector	2 sets
15	Miscellaneous Equipment		2 sets
16	OHP Sheet for Training	Total 250 units	1 set
17	Hand Book for Simulators	7 items	1 set
18	Cabinet		1 set
	2 - 14 BATTERY ROOM		
1	Hand Truck	Dimension (L x W) : 900 x 600mm	2 unit
2	Silicon Quick Charger	AC input : 3ph, 6.5 kVA	2 unit
3	Parts Rack		1 unit
4	Water Purifier	Normal flow rate : 25 liter/h	1 unit
5	Others		1 set
	2 - 15 CLEANING AREA		
1	Hot Water High Pressure Washer	Water discharge : 1600 lit./H	1 unit
2	Steam Cleaner	Water consumption : 800 lit./h	1 unit
3	Others		1 set
	2 - 16 PAINTING		
1	Air Compressor	Motor Output : 1.5kw (3-phase)	1 unit
2	Others		1 set

EQUIPMENT LIST FOR CETRAC

Item	Description	Main Specifications	Q'ty
	2 - 17 DIESEL FUEL STAND		
1	Fuel Station for Diesel Fuel	Fuel dispenser : 1 unit	1 set
2	Fuel Tank	Tank capacity : 5700 liter	1 set
3	Others		1 set
	2 - 18 COMPRESSOR		
1	Air Compressor with Accessories	Motor capacity : 15 kW, Screw type	1 set
2	Others		1 set
	2 - 19 LUBRICATION EQUIPMENT		
1	Portable Greasing Unit for Oil	Including air pump, nozzle, hose reel and etc.	1 unit
2	Others		1 set
	2 - 20 MATERIAL HANDLING EQUIPMENT		
1	Diesel Engine Forklift	Cap. : 2 ton	1 unit
2	Others		1 set
	2 - 21 TOOL ROOM		
1	General Tools		1 set
2	Measuring Tools		1 set
3	Basic Tools Set	Portable type, with carry case	60 sets
4	Others		1 set
	2 - 22 SPECIAL TOOL		
1	Special Tools for Engine	Engine assembling and disassembling tools	1 set
2	Special Tools for Chassis	Steering and Undercarriage repairing tools	1 set
3	Special Tools for Inspection		1 set
4	Others		1 set

EQUIPMENT LIST FOR CETRAC

Item	Description	Main Specifications	Q'ty
	2 - 22 PARTS WAREHOUSE		
	1. RACKS AND SHELVING FOR WAREHOUSE		
1	Rack	Various kinds	74 sets
2	Pallet Rack	2600 x 1100 x 3000 mm	3 sets
3	Mesh Box Pallet	1000 x 1200 x 850 mm	6 units
4	Rack for Long Heavy	1000 x 600 x 2300 mm	4 sets
5	Others		1 set
	2. W/HOUSE MANAGEMENT EQUIPMENT & FACILITY		
1	Work Bench with One Drawer	1700 x 700 x 750 mm	1 set
2	Pallet Truck	Capacity : 2,500kg	1 unit
3	Personal Computer	with Software for parts inventory	1 sets
4	Others		1 set

EQUIPMENT LIST FOR CETRAC

Item	Description	Main Specifications	Q'ty
	3. EDUCATIONAL EQUIPMENT		
	3.1 COMPONENTS		
1-1	Diesel Engine Assembly Unit with Stand	4 cycle, 6 cylinder in line, 170 ps	2 units
1-2	Diesel Engine Assembly Unit with Stand	4 cycle, 6 cylinder in line, PT-type, 220 ps	1 unit
1-3	Diesel Engine Assembly Unit with Stand	4 cycle, 4 cylinder in line, 100 ps	1 units
2-1	Fuel Injection Pump Unit	Bosh type, 6 plunger type.	3 units
2-2	Fuel Injection Pump Unit	PT type	1 unit
3	Starter Motor Unit	Power : 12 kW	4 units
4	Alternator Unit	Capacity : 50 kW	4 units
5	Generator Unit	Capacity : 24 V, 30 A	1 unit
6	Voltage Regulator Unit	For 30 Amp capacity of alternator.	1 unit
7	Torque Convertor Unit with Stand	Crawler tractor (170 ps).	2 units
8	Power Shift Transmission with Stand	Crawler tractor (170 ps).	2 units
9	Hydraulic Pump Assembly with Stand	Power Shovel (120 ps).	2 units
10	Hydraulic Control Valve (Right)	Control valve for Hydraulic Power Shovel (120 p	2 units
11	Hydraulic Control Valve (Left)	Control valve for Hydraulic Power Shovel (120 p	2 units
12	Hydraulic Motor with Stand	Hydraulic Motor for Hydraulic Power Shovel	2 units
13	Hydraulic Cylinder	Bucket Cylinder for Hydraulic Power Shovel	2 units
14	Others		1 set
	3.2 AUDIO VISUAL EQUIPMENT		
1	Overhead Projector	Aperture size : 280 x 280 mm, with Zoom lens.	5 units
2	Screen	Ceiling type, 1500 x 1500 mm, High Brightness	5 units
3	Screen with Tripod	Tripod type, 1500 x 1500 mm, High Brightness	1 unit
4	Color TV Monitor	PAL system, 29 "	5 units
5	Video Cassette Recorder	VHS, Multi system	5 units
6	Slide Projector	Slide size : 35 mm, including tape recorder	2 units
7	Rack for Monitor TV and VTR		5 units
8	AV System for Lecture Hall		1 set
9	AV System for Conference Room		1 set
10	Others		1 set
	3.3 TRAINING APPARATUS		
	1. TRAINING SLIDE		
1	General Knowledge of Machine	Bulldozer, Dozer Shovel, etc.	1 set
2	Operation and Maintenance	Bulldozer, Engine, Undercarriage, etc.	1 set

