3-3 Procurement of Lecturing Staff

It is as important to secure lectures as the allocation of funds for the operating costs. This is one of the key factors for the effective operation of the Center. Basically, the lecturers should be secured from people concerned in the coal industries, the official world and academic circles by the OEA. But as a temporal measure, several foreign experts will be required in the various fields of mining since most local engineers are technically immatured. It is then necessary that the OEA should prepare several local staff capable of acting as counterparts to the foreign experts in discussing and determining both curriculum and training methods in detail prior to the opening of the Center. It is also desirable that these local counterparts should go to foreign countries to observe and study mine operation and training programs provided for both engineers and workers overseas.

After the opening of the Center, both the local counterparts and the foreign experts shall cooperate together in giving lectures and seminars. During this period, technology and educational methods will be transferred to the local counterparts. If after a few years when the operation of the training center is well on its way, these counterparts become the lecturers whereby the foreign experts will no longer be needed (Figure 3-3-1). The number of foreign experts and local counterparts as well as the level of their expertise required for the center are shown below.

These local counterparts will take charge in organizing each specific course. In case that additional specialists are required to teach in other fields, the local counterparts shall be responsible for the recruitment of specialists from other private organizations.

Foreign Expert	Local Counterpart (Section Specialist)
1 Geologist	1 (Geologist)
1 Safety Engineer	1 (Safety Engineer)
1 Mining Engineer	1 (Mine Operations / Planning)
1 Mechanical Engineer	1 (Maintenance)
1 Electrical Enginer	
1 Chemist	1 (Coal Utilization / Coal Preparation / Chemistry & Analysis)

Further, local counterparts shall be full-time employees of the center. For the foreign experts, it is recommended that a mining engineer who is also the chief of foreign experts shall reside for 2 to 3 years while the other foreign experts will be dispatched only for a few months a year according to the curriculum. The relationship between the curricula and the dispatch schedule of foreign experts is shown in Figure 3-3-2 ~ 3.

Figure 3-3-2 CURRICULUM AND LECTURERS FOR THE CENTER (1990)

	WEEK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
																			*																																					
PROGRAMS FOR ENGINEERS	GEOLOGY AND GEOLOGICAL SURVEY																																																					
	GEOLOGY AND DRILLING																																																					
	SAFETY AND RESCUE																																																					
	MINING ENGINEERING																																																					
	EQUIPMENT MAINTENANCE & ENGINEERING																																																					
	COAL QUALITY AND UTILIZATION																																																					
PROGRAMS FOR WORKERS	SAFETY, RESCUE AND FIRST AID																																																				
	MINE DEVELOPMENT																																																					
	COAL WINNING																																																					
	MAINTENANCE OF MINE EQUIPMENT																																																				
	MAINTENANCE OF GENERATING SETS																																																				
FOREIGN EXPERTS	GEOLOGIST																																																				
	SAFETY ENGINEER																																																					
	MINING ENGINEER																																																					
	MECHANICAL ENGINEER																																																					
	ELECTRICAL ENGINEER																																																					
	CHEMIST																																																					
FILIPINO COUNTERPARTS	GEOLOGIST																																																				
	SAFETY ENGINEER																																																					
	MINING ENGINEER																																																					
	MECHANICAL/ELECTRICAL ENGINEER																																																				
	CHEMIST																																																					
NO. OF TRAINEES (ENGINEERS)																			15	15	15	15	15	15		15	30	30	30		15	15	15	15	15	15		15	15	15	15	15			15	15	15	15	15	15				90
NO. OF TRAINEES (WORKERS)																			25	25		25	25	25	25			25	25	25	25			25	25	25			25	25			25	25		25	25						175
TOTAL NO. OF TRAINEES																			40	40	15	15	40	40	25	40	30	30	55	25	40	40	15	15	40	40	25	15	15	40	40	15		40	40	15	40	40	15				265

* START OF THE TRAINING PROGRAMS AT THE CENTER

Figure 3-3-3 CURRICULUM AND LECTURERS FOR THE CENTER (1991 ~ 1992)

	WEEK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
PROGRAMS FOR ENGINEERS	GEOLOGY AND GEOLOGICAL SURVEY																																																					
	GEOLOGY AND DRILLING																																																					
	SAFETY AND RESCUE																																																				
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	EQUIPMENT MAINTENANCE & ENGINEERING																																																				
	COAL QUALITY AND UTILIZATION																																																				
PROGRAMS FOR WORKERS	SAFETY, RESCUE AND FIRST AID																																																				
	MINE DEVELOPMENT																																																				
	COAL WINNING																																																				
	MAINTENANCE OF MINE EQUIPMENT																																																			
	MAINTENANCE OF GENERATING SETS																																																			
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FILIPINO COUNTERPARTS	GEOLOGIST																																																		
	SAFETY ENGINEER																																																			
	MININIG ENGINEER																																																			
	MECHANICAL/ELECTRICAL ENGINEER																																																			
	CHEMIST																																																			
NO. OF TRAINEES (ENGINEERS)					15	15	15	15	15	15		15	15	15	15		30	30	30	30	15	15		15	15	15	15	15		15	15	15	15		25	15	15	15	15	15		15	15	15	30	30	30	15					135
NO. OF TRAINEES (WORKERS)					25	25			25	25	25	25		25	25		25	25	25	25		25	25	25		25	25		25	25		25	25	25	25			25	25		25	25	25	25		25	25	25					275
TOTAL NO. OF TRAINEES					40	40	15	15	40	40	25	40	15	40	40		55	55	55	55	15	40	25	40	15	40	40	15	25	40	15	40	40	25	40	15	15	40	40	15	25	40	40	40	30	55	55	40					410

3-4 Location and Layout of the Training Center

3-4-1 Selection of the Training Center Site

(1) Main Training Center (Area : 2 ha)

As a result of our site survey, the three sites considered as prospective locations for the construction of the main training center are;

a. University of the Philippines lot, Talisay (11 km from Cebu).

b. Cebu provincial lot in Lahug Airport area

c. Uling Lot in PNOC-CC Uling mine. (Lowest portion of the property)

The conditions of both lots are shown in the following Table 3-4-1.

Table 3-4-1 Comparison Table of Three Proposed Sites

	Description	Talisay lot	Lahug lot	Uling lot
1	Land Owner	University of the Philippines (UP)	Cebu Provincial Government	PNOC-CC
2	Available Area	8 ha	∞	1.5 ha
3	Present Condition	Coconut Plantation	Airport	Old muck dumped area
4	Future Development Plan	Training center for UP	Sports center & National governmental center (plan is not fixed)	None
5	Topography	Flat	Flat	Gently inclined flat terrace
6	Accessibility	Good	Good	Not good (30 km from Cebu city)
7	Availability of Utilities	Good	Good	Electricity: good Water: well or spring
8	Spoil Condition	Hard loam at surface Stable	Hard loam at surface Stable	Filled with shale and sandstone in the valley. Unstable
9	Living Conditions	Good	Good	Not recommendable

The lot data given in the above table can be supplemented by the following details:

a) Talisay lot:

* Talisay lot is located in the south of Talisay town, approximately 11 km from Cebu city, with about 20 km to go to the Uling experimental mine site.
* As the UP lot is about 8 ha wide, the required area of 2 ha for construction of the main training center is sufficient.
* It is necessary to negotiate with the UP concerning the use of land and other related matters, such as cooperation with the UP.

b) Lahug lot:

* Lahug lot is in the old airport of Cebu where the main portion is currently still used as a runway for light planes and the marginal area is occupied by illegal houses.
* The future plan by the Cebu provincial government is to utilize this land as a sports center and for government offices as soon as the certification procedures for the present registration of every lot are completed. Therefore, the use of this land might be delayed for several years.

c) Uling lot:

* Uling lot, located in the PNOC compound of the Uling mine site, is only 1.5 ha and consists of old dumped muck of clayey rocks. It is too narrow and costly for the main center to be built here and because of the possible danger of land slides or slope failure.

If the Lahug lot is selected for the center, the construction schedule will be greatly delayed. On the other hand, the Uling lot is too risky or costly in terms of soil stabilization.

As a result, the UP lot at Talisay would be the best choice at the moment, although a sort of cooperation with the UP would be required in the future. The decision has to be made by the OEA after negotiation with each land owner.

(2) Experimental mine

The experimental mine is scheduled to be located in the PNOC-CC Uling mine after the negotiations between OEA and PNOC on June 22, 1988. The exact location will be decided by PNOC-CC according to the request by OEA. The location of the Uling mine is shown in Figure 3-4-1.

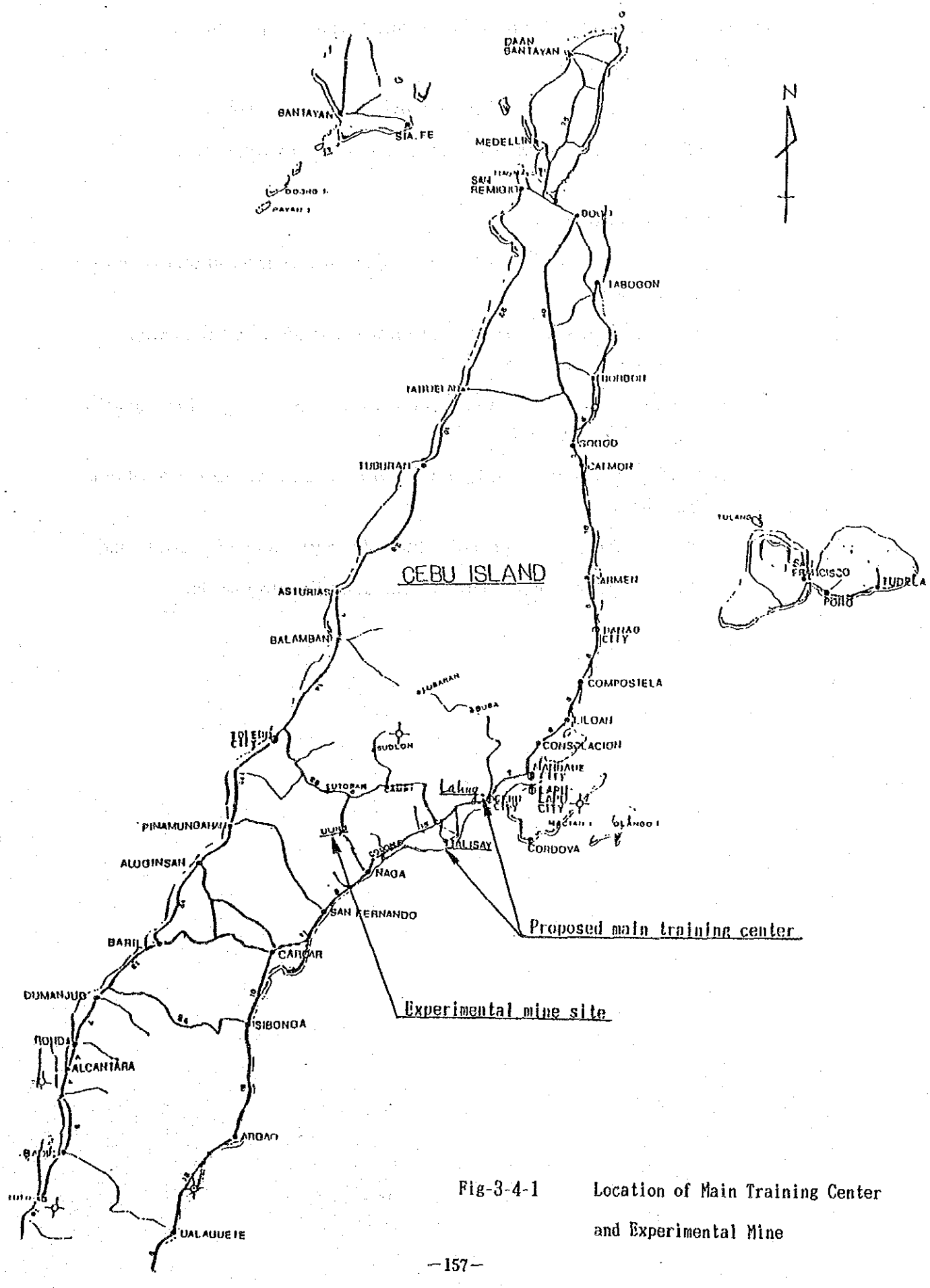


Fig-3-4-1 Location of Main Training Center and Experimental Mine

3-4-2 Layout of the Training Center and Conceptual Design Requirements

(1) Main Training center

The arrangement of the facilities is shown in Figure 3-4-2.

Scope of work for the center shall consist of the following items.

a. Site Preparation

Site preparation work shall be carried out before the commencement of building work.

