No. 4

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR ESTABLISHING
NATIONAL TRAINING CENTER FOR AUTOMOBILE ENGINEERING
IN
THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

NOVEMBER 1987

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

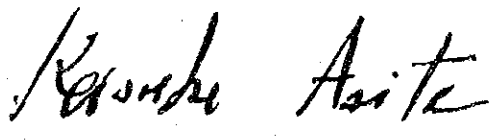
In response to the request of the Government of the Democratic Socialist Republic of Sri Lanka, the Government of Japan has decided to conduct a basic design study on the Project for Establishing the National Training Center for Automobile Engineering and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Sri Lanka a study team headed by Mr. Kazuyoshi Matsumoto, Assistant Director, Vehicle Service Division, Land Transport Engineering Department, Regional Transport Bureau, Ministry of Transport, from June 30 to July 23, 1987.

The team had discussions on the Project with the officials concerned of the Government of Sri Lanka and conducted a field survey in the Colombo area. After the team returned to Japan, further studies were made, and a draft report was prepared and, for the explanation and discussion of it, a mission headed by Mr. Yuji Ono, Vehicle Service Division, Land Transport Engineering Department, Regional Transport Bureau, Ministry of Transport, was sent to Sri Lanka from October 3 to October 12, 1987. As a result, the present report has been prepared.

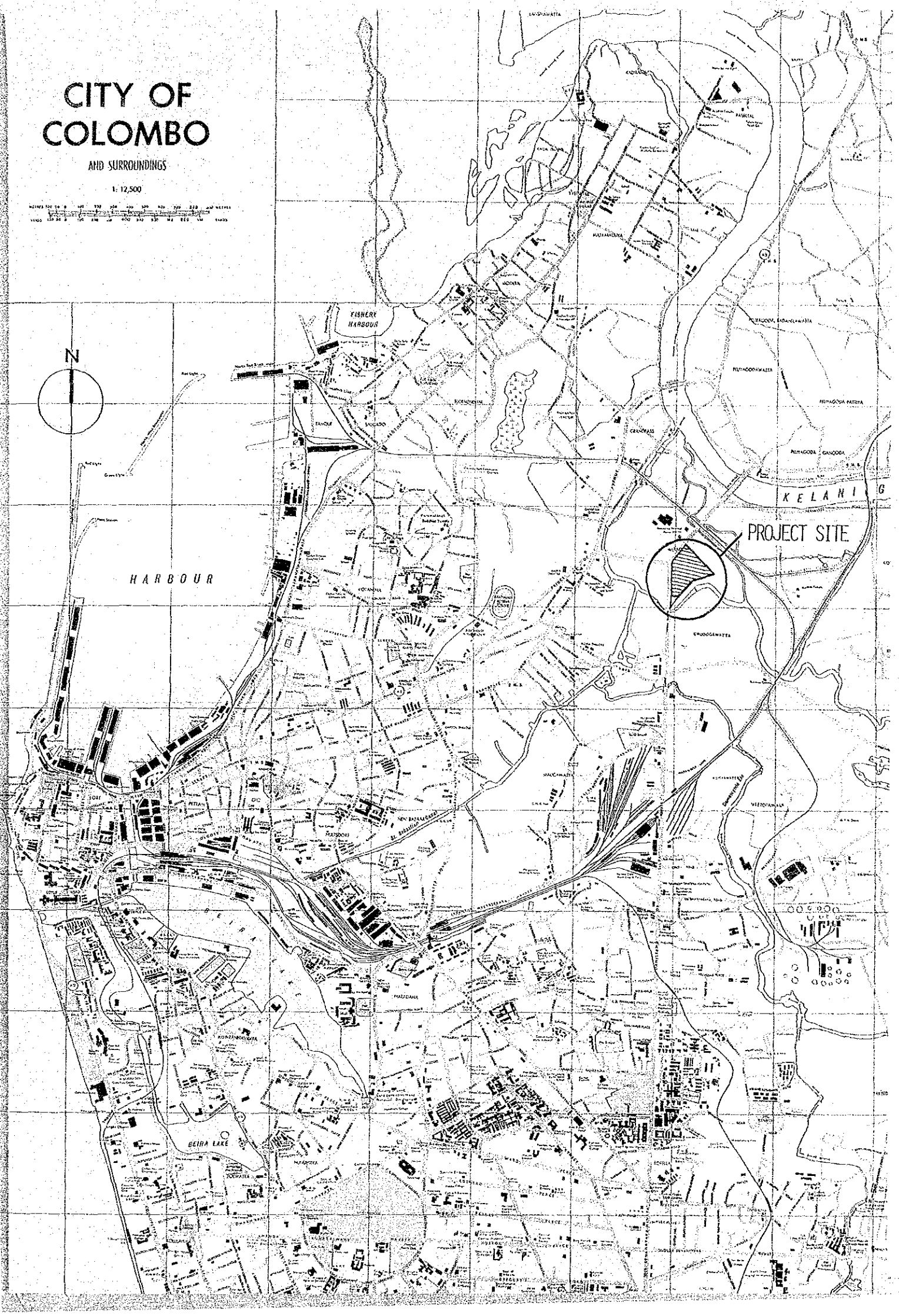
I hope that this report will serve for the development of the project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Democratic Socialist Republic of Sri Lanka for their close cooperation extended to the team.