EQUIPMENT LIST FOR CETRAC

Item	Description	Main Specifications	Q'ty
3	Structure and Function	Bulldozer, Wheel Loader, Motor Grader etc.	1 set
4	Others		1 set
	2. VIDEO CASSETTE TAPE		
1	Repair for Diesel Engine Series	Assembling & Disassembling.	1 set
2	Disassembly for Hydraulic Oil Pump	Assembling & Disassembling.	1 set
3	Disassembly for Hydraulic Motor	Assembling & Disassembling.	1 set
4	Trouble Shooting of Electrical System		1 set
5	Inspection & Adjustment of Electric System		1 set
6	Inspection and Adjustment for Excavator		1 set
7	Inspection and Adjustment for Roller		1 set
8	Inspection and Adjustment for Grader		1 set
9	Others		1 set
	3. OVERHEAD TRANSPARENCIES		
1	General	Structures of Bulldozer, etc.	2 set
2	Diesel Engine	General knowledge for engine	2 set
3	Diesel Engine	Structure for Diesel Engine	2 set
4	Diesel Engine	Structure for Diesel Engine (PT-pump type)	2 set
5	Power Train Equipment		2 set
6	Final Drive		2 set
7	Electric System		2 set
8	Hydraulic System		2 set
9	Others		1 set
	4. CUTAWAY MODEL		
1	Engine Assembly	4-cylce, 6-cylinders, 170 ps class	1 unit
2	Fuel Injection Pump	Bosh type, PT type	1 set
3	Alternator	Structure for Diesel Engine (PT-pump type)	1 unit
4	Starter Motor	Bulldozer	1 unit
5	Torque Flow Transmission	Bulldozer	1 unit
6	Injector	Structure for electrical parts	1 unit
7	Water Pump	Structure for Hydraulic Components	1 unit
8	Oil Filter		1 unit
9	Turbocharged		1 unit
10	Hydraulic Pump		1 unit
11	Torque Convertor		1 unit
12	Control Valve		1 unit
13	Steering Clutch		1 unit

EQUIPMENT LIST FOR CETRAC

Item	Description	Main Specifications	Q'ty
14	Track Roller		1 unit
15	Hydraulic Motor	Excavator, 150 PS class	1 unit
16	Hydraulic Cylinder		1 unit
17	Jack Hammer	19 kg class	1 unit
18	Others		1 set
	5. PLASTIC MODEL		
1	Mini Plastic Model	Planetary Gear	2 units
2	Plastic Model	Torque Convertor	2 units
3	Plastic Model	Planetary Gear	2 units
4	Others		1 set
	6. SYSTEM BOARD		
1	Hydraulic System Board	Bulldozer	1 unit
2	Electric System Board	Bulldozer	1 unit
3	Electric System Board	Truck	1 unit
4	Brake System Board		1 unit
5	Fuel System Board		1 unit
6	Others		1 set
	7. COMPUTER ROOM		
1	Personal Computer	Memory : 4 MB	9 sets
		With Key board, Mouse and 14" Color Display,	
2	Dot Printer	With Printer cable, Sheet feeder and Ribbons,	5 sets
3	Printer Selector	With cable	7 sets
4	Desk for Computer	1200 x 800 x 670 mm	9 units
5	Chair for Computer		9 units
6	Others		1 set
	8. CURRICULUM DEVELOPMENT EQUIPMENT		
1	Photo Camera	With zoom lens 35 mm to 105 mm	1 set
2	Micro Film Reader		1 set
3	Digital Duplicator		1 set
4	Color Video Camera PAL Type		1 set
5	Video Editing System		1 set
6	Film Product for OHP		1 set
7	Slide Film to TV Converter		1 set

EQUIPMENT LIST FOR CETRAC

Item	Description	Main Specifications	Q'ty
8	Book Binding Machine		1 set
	Cassette Tape Recorder	with Microphone	1 set
9	Others		1 set
	9. OFFICE EQUIPMENT		
1	Photo Copy Machine		2 sets
2	Electric Type Writer		2 sets
3	Personal Computer	Memory : 4 MB with Key board, Display.	5 sets
4	Application Software		1 sets
5	Laser Writer	with Component, Selecter, Paper	3 sets
6	UPS		5 sets
7	Desk for Computer	1200 X 800 X 750 mm	5 sets
8	Chair for Computer		5 sets
9	Desk for Typewriter		2 sets
10	Chair for Typewriter		2 sets
11	Others		1 set
	10. FURNITURE		
1	Furniture for Class Room		1 set
2	Furniture for Office		1 set
3	Furniture for Conference Room		1 set
4	Furniture for Welfare Facilities		1 set
5	Others		1 set
	3.4 VEHICLE		
1	Micro Bus	GVW : 5.4 ton, Passenger capacity : 30 Diesel Engine power : 90 ps	1 unit
2	Station Wagon	4 Wheel Drive, Passenger capacity : 10 Diesel engine power : 115 ps	3 units
3	Double Cab Pick Up Truck	4 Wheel Drive, Passenger capacity : 5 Diesel engine power : 115 ps	1 units