1) Filling work shall be in accordance with detailed drawings to be developed in the future.
2) All obstructions above and below grade, including debris, shall be removed from the site.
3) Surface of grading shall be within a vertical tolerance ±10 cm of final level.
4) Fill soil shall be compacted to 90% of the Proctor compaction test.
5) Slope shall be protected by sodding and retaining walls.

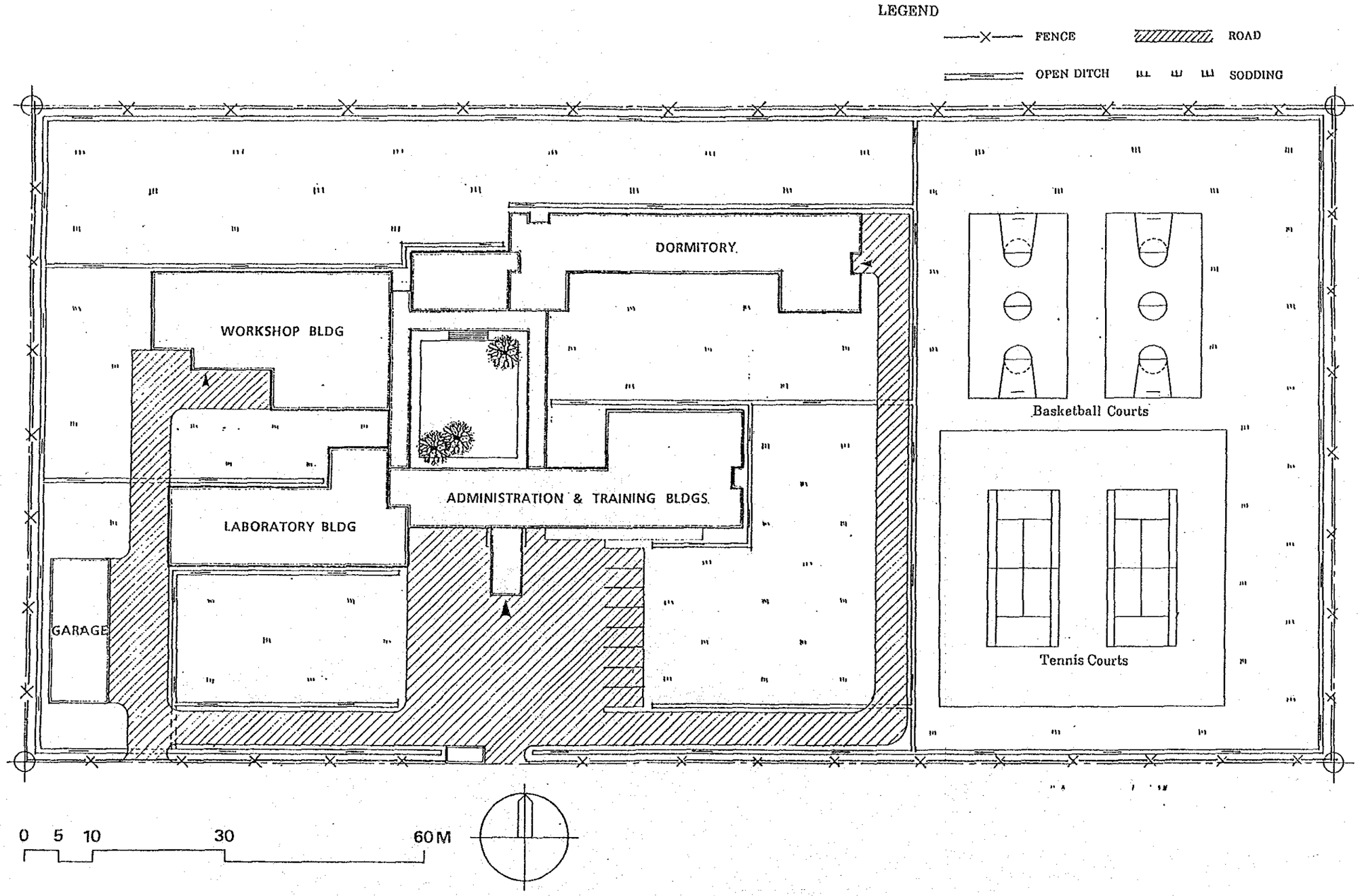


Figure 3-4-2 LAYOUT OF COAL MINING TECHNOLOGY DEVELOPMENT CENTER SITE PLAN

b. Buildings and Building Equipment

b-1 Design Base for Buildings

1) Buildings shall be of tropicalized construction to suit the local climate characterized by high temperature and high humidity.
From May to October, i.e., in the rainy season, heavy rainfall and strong winds prevail.
Average rainfall is 1500 mm/year, more than the national average.

2) Buildings shall be designed to suit the curriculum prepared in the master plan for coal mining technology development.

3) Buildings and related facilities shall have built-in flexibility for later expansion of, and changes to the lecture programs for future training.
The location of structural equipment shall be flexible for the training facilities.

4) Training center shall be operated at low cost by saving measures such as the maximum use of natural lighting and natural ventilation in the buildings.

5) Training center shall be designed on the principle of environmental protection and anti-polution control in Cebu.

b-2 Buildings (refer to Figures 3-4-3 and -4)

1) Administration and Training Building
Floor area shall be 950 m^2 including an entrance lobby, a director's room, an assistant director's room, five single expert rooms, one large expert room, a committee room, an administration office, three lecture rooms, a library and two toilets.

2) Laboratory Building
Floor area shall be 420 m^2, including a coal analysis room, a sample preparation room, a computer room, a laboratory for coal utilization, a storage, and office.

3) WorkShop Building
Floor area shall be 700 m^2, two workshops, a mine safety engineering room, a rescue training room, a mine machinery training room, and a first-aid training room, and two toilets are included in the building.

4) Dormitory

Floor area shall be 990 m^2 (max capacity to accommodate 48 persons), including six single bed rooms (I), five bed rooms for two persons (II), eight bed rooms for four persons (III), four toilets, two shower rooms, a dining room, a living room and a storage.

5) Others

Car port shall be 100 m^2 including an electric room and a guard house.

b-3 Construction materials

Construction materials shall be selected based on the results of the survey concerning factors such as local climatic conditions, required functions, local construction conditions, construction costs, and maintenance costs.

1) Structural materials

Main structural members shall be reinforced concrete. Ready mixed concrete are available in Cebu for large construction but the concrete for small scale construction will be made at the site.

Reinforcing bar shall be of high quality materials available in the city market.

2) Foundation

The foundations for the buildings shall be designed so that the reinforced concrete structures with a spread footing can be adequately supported on firm load-bearing soil. This is according to the building construction experience in the Philippines, although no sounding has been conducted to obtain soil data.

3) Concrete

Compressive strength of structural concrete shall not be less than 180 kg/cm^2.

4) Reinforcing bar

Reinforcing bar shall be the deformed bar :

16ϕ mm equal or larger, Yield point $>$ 3000 kg/cm^2

5) Floor

For the flooring of the Administration and Training Building and Dormitory, plastic tile manufactured in Manila shall be applied.

For the corridor and entrance hall usually being damped with water, mortar aggregate exposed finish shall be applied.

For the flooring of the workshop and laboratory buildings, mortar with steel trowel finish for contaminating with chemicals and easy maintenance shall be applied.

6) Exterior wall
For the exterior wall, spray tile coating for high weather durability shall be applied.

7) Interior wall
Interior wall shall be brick masonry and painting on mortar steel trowel finish.

8) Ceiling and corridor
For the main ceiling, light weight steel furring and for the corridor, wooden furring shall be applied.

9) Fittings
Exterior fittings shall be aluminum door and window produced in the Philippines.

10) Roof
Roof shall be the colored galvanized steel sheet roof.

11) Finishing materials
For finishing materials, locally available material with easy finishing, maintenance, and high durability shall be applied.

b-4 Heating, Ventilating & Air Conditioning (H.V.A.C.)

A window type cooling system shall be applied for air conditioning in order to carry out easier maintenance compared with a central H.V.A.C. system.

b-5 Sanitary facilities

Sanitary facilities shall be western style toilet, lavatory, slope sinks, etc.
Large-size sewer pipes shall be used for easier maintenance.

b-6 Kitchen equipment

The kitchen will be equipped with sinks, working tables, a pan rack, a gas range, an ice maker, refrigerator with freezer and dust table.

b-7 Lighting

1) Lighting shall be fluorescent strip lighting.
2) Emergency lighting shall be provided at least one set in each room, except for stores and toilets.
3) Lighting shall have more intense illumination, and five-pin emergency plug receptacles have to be furnished in the laboratory building.

c. Road and Pavement

Construction road and pavement for parking area shall be in accordance with the following:

1) Pavement shall consist of prepared subgrade, base course and paving by asphalt mixture.
2) Base course for asphalt paving shall consist of graded gravel mixture with uniform gravels of 50 mm maximum size and shall not be less than 250 mm thick after compaction. The base course shall be installed in two layers of 125 mm compacted thickness each. Compaction shall be adequate.
3) Asphalt paving shall be of a single layer finish of 50 mm thick after the compaction and composed of hotmixed bituminous course.

d. Sewer

Sewer requirements shall be in accordance with the following:

1) Sanitary sewer shall carry effluents under gravity flow from water closets, urinals and sinks in the buildings to the septic tank.
   Treated overflow from septic tank shall be connected to storm sewer.
2) Chemical sewage discharged from laboratory shall be collected in a neutralization pit, and then discharged to storm sewer after treating.
3) Storm sewer shall be collected in an open ditch and discharged outside.

e. Sodding

Sodding shall be in the form of locally available grass and trees.

f. Fence and gate

Fence and gate shall be in accordance with the following:

1) Fence shall be galvanized chain link of 2.1 m high, consisting of 1.8 m fabric topped with three strands of barbed wire.

2) Gate shall be steel made, hung on at least two steel hinges to pivot through 180 degrees.

g. Lighting

The site shall be reasonably illuminated at night.

(2) Experimental Mine and Training Facility.

Location of Experimental Mine and Training Facility is shown on Fig. 3-4-5, scope of work are as follows.

a. Site preparation

Site preparation shall be as described in section 3-4-2 (1) a.

b. Building and Building Equipment

b-1 Design Base for Buildings

Design Base for Buildings shall be as described in section 3-4-2 (1) b-1.

b-2 Buildings

Buildings for training facility is shown in Figure 3-4-6.

1) Main Building

Floor area shall be 270 m^2 including office room, rescue room, safety tool room, resting room, shower room, toilet, store, etc.

2) Canteen

Floor area shall be 90 m^2 including kitchen.

3) Work Shop

Floor area shall be 140 m^2 including air compressor room for operation of experimental mine, workshop, store and garage.

b-3 Construction materials

Construction materials shall be as described in section 4-3-2 (1) b-3

b-4 Ventilation and Airconditioning

Ventilation and air conditioning shall be as described in section 4-3-2 (1) b-4

b-5 Sanitary facilities

Sanitary facilities shall be as described in section 4-3-2 (1) b-5

b-6 Kitchen furniture

Kitchen Furniture shall be as described in section 4-3-2 (1) b-6

b-7 Lighting

Lighting shall be as described in section 4-3-2 (1) b-7.

c. Road and paving

Road shall have gravel paving as described in section 3-4-2 (1) C 2). base course for asphalt paving.

d. Sewer

Sewer shall be as described in section 4-3-2 (1) d.

e. Sodding

Sodding shall be as described in section 4-3-2 (1) e.

f. Experimental mine

The general layout of the experimental mine is shown in Figure 3-4-7. Basic requirements of Mine Structure in the Experimental Mine shall be in accordance with the following:

1) The mine shall be designed basically with a couple of central inclined shafts and several level roadways.

2) Two coal faces of one 15 m long for slanted and the other 21 m long semi-mechanized shall be set up.

3) One of these two inclined shafts, approximately 100 m long, shall be for air intake, transportation of mine cars and manpower. The other one shall be for air exhaust.

4) A storage bin will be required at the intersection of the inclined shafts and the level roadway. Scraper conveyors shall be installed in level roadways, and mine cars shall be used in the inclined shafts for transportation.
Total length of those mine roadways shall be approximately 700 m.

g. Lighting

Lighting shall be as described in section 4-3-2 (1) g.