November, 1987



Keisuke ARITA
President
Japan International Cooperation Agency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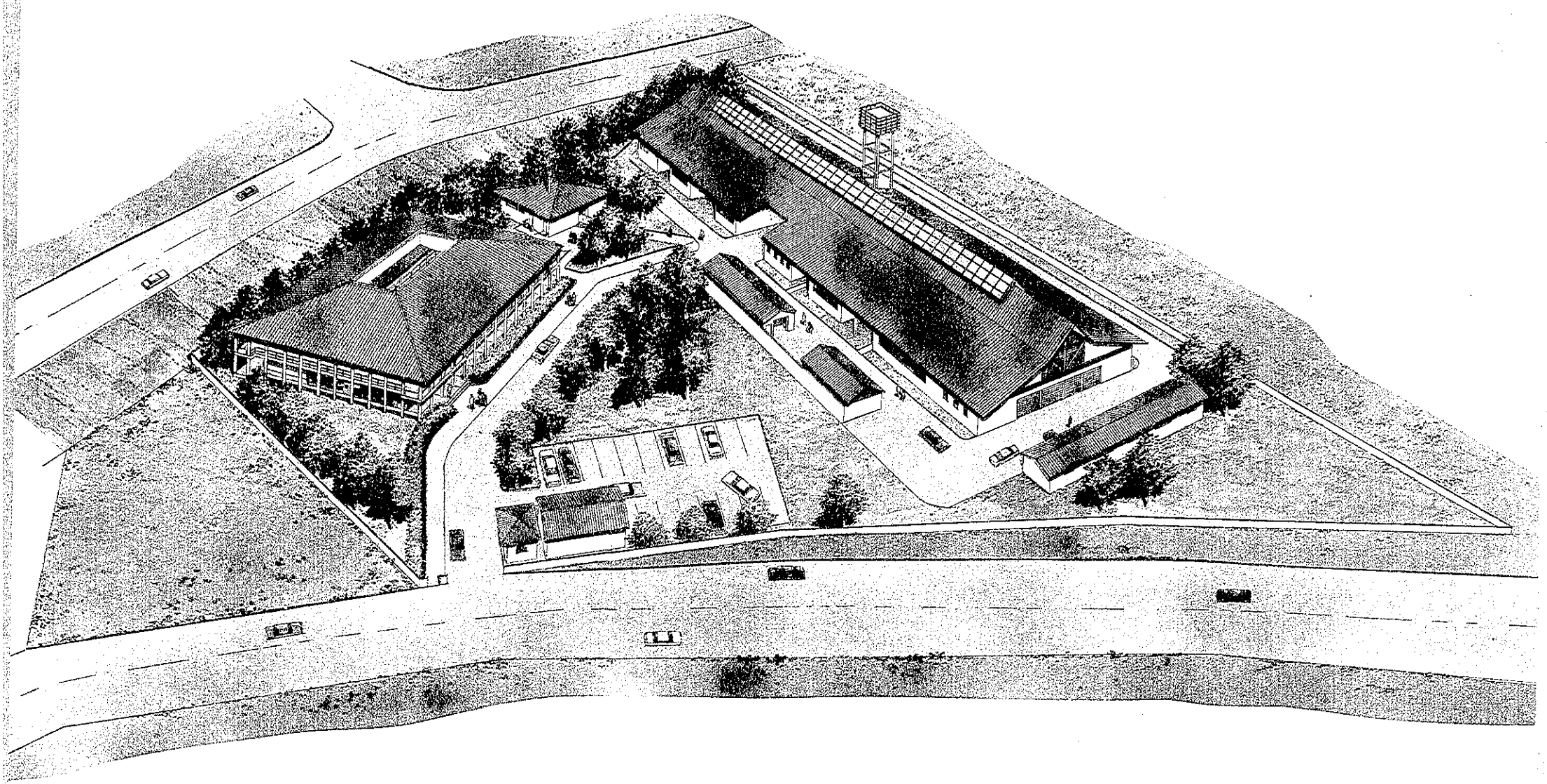