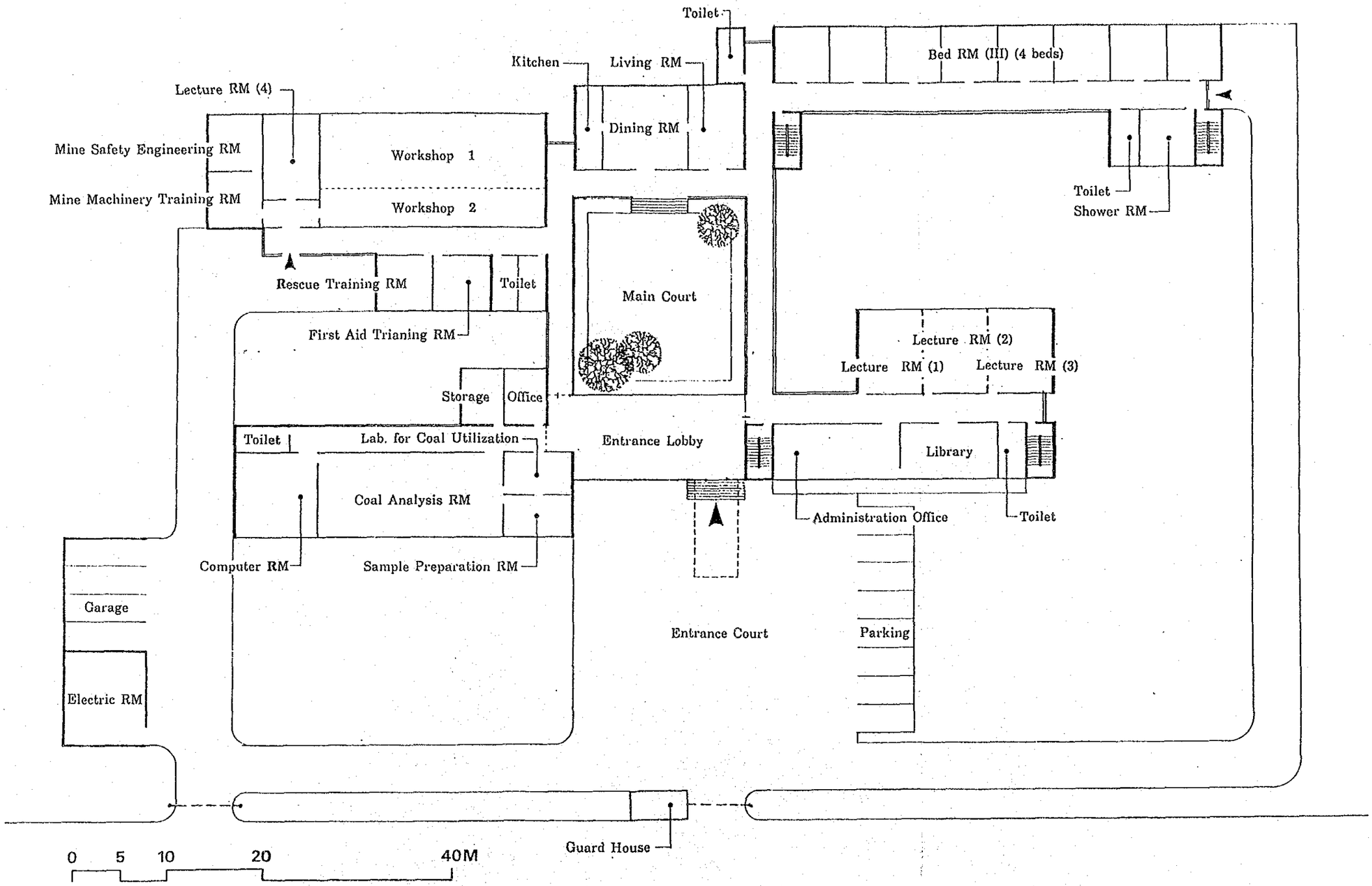


Figure 3-4-3 Layout of Buildings (1st Floor)

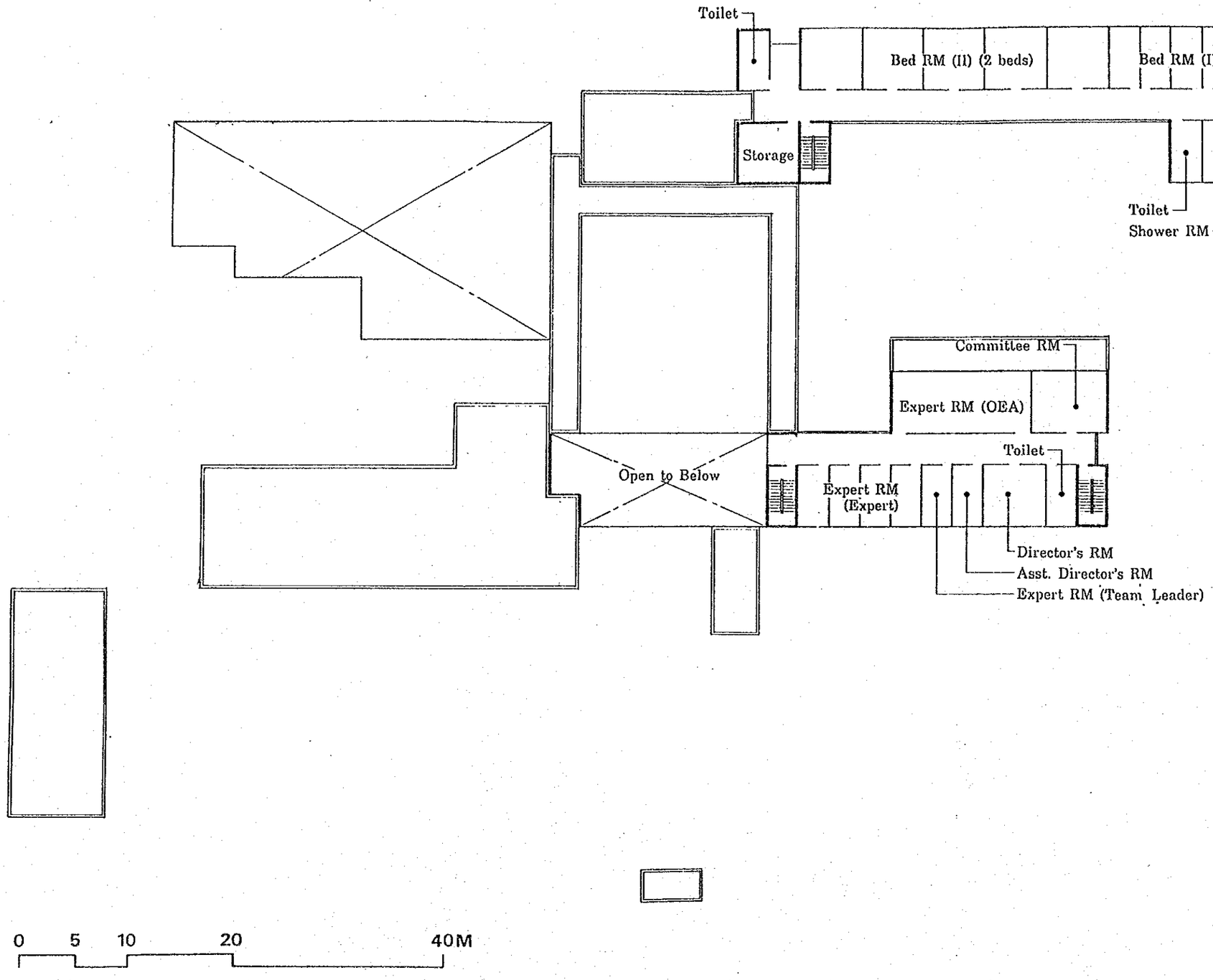


Figure 3-4-4 Layout of Buildings (2nd Floor)

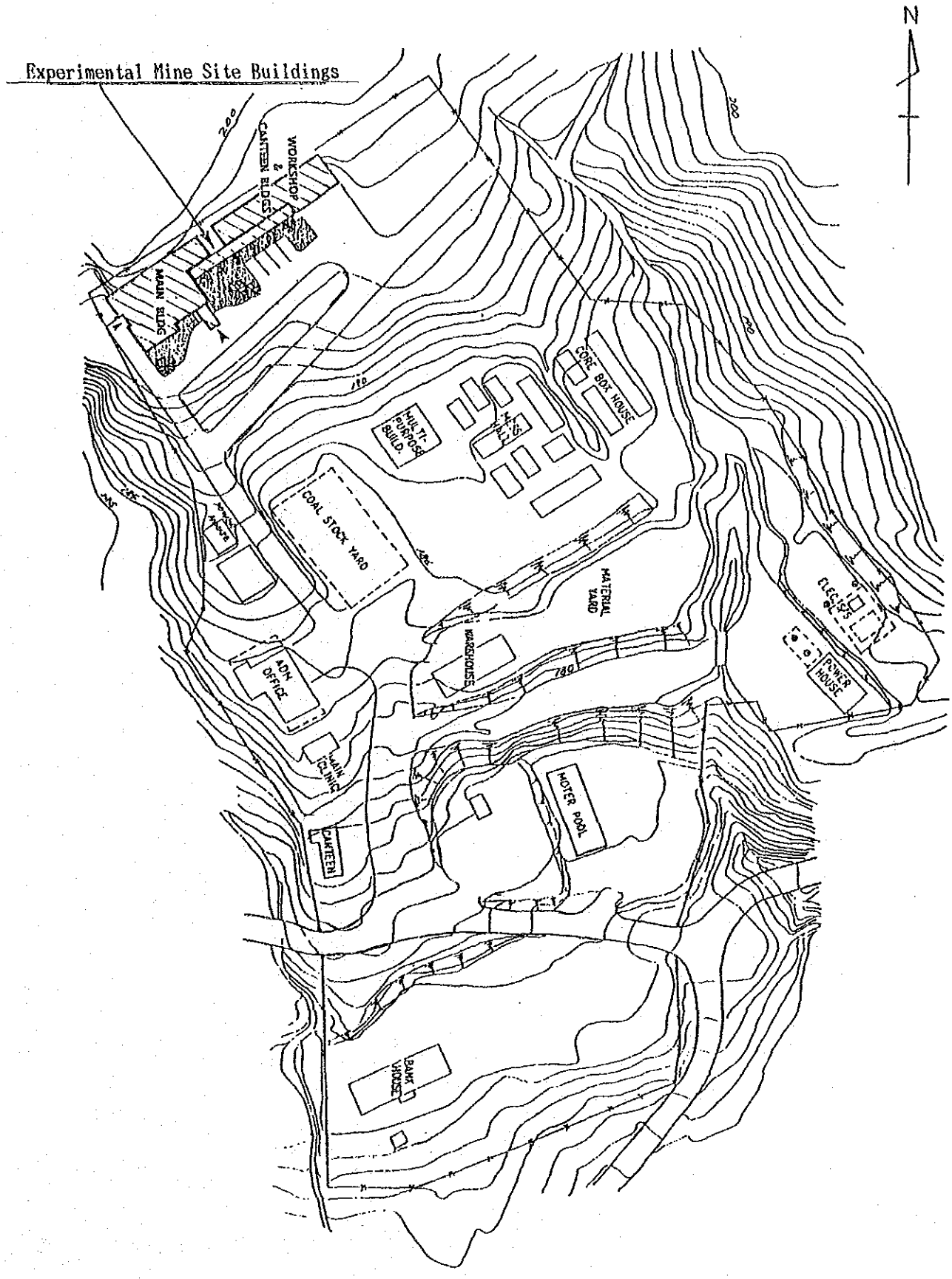


Figure 3-4-5 Location of Experimental Mine Site Buildings

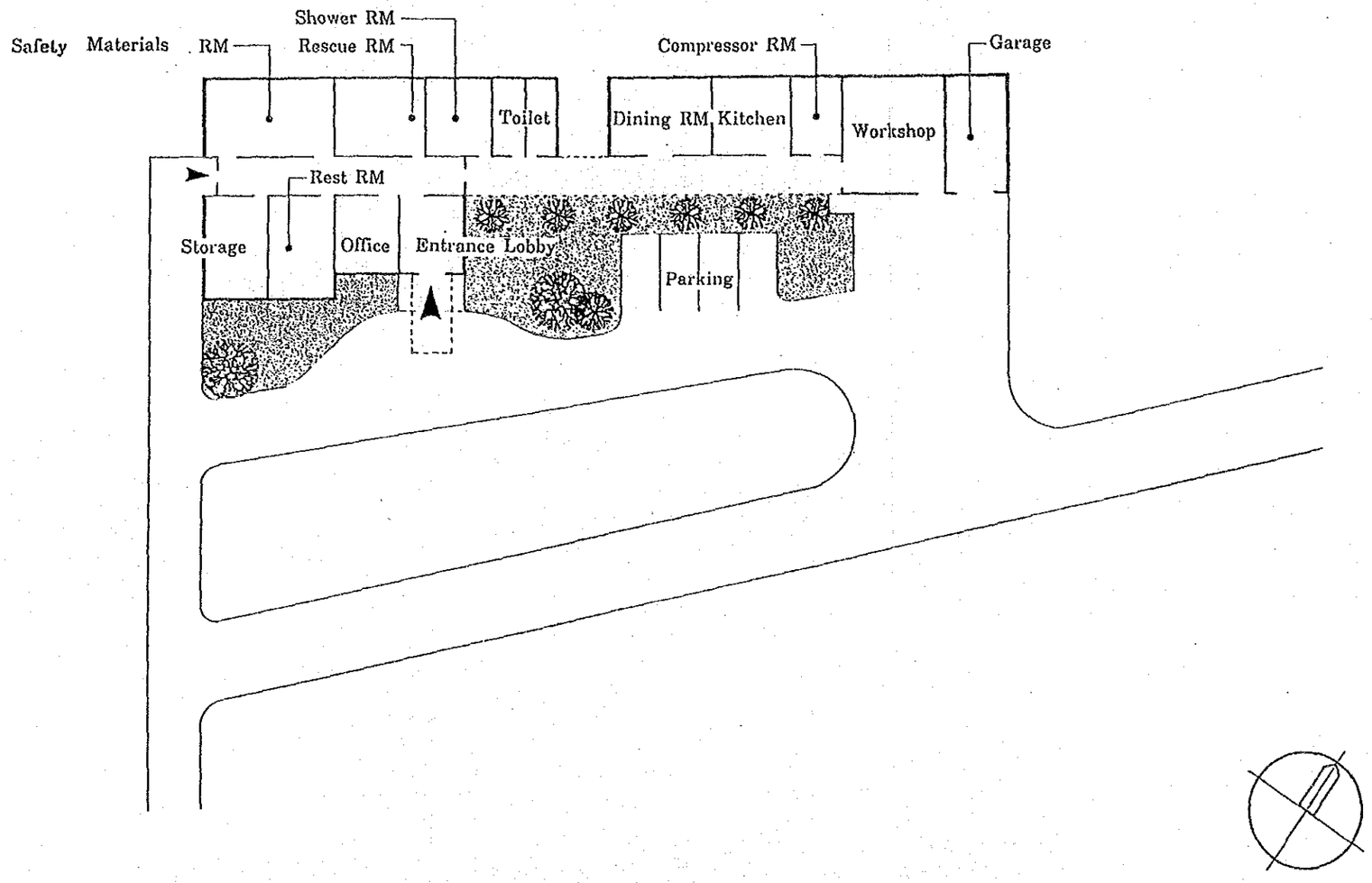


Figure 3-4-6 MINE SITE SURFACE FACILITIES GROUND FLOOR PLAN

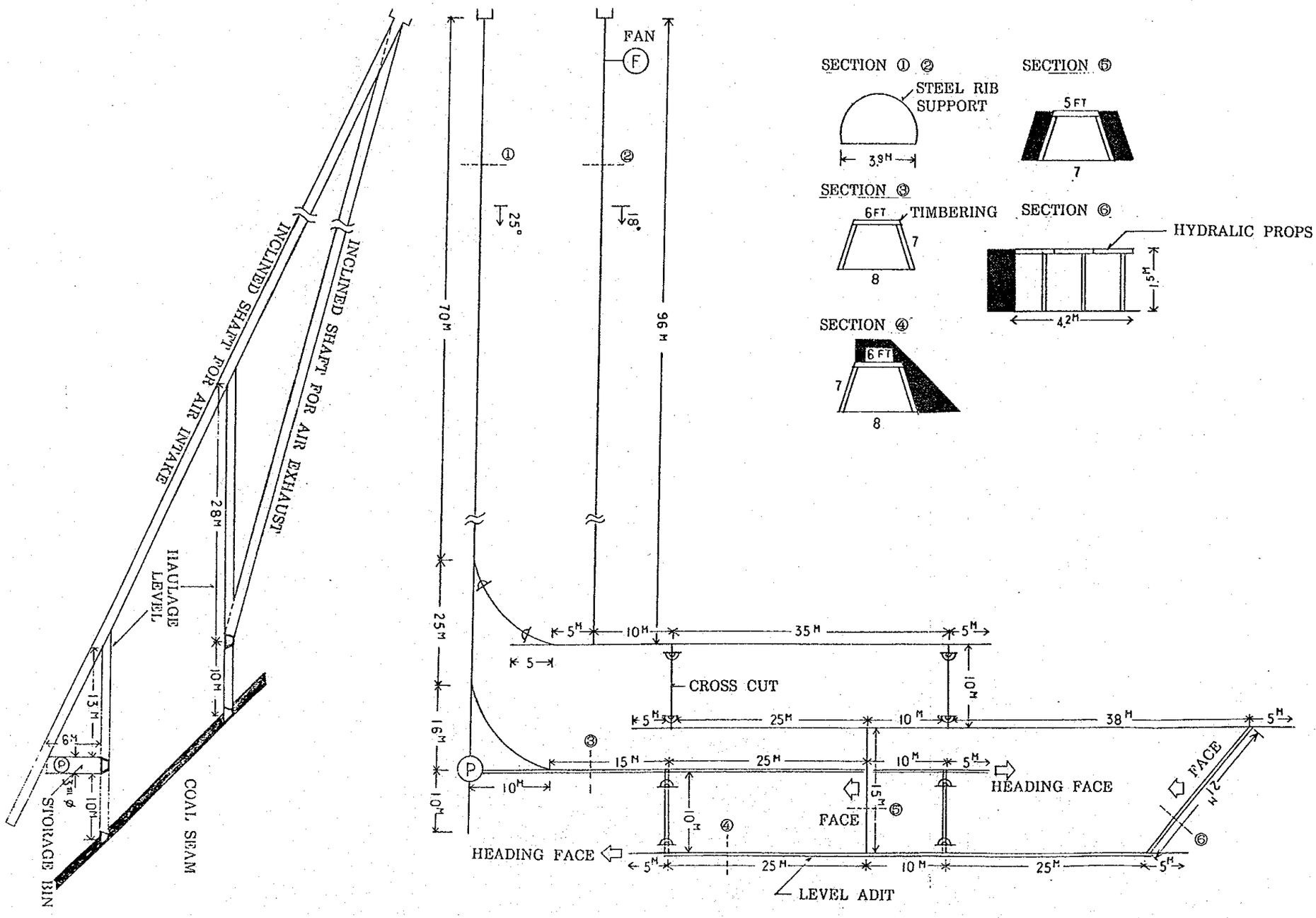


Figure 3-4-7 General Layout of the Experimental Mine

3-4-3 Utility Facilities

(1) Electricity Facilities

Electic power shall be supplied from a transformer set within the site boundary through switch-gears.
Watt-hour and Power Factor Meters shall be provided and connected for reading the value on each incoming feeder.
The necessary lighting and driving power shall be supplied from a terminal box.
The two substation capacities are as follows:

a. Main Training Center (220 V)

Building	110 KVA
Training Facilities	150 KVA
Total	260 KVA

b. Experimental Mine Site (440/220 V)

Building	60 KVA
Training Facilities	250 KVA
Total	310 KVA

A diesel-generator shall be provided for emergency back-up power in case of power failure.

1) The diesel-generator shall be a skid-mounted self-contained unit generating 440/220 V, 60 Hz, 3-phase electrity.
2) The diesel engine shall be a multi-cylinder four stroke type which may be naturally aspirated or turbo-charged with or without intercooling.
3) The diesel-generator set shall be supplied for emergency lighting, battery charging, safety equipment, etc.
   Immediately after a power failure, the diesel-generator shall start automatically.
4) The diesel-generator rating is 220 V, 75 KVA at Main Training center and 440 V, 125 KVA at Experimental Mine which is provided a stepdown transformer 440 V to 220 V.

(2) Water Supply Facility

Potable water shall be supplied within the site. The potable water shall be distributed from a Head Tank. The potable water supply is derived from Cebu's main water system for the Main Training Center.

In the Experimental Mine Site, water from a well shall be used with suitable softening treatment.

The Head Tank shall be as follows:

a. Main Training Center	3 m^3
b. Experimental Mine Site	2 m^3
Total	5 m^3

(3) Telephone system and Radio communication system

The telephone system and radio communication system between main training center and experimental mine shall be as described in section 3-5.

3-5 Equipment List for the Training Center

The criteria for the determination of equipment specifications will be as follows,

1) It will be neccessary to use equipment in the execution of the training curriculum.

2) With regards to the future mining conditions, deep-mine operation and mechanization of mining systems should be considered.

3) All electric motors shall be of the explosion-proof type suitable for underground mine use, and centralized supervisory and control systems shall be used.

4) All equipment shall be designed for simple operation and easy maintenance.

5) For electrical emergencies, two generators shall be installed as standby, one with a 75 KVA capacity in the training Center and another 125 KVA generator in the Uling coal mine. In the Uling coal mine, the standby generator will be used for driving the ventilation fans, pumps and detector sensors of the mine safety system.

6) For the communications system, telephones and FM mobile two-way radios will be used.

7) The coal analysis apparatus shall include, an X-ray fluorescence spectrometer to be delivered in the second stage, and other apparatus to be mounted in the first stage.

8) Price is estimated on a CIF basis delivered domicile, plus installation and training fees, as requested.

9) Equipment list is classified into two groups, A (training center) and B (Uling coal mine). Based on the curriculum, delivery time for equipment is classified into two stages, i.e., first and second stage.
The second stage will commence one year after the first stage.
The cost estimate for equipment is given in the following table.

Cost Estimate for Equipment

(million)

	First stage		Second stage		Total	
	US$	Pesos	US$	Pesos	US$	Pesos
Main Center	2.115	1.682	0.933	–	3.088	1.682
Experimental Mine	2.605	–	–	–	2.605	–
Total	4.760	1.682	0.933	–	5.693	1.682

A. Main Training Center

	Item	Equipment Name	Main Specification	1st schedule	2nd schedule
Teaching material	1. Geology Exploration	· Drilling equipment	LY-38 18.5 kw 1 unit	○	
		· Measuring apparatus	Transit, Level Vial etc.	○	
		· Logging System	T500 Digital Logging System 1 unit		○
	2. Safety	· Portable Methanometer	CH_4, Model 28 15 sets	○	
		· Personal CO Monitor	CO Model CO-82 15 sets	○	
		· Portable Anemometer	Type SF-15 15 sets	○	
		· Oxygen Breathing Apparatus	Type Mark-10 Duration of continuous use 2 hours 15 sets	○	
		· Others	CO mask, Minesem	○	
	3. Mechanical and Electrical	· Power Pack	EHP-3K 10 1 unit	○	
		· Armoured Conveyor	300 type × 10m 15 kw 1 unit	○	
		· Air Hoist	AH-36A 5kg/cm² 42 m/min 1 unit	○	
		· Pump	Electric Pump Worthington Pump	○	
		· Local Fan	TL-5 160m³/min explosive-proof	○	
		· Experimental Facilities	Pump Test, Ventilation Test	○	
		· Electric Experimental Apparatus	Recorder Tester etc.	○	
	4. Coal Analysis	· Sampling apparatus	Scoop, Riffle sampler Sieve shaker	○	
		Crusher	Jaw crusher (Brown crusher)	○	
		Proximate analysis apparatus	Moisture oven, Ash furnace, volatile matter furnace	○	

	Item	Equipment Name	Main Specification	1st schedule	2nd schedule
Teaching material		· Ultimate analysis apparatus	Nitrogen analyser, Carbon & Hydrogen analyser	○	
		· Calorie measuring apparatus unit	Calorimeter	○	
		· X-ray Spectrometer	Rigaku System 3070		○
		· Computer	PC9801	○	
		· Other analysis apparatus	F.S.I Testing Device, Drop shatter Tester etc.	○	
		· Test machine	Jig, Dense medium Separator, Flotation machine	○	
		Others	Exhaust Fan, Duct, Table etc.	○	
	5. Burning Test	Coal Combustion equipment			○
	6. Others	· Model	Washing plant, U/G mine	○	
		· Drawing instrument	Drafter, Drawing Utensils etc.	○	
		· Computer	IBM CAD System	○	
Fixture	1. Equipment of Building Construction	· Compressor	55 KW 7 kg/cm^2 9.0 m^3/min	○	
		· Generator	75 KVA 220V	○	
		· Communication equipment	UHF 50W within 50 km		
		· Telephone equipment	Exchange 50 lines, Telephone	○	
		· Audio/Visual	Audio Visual System, Slide Projector, Overhead Projector	○	
		· Water Supply System	Pump, Tank		
	2. Workshop Equipment	· Traveling Crane	3 tons Electric trolley	○	
		· Machine Tool	Lathe, Grinder, Drilling machine	○	

	Item	Equipment Name	Main Specification	1st schedule	2nd schedule
Fixture	2. Workshop Equip-ment	· Welder	Electric Welder, Acetylene Welder	○	
		· Portable Compressor	7.5 KW 9 kg/cm^2 0.84 m^3/min	○	
		· Tools		○	
	3. Distribu-tion Facilities	Substation	Explosion-proof of Dry type 2.4KV/220V Transformer, Switches, Cables	○	
	4. Vehicles	· Bus	60 Passengers		○
		· Small Bus	30 Passengers	○	
		· Land Cruiser		○	
		· Truck	2 tons Truck with crane	○	