NATIONAL TRAINING CENTER FOR AUTOMOBILE ENGINEERING
IN
THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

SUMMARY

SUMMARY

The Democratic Socialist Republic of Sri Lanka experienced economic expansion from the late 1970's, which resulted in growing demand for domestic transportation services and has made vehicle transportation to support such demand greater than ever. The number of vehicles has increased sharply in the 1980's, and the number of registered vehicles in Sri Lanka reached about 480,000 at the end of 1985, signifying the nation's advance into an age of motorization.

The repair shops owned by import agents are well equipped with advanced maintenance facilities and maintain a high level of technology compared to the normal standards of developing countries, owing to the direct instruction received from the automobile manufacturers. The medium- and small-scale local repair shops, which account for the great majority of the car repair shops operated at present in Sri Lanka, however, are poorly equipped and lack both the necessary knowledge and technology related to good quality car repair and maintenance work. In addition, as maintenance workers receive most of their training from their superiors, at their actual work places there is a shortage of fully trained, competent mechanics.

Thus, the maintenance system for the rapidly increasing number of road vehicles in Sri Lanka is insufficient, and the nation's automobiles typically operate with low efficiency. Because of such circumstances, traffic accidents tend to increase and there is a fear of increased air pollution from the exhaust gas.

At present, the following organizations and institutes are available for automobile mechanic training.

1) Technical Education System offered by the Ministry of Higher Education

2) National Apprentice Board (NAB), operated by the Ministry of Youth Affairs & Employment

3) Ceylon-German Technical Training Institute (CGTTI) operated by the Ministry of Transport

As the Technical Education system of the Ministry of Higher Education and the NAB do not provide or have their own practical training facilities, they commit such training to private repair shops, where workers are trained on-the-job. The single automobile mechanic training institute fully equipped with practical training facilities in Sri Lanka today is the CGTTI. The CGTTI was established in 1958 under a technical assistance agreement with the Federal Republic of Germany with the aim of training workers to maintain the fleet of buses owned by the Sri Lanka Transport Board (SLTB). The training at the CGTTI, therefore, focuses on maintenance and other work related of large diesel engine buses.

Since there is no educational institute which provides a systematic and practical training for the maintenance of gasoline fueled passenger cars and small trucks, which account for a majority of the registered vehicles in Sri Lanka, it seems to be an urgent necessity for Sri Lanka to establish the National Training Center for Automobile Engineering.

In consideration of these situations, it is of vital importance to systematically train workers specializing in automobile maintenance and to send them out to the industry. As it will be difficult, however, for private sectors to realize these ideas, the Government of Sri Lanka has planned the establishment of the "National Training Center for Automobile Engineering", and requested the Government of Japan for grant aid for its realization. In response to the request, the Government of Japan dispatched a preliminary study team in February 1987 to confirm the details of the request made by the Government of Sri Lanka. Based on the results of the preliminary survey, the Government of Japan, then dispatched a basic design study team through the Japan International Cooperation Agency headed by Mr. Kazuyoshi Matsumoto, Assistant Director, Vehicle Service Division, Land Transport Engineering Department, Regional Transport Bureau, Ministry of Transport from June 30 to July 23, 1987.