B. Uling Experimental Mine

	Item	Equipment Name	Main Specification	1st schedule	2nd schedule
Under-ground	1. Mining, Drilling, Loading	· Hydraulic Prop	Usable Height 2.4 m ~ 15 m 150 sets	○	
		· Hinged Iron Bar	1.2 m Long Pin type 150 sets	○	
		· Pneumatic Pick	CA-7 wt 7 ~ 8 kg, 10	○	
		· Air Auger	For Coal and Soft Rock wt 8 ~ 9 kg, 5	○	
		· Leg Hammer	322-D Bit, Rod	○	
		· Shifter			
		· Mine Car	Steel 1 m^3 10 units	○	
		· Bucket Loader	Side dump loader 612 1 unit	○	
		· Tools	Air block, lever block	○	
	2. Safety	Safety Measuring Equipment	CH_4, CO, Anemometer, Temperature	○	
	3. Machinery Electricity	· Armoured Conveyors	1. 450 m/m W×20 m 30 KW (for face) 1 set 2. 450 m/m W×15 m 15 KW (for gate) 2 sets 3. 450 m/m W×30 m 15 KW (for gate) 2 sets 4. 450 m/m W×40 m 30 KW (for gate) 3 sets 5. 450 m/m W×50 m 30 KW (for gate) 1 set	○	
		· Chain Feeder	$1,000^{W}$×$3,000^{L}$, 7.5KW 1 set	○	
		· Air Hoist	AH-36A 5 kg/cm^2 42 m/min 4 sets	○	
		· Pump	Centrifugal pump, Worthington Pump, Piping, Valve etc. 1 unit	○	
		· Local Fan	TL-5 160 m^3/min Exprosive-Proof 3 sets	○	

	Item	Equipment Name	Main Specification	1st schedule	2nd schedule
Surface	Fixture Equipment	· Power Pack	EHP-3K50, 37 KW, Strainer 1 unit	○	
		· Electric Winder	45 KW, Rope Speed 50 m/min 100 mL 2 sets	○	
		· Comprssor	55 KW, 7kg/cm^2, 9.0 m^3/min 2 sets	○	
		· Ventilation Fan	700 m^3/min, 100 mmAq 22 KW 1 set	○	
		· Generator	125 KVA, 440V, Automatic 1 set	○	
		· Water Supply System	Pump, Tank 1 set	○	
		· Cap Lamp	Cap lamp 30 sets, Charging facilities, Washing Equipment	○	
		· Workshop Equipment	Grinder, Drilling Machine, Welder etc.	○	
	Electric Equipment	· Distributing Facilities	· Explosion-proof of Dry type 2.4KVA/440V Transformer · Switches · No Fuse Breaker · Cables 30~60 mm^2 900 m	○	
		· Telephone	Exchange 20 lines, Telephones 20 sets	○	
	Others	· Measuring Apparatus		○	
		· Tools		○	

3-6 Construction Cost

3-6-1 Estimation Bases

Construction costs have been estimated on the basis of the Guidelines for Price Estimations for Building and Constructions published by JICA March 1985 as well as on the basis of the results of our site survey from April 27 to May 11, 1987.

(1) Site selection is described in section 3-4-1.

(2) Local material
Local materials shall be purchased in Cebu and its vicinity as much as possible, and the cost estimate made is based on the local purchasing survey report prepared by JICA on March 1986.

(3) Building equipment for sanitary, aircondition and lighting shall be locally purchased with the lowest price to be offered in Cebu.

(4) Building foundations shall be spread foundations supported on firm load-bearing soil, wherein the cost estimate made is based on the actual unit price obtained from the experience of building constructions in the Philippines, including Cebu, Mindanao, Bohol, Leyte and Luzon.

(5) Specifications of the building shall be prepared for one international contractor basis (I) and local contractor basis (II), respectively.

The main reasons of the difference between these two cost estimates are as follows;

a) No foreign consultancy cost for construction supervision is included for the local construction cost.

b) A large amount of off-specification architechtural and construction materials commonly found in the local market may adversely affect the construction finish, thereby some have to be imported. This would escalate the cost further.

3-6-2 Cost Estimation (Philippine Peso)	(I)	(II)
(1) Estimated costs for Buildings		
a) Main Training Center in Cebu	92,585,400	46,160,700
b) Training Building in Uling Experimental mine site	10,928,600	5,716,500
Total	103,514,000	51,877,200
(2) Site Preparation including related facilities for the Center.		
a) Main Training Center in Cebu	13,450,600	13,450,600
b) Training Building for Experimental mine in Uling	1,681,300	1,681,300
Total	15,131,900	15,131,900
(3) Estimated costs for Experimental Mine (excluding mine equipment)	26,901,200	16,813,200
Grand Total (1)+(2)+(3) =	145,547,100	83,822,300

3-7 Management and Operation Scheme

Whether the Center can achieve its expected objectives will depend on the management and operational efficiency in running the Center. It will be vital to ensure the availability of appropriate management schemes and a proper organizational backup for its operation. Therefore qualified personnel responsible for training, management, and maintenance of the Center has to be prepared.

Further, another essential condition is to secure the funding needs to meet the operating costs of the Center. This, therefore necessitates an implementation scheme supported by the government executive authorities, and desirably a chief advisor representing the foreign experts.

1. Government Executive Authorities

The OEA in its capacity as the government executive authority in charge of the coal mining industry, should also assume responsibility for the operation of the Center.

2. Organization

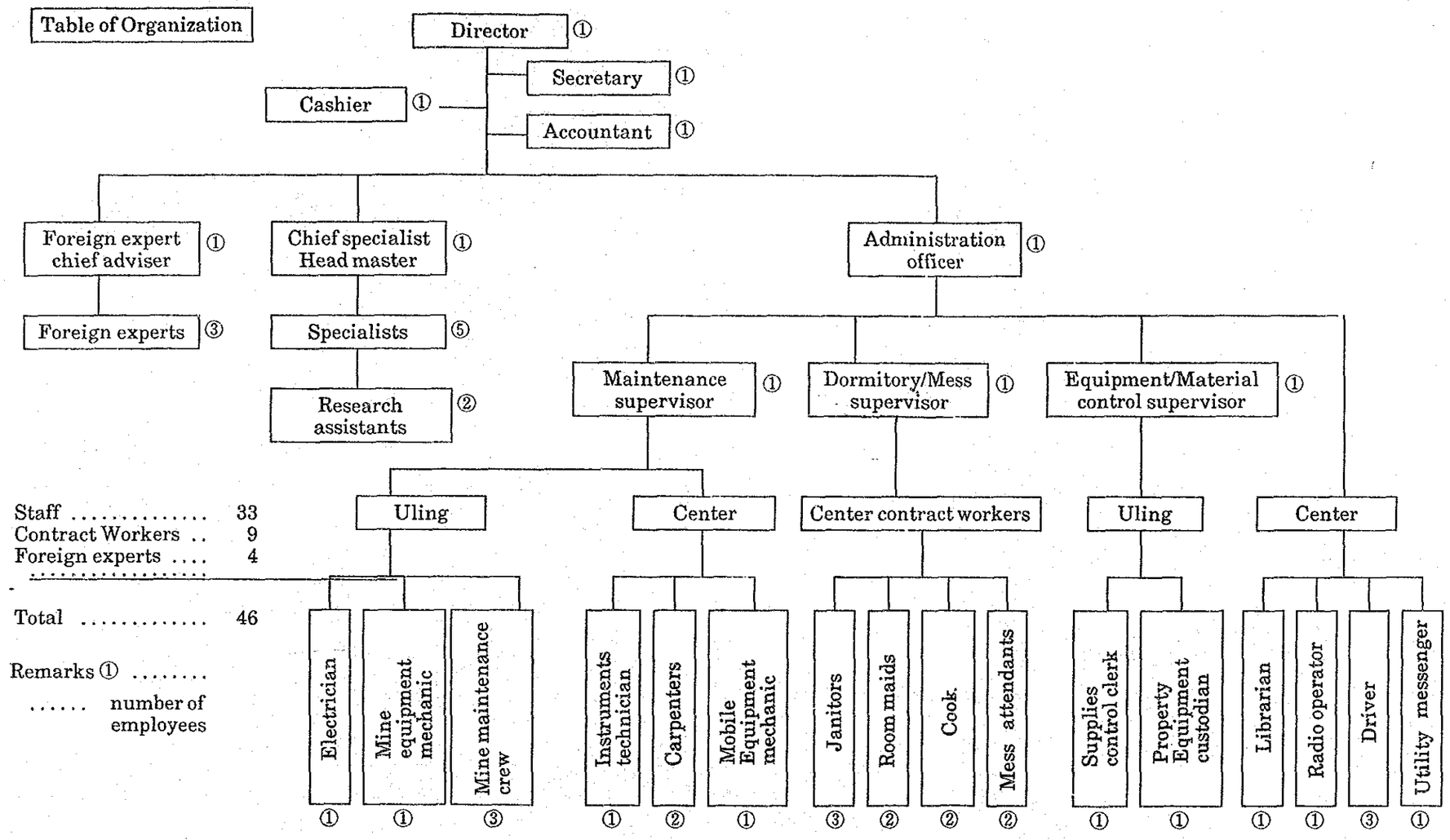
The organizational structure should be as shown in Figure 3-7-1. As stated in 3-3, several foreign experts are desired. The chief advisor representing all foreign experts should be responsible to the Director of the Center and plays an important role in the decision-making process in cooperation with the Director and the Head of the local counterparts. Other foreign experts should hold periodic discussion meetings with their local counterparts on curricular matters and training programs in detail.

The training programs should be carried out in cooperation with both the foreign experts and their local counterparts. This would facilitate the eventual transfer of overseas technology to the Philippines.

3. Personnel

A total staff of 33 will be required for the operation of the Center, excluding the foreign experts, as shown in Figure 3-7-1. In addition, 9 contractual workers will be required. The OEA should secure the necessary staff members prior to the opening of the Center.

Figure 3-7-1 Organizational Structure



4. Maintenance of buildings and facilities

Maintenance and operating manuals for the buildings, facilities and training equipment used both in the Center and the experimental mine should be provided when construction is completed. The personnel concerned should study the documentation in depth and should be fully conversant with the use of all equipment. Further, the Director has to appoint persons to take charge of the buildings, facilities, and equipment.

5. Operation, Management, and Maintenance Costs

Based on this study and the analysis of the collected data, the expenses required for the administration, operation and maintenance of the facilities of the Center are estimated as follows;

(1)	Salaries and wages	P1,806,000
(2)	Supplies and training materials	P 783,000
(3)	Fuels and lubricants	P 347,000
(4)	Power cost	P 791,000
(5)	Security	P 200,000
(6)	Maintenance for mobile and other mechanical equipment	P 748,000
(7)	Building maintenance and fixtures	P 10,000
(8)	Honoraria	P 108,000
(9)	Communication costs	P 10,000
	Total costs per year	P4,803,000

The budget for the operation of the Center should be met, in part, from the fund allocations from coal production to be made available by the OEA and/or private contributions. The OEA forecast of its budgetary availabilities by the year 1990 has been given as follows:

(1) Fund allocations to be made by the OEA (OEA share)

1.3 million tons/year × P800/ton × 0.03 × 0.16 = ₱4,992,000

(2) If by private contributions

1.3 million tons/year × P4/ton = ₱5,200,000

3-8 The Center's Operating Cost and Financing

3-8-1 Operating Cost

The operating costs for the Center is shown in Table 3-8-1, and the annual total is expected to be 4.8 million pesos. Of this total, experimental mines account for 27%. In terms of expenditure items, salaries and wages account for 38%, the largest share of the total. The second largest items are; supplies and materials, power, and equipment maintenance, with 16% each.

Table 3-8-2 shows a comparison of expenditures per employee with similar institutions. The operating costs of this Center are larger than that of other institutions. As far as salaries and wages are concerned, there are no significant differences. Of other expense categories, the figures for materials and supplies, power and equipment maintenance costs are all higher than other institutions. This is largely due to the differences in the kinds and numbers of equipment purchased. The differences are caused by the specific character of this Center.

3-8-2 Financing

The OEA shall consider the possiblility of allocating a part of the its share (about 3% of the gross sales) or to include in the annual budget of the OEA as the major fund to meet the operating cost of the Center. To this end, it will be necessary to pass a law. The OEA is lobbying with the legislative body to obtain appropriations. In case the above source of fund is not yet available, the OEA is expecting to have a contribution of about 4 pesos per ton from coal companies. Consultation with major members of the Chamber of Coal Mines has led the OEA to believe that they will agree. Some income can be obtained toward the operating fund by providing services such as inspection, but this is looked upon as a supplementary income.