The basic design study team discussed with the representatives of the Government of Sri Lanka the project for the training center concerned as well as the training curriculum to the extent necessary for the implementation of the project. After returning to Japan, the basic design study team examined the results of the survey, and formulated the basic

design for the facilities and training equipment of the most appropriate scale. The result was compiled in the Basic Design Study Draft Final Report. Upon completion of the report, the study team, headed by Mr. Yuji Ono, Vehicle Service Division, Land Transport Engineering Department, Regional Transport Bureau, Ministry of Transport, was dispatched to Sri Lanka from October 3 to 12, 1987 to explain the report. The outline of the facilities and training equipment which are deemed appropriate based on the results on the preceding investigations and discussions, is given below.

1. Training Programs

(1) Target vehicles: Passenger cars and small- and medium-sized buses and trucks.

(2) Training courses

(a) Automobile mechanic training course:
No. of trainees: 3 classes x 20 trainees = 60 trainees
Period: One year and a half

(b) Automobile electrician training course:
No. of trainees: 1 class x 25 trainees = 25 trainees
Period: One year and a hlaf

(c) Automobile machinist training course:
No. of trainees: 1 class x 15 trainees = 15 trainees
Period: One year and a half

100 trainees

(d) Automobile mechanic training course for semi-skilled workers:
No. of trainees: 1 class x 20 trainees = 20 trainees
Period: Evening course, approx. 6 months

2. Proposed Site

The proposed construction site is located within the Colombo District, and is approximately 5 km north-northeast of the center of the city. The site is nearly trapezoidal with an area of approximately 18,000 m^2, and is easily accessible as it faces a trunk road connecting the central part of Colombo city with the Colombo International Airport.

3. Facilities

(1)	Administration/Classroom Building: 2-storey reinforced concrete structure (A director's room, an office, a training staff room, classrooms, etc.)		2,232 m^2
(2)	Two Training Buildings: One-storey steel framed structure (Practical training rooms, etc.)		3,874 m^2
(3)	Car Washing/Inspection Training Building: One-storey reinforced concrete structure		224 m^2
(4)	Canteen: One-storey reinforced concrete structure		195 m^2
(5)	Others: One-storey reinforced concrete structure (Toilets/Locker Building, Car garages, Guard house, and Sub-station)	Subtotal	418 m^2
		Total	6,963 m^2

4. Training Equipment

(1) Training equipment for automobile mechanics
(2) Training equipment for automobile electricians
(3) Training equipment for automobile machinists
(4) Audio-visual equipment to be used for lectures provided in classrooms

The construction of the National Training Center for Automobile Engineering is expected to take about 20 months in total from the conclusion of the "Exchange of Notes" between the two countries to the completion of the buildings: three months for detailed design; two months for tendering work; and another 15 months for construction. All the work will be carried out in two phases.

It is expected that the execution of this project will foster well-trained automobile mechanics who have learned the basics of automobile maintenance and have received practical training, and that they will spread their acquired knowledge and technology among other workers, which will consequently contribute to the improvement of the automobile maintenance industry throughout Sri Lanka. In the long run, it is also expected that the condition of maintenance, the working rate, and the service life of automobiles will be improved and this will contribute to the economic improvement of Sri Lanka.

This project will be implemented and operated under the control of the Ministry of Industries & Scientific Affairs. With a cooperative relationship with other automobile mechanic training institutes taken into consideration, the Ministry will establish a management board consisting of the Secretary of the Ministry of Industries & Scientific Affairs as the chairman and representatives of the Ministry of Higher Education, the Ministry of Youth Affairs and Employment, the Ministry of Finance & Planning and private repair shops for the administration of the training center.

As the Government of Sri Lanka is well aware of the significance of this project and is prepared for the execution and operation of this project, as mentioned above, it is hoped that this project will be executed with dispatch.