According to a preliminary calculation, approximately 16% of the OEA share will be sufficient to meet the Center's operating costs. (Table 3-8-3.)

Table 3-8-1 Operating Cost Estimate

(P 1,000)

Items		Main Center	Experimental Mine	Dormitory Mess	Common Cost	Total	
							%
1. Salaries & Wages		251	336	235	984	1,806	38
2. Supplies & Materials		229	406	48	100	783	16
3. Fuels & Lubes		27	17	10	293	347	7
4. Power		482	270	39	0	791	16
5. Security		100	100	0	0	200	4
6. Equipment Maintenance		295	165	0	288	748	16
7. Buildings & Fixtures Maint.		0	0	0	10	10	-
8. Honorarium		0	0	0	108	108	2
9. Communication		0	0	0	10	10	-
10. Total		1,384	1,294	332	1,793	4,803	100
	%	29	27	7	37	100	

* This cost estimate does not include cost required for dispatch of foreign experts.

Table 3-8-2 Operating Budget Comparison

(Pesos / Employee)

	Coal M. T. D. Center (1)		OEA	Transportation	Nat. Skills
	Total	Excl. Exp. Mine *	Laboratory (2)	Train. Center (3)	Train. Center (4)
Number of Employees	36	27	33	50	68
Salaries & Wages	P 50,200	P 54,400	P 47,150	P 43,500	P 29,700
Other Operating Expenses	83,200	75,600	28,670	20,200	53,800
Total	133,400	130,000	75,820	63,700	83,500

Note:

1. Coal M. T. D. Center: Coal Mining Technology Development Center
2. OEA: Salaries & wages are for 1988 (after 1987 raise). Inflation and allowance (50% of annual salaries and wages) are included.
3. Transportation Training Center: Based on 1987 budget, but salaries and wages are assumed to be raised by 10% and include honoraria, 15% of basic salaries.
4. National Skills Training Center: NSTC has no special allowance.

Table 3-8-3 Proposed Sources of Operating Budget

(Million Pesos)

	From OEA Share (Gross Sales×0.48%)	Private Contributions (P 4.0/T)	Other Services
1990	5.0	5.2	(Supplemental)
1995	10.8	12.0	— do —
2000	10.9	14.4	— do —

Note:

1. Coal price is assumed to be 800 P/T in 1990, 753 P/T in 1995 and 630 P/T in 2000.
2. Funding for the center operations is about 16% of the OEA share.
3. or a Contributions of P 4.0 per ton from coal mining companies.
4. Other services which will supplement budget deficit.

APPENDICES

APPENDIX 1

COAL SUPPLY – DEMAND OUTLOOK ('000 tons 10,000 BTU/lb)

SUPPLY	1988		1989		1990		1991		1992		1993		1995		2000	
SEMIRARA	630		648		720		720		1,440		1,440		2,160	(1,800)	2,592	(2,160)
PNOC AREAS	353		327		293		363		402		402		402		402	
CEBU	374	(338)	483	(432)	576	(504)	606	(534)	630	(558)	654	(582)	825	(689)	1,132	(689)
BATAN	75		130		142		142		142		142		142		142	
OTHERS	164		271	(264)	360	(332)	370	(342)	460	(398)	464	(402)	719	(525)	2,800	(2,513)
TOTAL	1,596	(1,560)	1,859	(1,801)	2,091	(1,991)	2,201	(2,101)	3,074	(2,940)	3,102	(2,968)	4,248	(3,558)	7,068	(5,906)
DEMAND																
NPC	1,054		1,063		1,071		1,080		1,941		1,925		2,833		5,034	
CEMENT INDUSTRY	774		813		854		897		942		989		1,090		1,392	
ATLAS	275		287		301		318		337		359		413		635	
PHILPHOS	14		40		40		40		40		40		40		40	
OTHERS	119		125		134		144		158		173		211		340	
TOTAL	2,236		2,328		2,400		2,479		3,418		3,486		4,587		7,441	
SURPLUS/(SHORT FALL)	640		469		309		278		344		384		339		373	

*( ) Projected Coal Suppley reviewed by JICA

SUMMARY OF RESERVES OF COAL REGIONS
As of 30 June 1986 (Million Tons)

	Resource* Potential	Positive	Probable	In-situ	Mineable Reserves
SEMIRARA	550	132.28	29.76	152.12	129.30
CAGAYAN VALLEY	336	68.48	53.18	103.58	88.04
MINDORO	100	3.07	1.40	4.01	2.40
POLILLO-BATAN-CATANDUANES	17	6.49	4.44	9.45	7.70
QUEZON	2	0.09	–	0.09	0.08
NEGROS	4.5	1.05	1.06	1.75	1.05
NORTHERN CEBU	75	1.48	0.37	1.72	1.03
CENTRAL CEBU	40	2.27	0.15	2.37	1.42
SOUTHERN CEBU	50	3.94	2.38	5.53	3.32
BOHOL	–	0.39	0.74	0.89	0.53
DAVAO	100	0.21	–	0.21	0.12
SURIGAO	209	30.45	23.38	46.04	34.28
ZAMBOANGA	45	28.92	7.40	33.85	20.31
SAMAR	27	4.50	4.45	7.47	6.35
MASBATE	2.5	0.29	–	0.29	0.18
TOTAL	1,558.0	283.91	128.71	369.37	296.11

* Based on Robertson Research International Ltd. 1977 evaluation

1. Positive reserves are those sufficiently explored by drilling and/or tunnelling to warrant inclusion in a company's five-year development/production program. Drill holes are generally spaced at not more than 200 meters apart and in highly disturbed areas like Cebu, holes are spaced not more than 100 meters apart.

2. Probable reserves are those also explored by drilling and/or tunnelling, but still need confirmatory drilling and/or tunnelling. Drill holes are generally spaced at 200 to 400 meters apart, except in fairly undisturbed areas like Cagayan.

3. The mineable reserves are computed by multiplying the total in-situ reserves (positive + 2/3 probable) by a mining recovery factor of 60% for underground and 85% for open pit.

4. Except for Cagayan, Semirara, part of Samar, and Surigao, all other coal areas are treated as underground coal areas.

OUTLINE OF COAL MINES

	J.D. ALMENDRAS	CEBU COAL	ULING	MANGUERRA	LUVIMIN	CRAVAT (CARBEX)	SEMIRARA
1987 PRODUCTION (MT) (R.O.M)	20,213	30,093	11,910	25,264	51,570	33,512	606,276
1988 PRODUCTION PLAN (MT) (R.O.M)	44,000	40,000	25,000	41,000	100,000	60,000	875,000
WORK FORCE	265	320	191	352	629	357	1,050
PRODUCTIVITY (MT/MAN/SHIFT)	0.25	0.31	0.21	0.24	0.27	0.31	1.92
MINING METHOD	ROOM & PILLAR	ROOM & PILLAR	SHORT WALL	ROOM & PILLAR (TOP SLICING)	SHORT WALL	SHORT WALL OPEN PIT	OPEN PIT
MINE VENTILATION	NATURAL	NATURAL PARTIALLY FORCING	EXHAUSTING FAN	NATURAL	FORCING FAN	—	—
HAULAGE	HOIST & MINE CAR 0.6 MT/CAR	HOIST & SLED 0.05 MT/SLED	HOIST & MINE CAR 1.3 MT/CAR	HOIST & SKIP 0.6 MT/SKIP	MINE CAR & HAND TRAMMING 0.7 MT/CAR	20 TONNE TRUCK	BELT CONVEYOR
PREPARATION	SIMPLE WASHING	—	—	—	—	—	—
CONSUMER	NPC NAGA, ACMDC, LUDO, APOCEMCO, UNICEMCO	NPC NAGA, APO CEMCO, LUDO, ACMDC	ACMDC,	ACMDC, LUDO	ACMDC, PACIFIC CEMENT	ACMDC, RIZAR CEMENT, SOLID CEMENT, PHINMA, NPC	NPC CALACA, ACMDC
STOCK YARD	DANAO	LAGTANG	—	DALAGUETE	TALOOT	BATAN	—
HAULAGE DISTANCE (MINE~YARD~ CONSUMER)	8 km (M~Y) 51 km (Y~NAGA)	22 km (M~Y) 15 km (Y~NAGA)	17 km (M~NAGA)	18 km (M~Y) 68 km (Y~NAGA)	25 km (M~Y) 52 km (Y~NAGA)	2 km (M~PIER)	200 km (M~CALACA)
HAULAGE METHOD (MINE~YARD~ CONSUMER)	TRUCK	TRUCK	TRUCK	TRUCK & BARGE	TRUCK & BARGE	TRUCK & BARGE	SHIP
WATER DRAINAGE	ELECTRIC PUMP	ELECTRIC PUMP	ELECTRIC PUMP	ELECTRIC PUMP	ELECTRIC PUMP	ELECTRIC PUMP	ELECTRIC PUMP
OPERATING DAYS (DAYS/YEAR) <SHIFTS/DAY>	300 <2>	300 <1>	300 <4>	300 <3>	300 <3>	300 <3>	300 <3>

RESULTS OF GEOLOGICAL INVESTIGATION

Items \ Coal Mines	J.D. Almendras Mine	Cebu Coal Mine	PNOC-CC (Uling)	Manguerra	Luvimin	Carbex, Inc.
1. Coal Bearing Formation A. Name B. Age	A. Malubog Formation B. Early Miocene	A. Malubog Formation B. Early Miocene	A. Malubog Formation B. Early Miocene	A. Calagasan Formation B. Early Miocene	A. Calagasan Formation Linut-Od Formation B. Early~Middle Miocene	A. Bilbao Formation B. Middle Miocene
2. Main Coal Seams A. Number of Mineable Coal Seams B. Name C. Thickness	A. 2 seams B. No. 1 seam, No. 2 seam C. No. 1 seam ..... 1.5 m No. 2 seam ..... 1.3~1.4 m	A. 2 seams B. Upper seam, Lower seam C. Upper seam ..... 0.3 m Lower seam .... 0.7~1.2 m	A. 2 seams B. N6, Dona Margarita C. N6 ..... 1.0 m (average) Dona Margarita ..... 1.0~1.8 m	A. 2 seams B. Upper seam (seam B) Lower seam (seam C) C. Upper seam .... 2.0~5.0 m Lower seam .... 1.5~2.0 m	A. 5 seams B. A seam, B seam (Linut-Od) Bala-As seam, Tong Kot seam, Bayabas seam (Calagasan) C. A seam (1.0 m), B seam (1.0 m) Bala-As seam (1.5 m) Tong kot seam (2.0 m) Bayabas seam (2.0 m)	A. 3 seams B. Upper seam Middle seam Lower seam C. Upper seam ..... 0.9 m Middle seam ..... 1.0 m Lower seam ..... 3.0 m
3. Geological Structure A. Strike & Dip	Western limb of Northeast tranding Syncline A. N40E, 30E	Eastern limb of Southwest plunging Anticline A. N32E, 20 E	Eastern limb of Northeast trending Syncline A. N50E, 45W	Poorly defined structure Northwest trending homoclinal structure A. N26W, 82W	North trending homoclinal sturcture Regionaly defined structure A. N~N45E, 55W	Northeast trending homoclinal structure Regionaly defined structure A. NE, 15~20 W
4. Exploration	No. of drillholes ..... nil Measured survey is conducted by Mining Engineer with Compass	No. of drillholes ..... nil Measured survey is conducted by Mining Engineer of Toledo Office once a month	No. of drillholes ..... 175 Total depth of drillholes ..... 35,042 m Geophysical Investigation ... nil Mapping ..... · 1/15,000 · 1/5,000 · 1/1,000 scale Geologist ..... 1 (Cebu Office) Surveyor 1 (4-year-experience)	No. of drillholes ..... nil Mining Engineer is in charge of geological work. Surveyor 1	No. of drillholes ..... 18 Average depth of drillholes ..... 170 m Geophysical Investigation ... nil Geologist ..... 1 Surveyor ..... 1 2 drill teams are supervised by Geologist	No. of drillholes ..... 236 Total depth of drillholes ..... 7,367.6 m Geophysical Investigation ... nil Mining Engineer is in charge of geological work Surveyor 1
5. Coal Quality * T.M. .... Total Moisture (%) I.M. ..... Inherent Moisture (%) Ash ..... Ash (%) V.M. .... Volatile Matter (%) F.C. ..... Fixed Carbon (%) H.V. ..... Heating Value (Btu/lb) T.S. ..... Total Sulfur (%) H.G.I.... Hardgrove Grindability Index	No. 1 seam / No. 2 seam T.M. 22.69 / 19.36 I.M. 19.64 / 17.58 Ash 3.27 / 7.41 V.M. 42.69 / 43.34 F.C. 34.40 / 31.67 H.V. 9,630 / 9,420 T.S. 0.39 / 0.31 (air dried basis)	Lower seam T.M. 3.8 I.M. 2.1 Ash 7.3 V.M. 39.8 F.C. 50.8 H.V. 12,920 T.S. 3.38 (air dried basis)	Dona Margarita, N6 T.M. — / — I.M. — / — Ash 11.1 / 16 V.M. — / — F.C. — / — H.V. 9,496 / 9,368 T.S. 1.01 / 3.14 (air dried basis) (average)	Upper seam T.M. — I.M. 4.3 Ash 11.2 V.M. 46.2 F.C. 38.3 H.V. 11,930 T.S. 0.95 (air dried basis)	Delivered coal to NCC T.M. 8.42 I.M. 3.06 Ash 15.76 V.M. 38.91 F.C. 42.27 H.V. 11,319 T.S. 1.35 H.G.I. 55 (air dried basis)	Middle seam, Lower seam T.M. — / 16.03 I.M. 10.14 / 10.56 Ash 6.81 / 5.73 V.M. 43.16 / 42.55 F.C. 39.39 / 41.16 H.V. 10,826 / 10,827 T.S. 2.12 / 0.94 (air dried basis)
6. Reserves	Positive reserves 53,000 t Probable reserves 260,000 t (Company report submitted OEA for 5-year-program from 1987 to 1991) Positive reserves 366,000 t Probable reserves 369,000 t In-situ reserves 612,000 t (OEA (1986))	Coal reserves based on 5-year program ..... 156,000 t Positive reserves 887,620 t Probable reserves 841,500 t (Investigation of JICA (1988))	Mineable reserves NE-1 Mine ..... 216,000 t Cambahi & North Cambahi ..... 324,000 t Total 540,000 t In-situ reserves NE-1 Mine ..... 360,000 t Cambahi ..... 200,000 t North Cambahi..... 340,000 t Total 900,000 t (Company report)	Total coal production on 5-year-program ..... 117,000 t (Company report submitted OEA for 5-year-program from 1984 to 1988) Positive reserves ..... 210,000 t (OEA (1986))	Total coal production on 5-year-program ..... 456,032 t (Company report submitted OEA for 5-year-program from 1987 to 1991) Positive reserves..... 1,586,000 t Probable reserves.... 2,080,000 t In-situ reserves ..... 2,973,000 t (OEA (1986))	Bilbao open-pit plan Coal production 50,400 t Overburden (BCM) 360,102 t Strip ratio 7.14 BCM/t Measured reserves Upper seam 13,000 t Middle seam 267,800 t Lower seam 250,400 t Sub-total 531,200 t Indicated reserves Upper seam 13,000 t Middle seam 218,200 t Lower seam 80,600 t Sub-total 311,800 t Inferred reseveres Upper seam — Middle seam 159,900 t Lower seam — Sub-total 159,900 t Total 1,002,900 t (Investigation of JICA (1988))

COAL RESERVES OF INDIVIDUAL CONTRACTORS ('000 Tons)

Contractors / Reserves	Positive Reserves	Probable Reserves	In-situ Reserves	Data Sources
SEMIRARA	132,276	29,765	152,120	OEA (1986)
CAGAYAN VALLEY				
· Isabera Consortium	40,045	38,180	65,498	OEA (1986)
· Diamond Coal Mine	339	–	339	OEA (1986)
· Phil-German Coal Expl. Area	28,100	15,000	38,000	OEA (1986)
MINDORO				
· F.F. Cruz & Co.	3,073	1,401	4,007	OEA (1986), from data of CDC Mining Corp.
POLILLO				
· Tantuco Mining Corp.	81	130	168	OEA (1986), from data of INIMACO
· Pil-Cathay	195	300	395	OEA (1986)
BATAN				
· Carbex Inc. (Cravat Coal)	531	312	1,002	from investigation of JICA (1988)
· ACRI	3,115	727	3,599	OEA (1986)
· Project Managers	1,883	2,252	3,384	OEA (1986) from data of Coalfields
· Bicol Coal Devt.	315	1,000	982	OEA (1986)
· Al Mining	259	33	281	OEA (1986), from data of Pamana Coal Mines
CATANDUANES				
· Catanduanes Coal Devt. Co.	645	–	645	OEA (1986), from data of Sam Chok
QUEZON				
· Tantuco Coal Mines	93	–	93	OEA (1986)
NEGROS				
· Tindalo Mining Corp.	1,046	1,055	1,750	OEA (1986)
DAVAO				
· Almendras	208	–	208	OEA (1986)
SURIGAO				
· Benguet Corp. DMC	5,000	–	5,000	OEA (1986)
· DMC-CERI	7,470	–	7,470	OEA (1986), from data of Atlas & PNOC-Bislig
· Montenegrin	2,765	–	3,108	OEA (1986)
· Piedra Negra	450	87	508	OEA (1986)
SURIGAO				
· Pauling Ltd.	1,014	–	1,014	OEA (1986)
· JINICO	750	–	750	OEA (1986)
· PNOC-San Miguel	13,000	–	13,000	OEA (1986)
ZAMBOANGA				
· Zamboanga Industrial	1,677	348	1,909	OEA (1986), from data of INIMACO
· F.F. Cruz	40	–	–	from Company report submitted OEA
· DMC-CERI	–	–	–	no information
· PNOC-Malangas	16,000	1,000	16,667	OEA (1986)
· PNOC-Lalat	11,240	6,050	15,273	OEA (1986)

APPENDIX 5

Reserves Contractors	Positive Reserves	Probable Reserves	In-situ Reserves	Data Sources
SAMAR				
· MMIC	1,105	4,320	3,985	OEA (1986)
· IEI	3,400	129	3,486	OEA (1986)
Northern Cebu				
· Durano Coal Mine	378	–	378	OEA (1986)
· Unicemco	141	–	140	OEA (1986)
· J. D. Almendras	366	369	612	OEA (1986)
· Providence Mining	33	–	33	OEA (1986)
· Fortune Exploration Corp.	135	–	135	OEA (1986)
· Manto Agro-Industrial	48	–	48	OEA (1986)
· Il Rey' C	265	–	265	OEA (1986)
· Phil-Taiwan	–	–	–	no information
· Adlaon	–	–	–	no information
· Aznar	239	839	–	from Company report submitted OEA
CENTRAL CEBU				
· ARGONEX	182	–	182	OEA (1986)
· Cebu Alpaco	129	–	129	OEA (1986)
· Fortune Coal	288	–	288	OEA (1986), from data of Bacaltos Mine
· Cebu Coal Mine	888	842	–	from investigation of JICA (1988)
· D.G. Sanchez Coal Mines	1,253	2,292	5,606	from Company report submitted OEA
· INIMACO	126	–	126	OEA (1986), from data of Fil-Carbon
· JLB	69	154	172	OEA (1986)
· EDMAN	–	–	2,698	from Company report submitted OEA
· PNOC-Uling	540	–	900	from Company report
SOUTHERN CEBU				
· Luvimin	1,586	2,080	2,973	OEA (1986)
· INIMACO	1,500	300	1,700	OEA (1986), from data of Fil-Carbon
· Manguerra	210	–	210	OEA (1986)
· Kinway	530	–	530	OEA (1986), from data of Interport
· IEVI	663	413	1,799	from Company report submitted OEA
BOHOL				
· First Bohol Mining	392	740	886	OEA (1986)
MASBATE				
· Hercules Mining	292	–	292	OEA (1986)

Coal Quality in the Philippines

Items / Coal Mines	T.M. (%)	I.M. (%)	Ash (%)	V.M. (%)	F.C. (%)	S (%)	H.V. Btu/lb	Class (ASTM)	Remarks
Polillo	8.4	5.8	14.3	35.2	44.7	0.62	10,680	HVB-C	PNOC ('85)
Lagunac (Quezon)	–	4.7	13.3	42.4	39.7	0.34	10,930	HVB-C	Tantuco ('83)
Cagayan (RP/UK)	51.1	15.3	21.3	36.9	24.7	1.0	6,640	SB-C	RP/UK ('85)
Isabera	38.8	4.7	3.6	36.6	21.0	0.3	6,330	Lig-A	BACNOTAN
Batan E. (CMIC)	21.7	13.5	10.5	42.3	33.7	2.4	8,990	SB-B	ATLAS Rec.
Batan E. (Carbex) (Middle Seam)	–	10.14	6.81	43.16	39.39	2.12	10,826	HVB-C	SGS Far East Ltd.
Batan E. (Carbex) (Lower Seam)	16.03	10.56	5.73	42.55	41.16	0.94	10,827	SB-A	SGS Far East Ltd.
Batan W. (BMC)	–	11.6	4.6	36.3	47.5	1.0	10,730	SB-A	BED
Catanduanes (Ermitanto)	–	3.1	18.8	20.1	57.9	1.4	11,800	MVB	RRI ('77)
Catanduanes (Magnesia)	33.1	–	12.9	34.0	20.1	–	7,180		RRI ('77)
Masbate (Hercules)	8.7	6.4	10.2	41.9	41.5	1.72	11,120	HVB-C	PNOC ('85)
Samar (MMIC-Bagacay)	–	25.1	7.9	35.3	31.8	2.5	8,280	SB-C	MMIC
Samar (Giporlos)	–	19.5	20.0	33.1	27.5	2.68	7,320	SB-C	MMIC
Leyte (Peat)	67.0	10.5	54.8	26.8	8.0	–	2,640	Lig-B	RRI ('77)
Mindoro	24.4	16.4	5.0	41.2	37.4	3.15	8,900	SB-C	RRI ('77)
Mindoro (Bulelacao coal)	28.8	–	4.9	34.7	31.6	2.9	8,010		Bureau of Mine 1955 as received.
Negros E. (Bagonban)	18.9	(9.3)	10.3	33.2	37.7	(3.9)	8,940	SB-C	Melendres
Negros W.	–	9.3	15.1	39.8	35.8	4.0	9,500	SB-A	Melendres
Bohol	18.0	11.3	29.6	50.0	9.1	4.26	7,870	SB-A	BCMC
AAM (North)	15.9	11.4	12.3	44.0	32.3	1.96	9,260	SB-A	PNOC Naga
J.D. Almendras (North)	20.7	17.1	12.7	42.3	27.9	0.4	8,550	SB-B	PNOC Naga
"	28.29	13.41	13.13	49.12	24.34	0.93	9,050	SB-B	PNOC Naga ('87)
Il Ray'C (North)	15.2	11.2	12.5	44.5	31.9	1.99	9,270	SB-A	PNOC Naga
DCM Man (North)	11.1	10.4	8.1	42.3	39.1	0.9	10,030	SB-A	PNOC Naga
Aznar (North)	15.4	14.3	9.0	41.3	35.4	1.0	9,840	SB-A	PNOC Naga
Manto (North)	–	11.7	15.7	35.4	37.4	1.23	8,900	SB-A	PCCM
DG Sanchez (Central) (Suom Seam 1)	–	6.82	7.11	41.39	44.68	1.85	11,477	HVB-C	Company report
" (Luka Seam 2)	–	7.90	5.78	43.51	42.81	3.57	11,622	HVB-C	"
"	7.8	6.8	7.1	41.1	44.7	1.85	11,480	HVB-C	PNOC Naga
Angonex (Central)	15.6	13.1	15.3	42.9	28.7	2.01	9,060	SB-A	PNOC Naga
Cebu Coal Mine (Central)	3.8	2.1	7.3	39.8	50.8	3.38	12,920	HVB-B	PNOC Naga
Bacaltos (Central)	19.4	17.5	4.3	40.8	37.4	0.8	9,910	SB-B	PNOC Naga
Luvimin (South)	–	2.7	14.6	44.8	37.9	1.74	11,710	HVB-B	PNOC Naga
"	8.42	3.06	15.76	38.91	42.27	1.35	11,319	HVB-B	NCC ('87)
EDMAN (Upper seam)	–	16.36	7.77	35.63	40.24	2.43	9,100	SB-B	Company report
EDMAN (Lower seam)	–	15.24	5.45	40.19	39.12	2.51	10,046	SB-A	"

Coal Quality in the Philippines

Items / Coal Mines	T.M. (%)	I.M. (%)	Ash (%)	V.M. (%)	F.C. (%)	S (%)	H.V. Btu/lb	Class (ASTM)	Remarks
Pilcarbon (South)	–	5.9	11.3	39.6	43.2	2.5	11,000	HVB-C	PCCM
Jeston (South)	8.4	6.6	4.3	42.2	46.9	1.0	11,890	HVB-C	PNOC Naga
Manguerra (South)	–	4.3	11.2	46.2	38.3	0.95	11,930	HVB-B	PNOC Naga
Semirara (Himaliam)	26.3	19.7	15.1	32.9	32.3	0.7	8,022	SB-C	Dames & Moore
Malangas (ROM)	3.5	1.6	19.2	21.2	58.0	0.6	11,990	MVB	MCC
Malangas (Processed)	4.6	1.6	16.2	23.2	59.1	0.6	12,410	MVB	MCC
Little Baguio (ROM)	5.3	2.2	14.3	33.5	50.0	0.5	12,560	HVB-A	PNOC
Little Baguio (Processed)	4.5	2.0	12.8	31.9	53.3	0.6	12,400	HVB-A	PNOC
Lalat (B)	–	2.5	8.0	37.0	52.5	0.5	13,120	HVB-A	PNOC
Lalat (A)	–	2.5	14.0	35.0	48.5	0.4	11,280	HVB-B	PNOC
Bislig (#k)	–	12.0	23.3	34.7	30.1	0.8	8,120	SB-A	PNOC
Bislig (#I)	–	11.3	29.8	31.7	27.1	1.0	7,200	SB-B	PNOC
Bislig (#H)	–	11.1	24.5	33.7	30.6	0.7	8,080	SB-A	PNOC
Bislig (#HL)	–	11.0	29.1	32.8	26.4	0.9	6,940	SB-B	PNOC
Bislig (#5)	–	10.3	18.1	36.7	34.9	1.4	9,120	SB-A	PNOC
Bislig (#6)	–	9.0	13.7	39.4	38.0	1.2	10,290	HVB-C	PNOC
Piedra Negra	–	24.44	4.49	35.23	35.84	1.87	8,005	SB-C	Company report
"	–	16.16	4.22	38.14	41.48	0.48	9,273	SB-B	"
ATLAS PODOCO	17.3	15.8	18.9	44.8	20.5	–	8,220	SB-B	BED
Tarragona (PNOC L)	–	12.1	5.9	39.0	43.0	0.94	10,950	HVB-C	PNOC
Tarragona (PNOC U)	–	25.8	9.8	33.0	31.4	0.64	8,210	SB-B	PNOC
Lianga (Diversified)	14.2	5.4	5.3	47.0	42.3	1.0	11,800	HVB-C	Diversified
San Miguel (PNOC 5)	23.9	18.8	12.5	42.0	24.6	2.1	8,010	SB-C	PNOC

Remarks: Air dried basis for all analyses except total moisture.

Lig —— Lignite
SB —— Sub Bituminous Coal
LVB —— Low Volatile Bituminous Coal
MVB —— Medium Volatile Bituminous Coal
HVB —— High Volatile Bituminous Coal
PCCM —— Philippine Chamber of Coal Mines, Inc.
RRI —— Robertson Research

PROJECTED PHILIPPINE COAL PRODUCTION (1988~2000) ['000 Tons – 10,000 BTU/lb]

Year / Coal Mines	1988	1989	1990	1991	1992	1993	1995	2000
SEMIRARA (open pit)	630	648	720	720	1,440	1,440	2,160 (1,800)	2,592 (2,160)
PNOC AREAS								
· Malangas	328	327	293	363	402	402	402	402
· Central Cebu (Uling)	25	—	—	—	—	—	—	—
Total	353	327	293	363	402	402	402	402
PRIVATE-OWNED AREAS OUTSIDE CEBU								
A. Surigao								
· DMC-CERI	65	68	79	79	90	90	122	159
· BCI–Diversified (open pit)	27	27	27	27	68	68	112	150
· Montenegrin (open pit)	0	18	34	34	34	34	68 (34)	150 (75)
· Piedra Negra (open pit)	4	18	34	34	68 (34)	68 (34)	112 (34)	150 (34)
Sub-Total	96	131	174	174	260 (226)	260 (226)	414 (302)	609 (418)
B. Zamboanga								
· Zambo	15	30	45 (30)	45 (30)	45 (30)	45 (30)	45 (30)	45 (30)
· F.F. Cruz	8	20 (13)	26 (13)	26 (13)	26 (13)	26 (13)	53 (13)	66 (13)
· DMC-CERI	—	—	—	—	—	—	26	53
Sub-Total	23	50 (43)	71 (43)	71 (43)	71 (43)	71 (43)	124 (69)	164 (96)
C. Batan								
· ACRI/Batan (open pit)	0	24	36	36	36	36	36	36
· Bicol Coal (open pit)	15	15	15	15	15	15	15	15
· Project Manager, Inc.	0	31	31	31	31	31	31	31
· Cravat Coal Mines, Inc. (open pit)	60	60	60	60	60	60	60	60
Sub-Total	75	130	142	142	142	142	142	142
D. Polillo								
· Pilipino Cathay	14	26	26	26	26	26	40 (26)	40 (26)
· INIMACO	—	—	—	—	—	—	26 (13)	40 (26)
Sub-Total	14	26	26	26	26	26	66 (39)	80 (52)
E. Other Areas								
· Cagayan	4	13	26	26	26	26	26	40
· Catanduanes	0	7	13	17	21	25	33	51
· Negros	15	20	20	20	20	20	20	20
· Masbate	12	24	30	36	36	36	36	36
· Mindoro	—	—	—	—	—	—	—	800
· Isabera	—	—	—	—	—	—	—	1,000
Sub-Total	31	64	89	99	103	107	115	1,947
Total (Private-Owned Areas outside Cebu)	239	401 (394)	502 (474)	512 (484)	602 (540)	606 (544)	861 (667)	2,942 (2,655)

Coal Mines \ Year	1988	1989	1990	1991	1992	1993	1995	2000
CEBU								
· Adlaon	12 (6)	18 (9)	24 (12)	24 (12)	24 (12)	24 (12)	24 (12)	24 (12)
· Philippine Taiwan (AMC-Licos)	20	24	36	36	36	36	63	95 (63)
· Argonex	7	12	12	12	12	12	10	10
· Aznar	12	18	24	24	24	24	23	23
· Cebu Alpaco	12	18	18	18	18	18	15	15
· Cebu Coal	40 (30)	48 (30)	48 (30)	48 (30)	48 (30)	48 (30)	54 (30)	81 (30)
· D.G. Sanchez	9	15	24	30	30	30	42	42
· EDMAN	11	18	24	24	24	24	22	22
· Fortune	0	6	6	6	6	6	6	6
· IEVI	14	24	24	24	24	24	25	25
· Il Rey'C	12	18	24 (18)	24 (18)	24 (18)	24 (18)	22 (18)	22 (18)
· INIMACO	13	18	24	24	24	24	57	92 (57)
· J.D. Almendras	44 (24)	48 (24)	48 (24)	48 (24)	48 (24)	48 (24)	54 (24)	81 (24)
· Kinway	11	18	24	24	24	24	26	26
· Luvimin	100	108	120	132	144	156	196	262 (196)
· Manguerra	41	48	60	72	84	96	132 (96)	198 (96)
· R.M. Durano	16	24	36 (24)	36 (24)	36 (24)	36 (24)	54 (24)	108 (24)
Total	374 (338)	483 (432)	576 (504)	606 (534)	630 (558)	654 (582)	825 (689)	1,132 (689)
GRAND TOTAL	1,596 (1,560)	1,859 (1,801)	2,091 (1,991)	2,201 (2,101)	3,074 (2,940)	3,102 (2,968)	4,248 (3,558)	7,068 (5,906)

PROJECTED PHILIPPINE COAL PROCUCTION (1988~2000) ['000 Tons – Run of Mine]

Year / Coal Mines	Positive Reserves	Total Production (1988~2000)	1988	1989	1990	1991	1992	1993	1995	2000
SEMIRARA (open pit)	132,276	28,375 (25,275)	875	900	1,000	1,000	2,000	2,000	3,000 (2,500)	3,600 (3,000)
PNOC AREAS										
· Malangas	16,000	4,290	285	284	255	316	350	350	350	350
· Central Cebu (Uling)	540	25	25	—	—	—	—	—	—	—
Total	16,540	4,315	310	284	255	316	350	350	350	350
PRIVATE-OWNED AREAS OUTSIDE CEBU										
A. Surigao										
· DMC-CERI	7,470	1,612	74	78	93	93	108	108	150	200
· BCI-Diversified (open pit)	5,000	1,364	36	36	36	36	90	90	150	200
· Montenegrin (open pit)	2,765	899 (574)	0	24	45	45	45	45	90 (45)	200 (100)
· Piedra Negra (open pit)	450	1,340 (525)	6	24	45	45	90	90 (45)	150 (45)	200 (45)
Sub-Total	15,685	5,215 (4,075)	116	162	219	219	333	333 (288)	540 (390)	800 (545)
B. Zamboanga										
· Zambo	1,677	432 (300)	12	24	36 (24)	36 (24)	36 (24	36 (24)	36 (24)	36 (24)
· F.F. Cruz	40	445 (151)	7	18 (12)	24 (12)	24 (12)	24 (12)	24 (12)	48 (12)	60 (12)
· DMC-CERI	—	168	—	—	—	—	—	—	24	48
Sub-Total	1,717	1,045 (619)	19	42 (36)	60 (36)	60 (36)	60 (36)	60 (36)	108 (60)	144 (84)
C. Batan										
· ACRI/Batan (open pit)	3,115	420	0	24	36	36	36	36	36	36
· Bicol Coal (open pit)	315	234	18	18	18	18	18	18	18	18
· Project Manager, Inc.	1,883	456	24	36	36	36	36	36	36	36
· Cravat Coal Mines, Inc. (open pit)	531	780	60	60	60	60	60	60	60	60
Sub-Total	5,844	1,890	102	138	150	150	150	150	150	150
D. Polillo										
· Pilipino Cathay	195	373 (301)	13	24	24	24	24	24	36 (24)	36 (24)
· INIMACO	81	156 (84)	—	—	—	—	—	—	24 (12)	36 (24)
Sub-Total	276	529 (385)	13	24	24	24	24	24	60 (36)	72 (48)
E. Other Areas										
· Cagayan	28,100	2,000	—	—	—	—	—	—	—	2,000
· Catanduanes	645	196	4	12	24	24	24	24	24	36
· Negros	1,046	388	0	8	15	20	25	30	40	60
· Masbate	292	306	18	24	24	24	24	24	24	24
· Mindoro	3,073	426	12	24	30	36	36	36	36	36
· Isabera	40,045	2,000	—	—	—	—	—	—	—	2,000
Sub-Total	73,201	5,316	34	68	93	104	109	114	124	4,156
Total (Private-Owned Areas outside Cebu)	96,723	13,995 (12,285)	284	434 (428)	546 (522)	557 (533)	676 (607)	681 (612)	982 (760)	5,322 (4,93)

Year / Coal Mines	Positive Reserves	Total Production (1988~2000)	1988	1989	1990	1991	1992	1993	1995	2000
CEBU										
· Adlaon	no information	294 (147)	12 (6)	18 (9)	24 (12)	24 (12)	24 (12)	24 (12)	24 (12)	24 (12)
· Philippine Taiwan (AMC-Licos)	no information	614	20	24	36	36	36	36	60	90 (60)
· Argonex	182	151	7	12	12	12	12	12	12	12
· Aznar	239	294	12	18	24	24	24	24	24	24
· Cebu Alpaco	129	228	12	18	18	18	18	18	18	18
· Cebu Coal	888	718 (390)	40 (30)	48 (30)	48 (30)	48 (30)	48 (30)	48 (30)	60 (30)	90 (30)
· D.G. Sanchez	1,253	384	9	15	24	30	30	30	36	36
· EDMAN	no information (In-situ 2,698)	293	11	18	24	24	24	24	24	24
· Fortune	North Cebu 135 Central Cebu 288	72	0	6	6	6	6	6	6	6
· IEVI	663	302	14	24	24	24	24	24	24	24
· Il Rey'C	265	294 (228)	12	18	24 (18)	24 (18)	24 (18)	24 (18)	24 (18)	24 (18)
· INIMACO	Central Cebu 126 South Cebu 1,500	469 (439)	13	18	24	24	24	24	48	78 (48)
· J.D. Almendras	366	722 (312)	44 (24)	48 (24)	48 (24)	48 (24)	48 (24)	48 (24)	60 (24)	90 (24)
· Kinway	530	293	11	18	24	24	24	24	24	24
· Luvimin	1,586	2,056 (1,996)	100	108	120	132	144	156	180	240 (180)
· Manguerra	210	1,277 (1,073)	41	48	60	72	84	96	120 (96)	180 (96)
· R.M. Durano	378	640 (304)	16	24	36 (24)	36 (24)	36 (24)	36 (24)	60 (24)	120 (24)
Total	8,738	9,101 (7,520)	374 (338)	483 (432)	576 (504)	606 (534)	630 (558)	654 (582)	804 (660)	1,104 (660)
GRAND TOTAL	254,277	55,786(49,395)	1,843 (1,807)	2,101 (2,044)	2,377 (2,281)	2,479 (2,383)	3,656 (3,515)	3,685 (3,544)	5,136 (4,270)	10,376 (8,993)

* ( ) Projected Coal Production reviewed by JICA