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ABBREVIATIONS

CGTTI	Ceylon-German Technical Training Institute
CGR	Ceylon Government Railway
G.C.E. (A/L)	General Certificate of Education (Advanced Level)
G.C.E. (O/L)	General Certificate of Education (Ordinary Level)
H.N.D.	Higher National Diploma
NAB	National Apprentice Board
N.C.	National Certificate
N.C.C.	National Craft Certificate
N.C.T.	National Certificate in Technology
N.D.	National Diploma
N.D.T.	National Diploma in Technology
SLTB	Sri Lanka Transport Board
TTI	Technical Training Institute

CHAPTER 1. INTRODUCTION

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The current Jayewardena Government established in 1977 has adopted a policy of a free economy and has been aggressively tackling such problems as the promotion of economic development and the introduction of foreign capital. Consequently, economic activities have been greatly encouraged and the annual average rate of economic growth between 1977 and 1985 improved to 5.6%. Though the agricultural sector has played a leading role in the economic recovery, manufacturing industries have done well and exports of textiles, apparel and oil products are edging up smoothly. On the other hand, however, imports have also grown sharply in parallel and though the international balance of payments has improved recently, it still remains in the red.

Sri Lanka entered the 1980s under such circumstances and car imports began to soar. The number of registered vehicles was about 480,000 in 1985 and, like other developing nations, Sri Lanka drove into an age of full-scale motorization. But, in Sri Lanka, social foundations to support said motorization remain weak and the number of repair shops and skilled mechanics are both small. As a result, not only are the operating efficiency of automobiles low, but also many poorly-maintained cars are on the roads, resulting in many cases of traffic accidents and congestion.

Sri Lanka does not produce automobiles at all, almost all the products related to automobiles including spare parts are imported. However, obtaining parts is generally very difficult as they are expensive, thus extending the service life of automobiles by appropriate servicing is very important for the development of the economy and society of Sri Lanka. Under such circumstances, upgrading the skills of Sri Lanka's mechanics is considered urgent.

To deal with such a situation, the Government of Sri Lanka has planned the establishment of the "National Training Center for Automobile Mechanics" and requested of the Government of Japan grant aid for its realization. In response to the request, the Government of Japan sent a preliminary study team to Sri Lanka in February, 1987. The study team confirmed the contents of the Sri Lanka's request and, at the same time, surveyed the background. Based on the results of the survey, the study team made proposals in its preliminary study report concerning a plan for constructing the facilities necessary for educating 100 trainees equivalent to Japanese Class-3 mechanics every year and for providing the necessary facilities and equipment to accomplish this.

In view of the findings of this preliminary study team, the Government of Japan sent to Sri Lanka, through the Japan International Cooperation Agency, a basic design study team headed by Mr. Kazuyoshi Matsumoto, Assistant Director, Vehicle Service Division, Land Transport Engineering Department, Regional Transport Bureau, Ministry of Transport, between June 30 and July 23, 1987.

This study team surveyed subjects related to the background of this project such as traffic conditions, car repair conditions, education conditions and similar automobile mechanic training facilities in Sri Lanka. It then reviewed the necessity and expected effects of the project. At the same time, the team exchanged views on the training program, training curriculum, facilities and equipment required in view of the preliminary study results with the officials concerned of the Ministry of Industries and Scientific Affairs of Sri Lanka. In addition, the organization respensible for project implementation, management and maintenance of this center, and the cost to be borne by the Government of Sri Lanka were also discussed.

After coming back to Japan, the study team reviewed and analyzed survey data and the contents of discussions, evaluated the effects of this project on the improvement of car repair conditions in Sri Lanka and formulated a basic design suggesting the most appropriate scale and facilities in the Basic Design Study Draft Final Report. Upon receipt of the results, JICA dispatched a Study Team, headed by Mr. Yuji Ono, Vehicle Service Division, Land Transport Engineering Department, Regional Transport Bureau, Ministry

of Transport, to Sri Lanka from October 3 to 12, 1987 to discuss the Draft Final Report with the concerned officials of Sri Lanka. Based on the results of the above study, this report has been compiled regarding basic design for facilities and equipment judged to be most appropriate in implementing this project, project cost, project evaluation, and recommendations etc.

The members of this study team, the officials of the Government of Sri Lanka involved, the schedule of the survey and the minutes of discussions are included in the Appendix.

CHAPTER 2. BACKGROUND OF PROJECT

CHAPTER 2. BACKGROUND OF PROJECT

2-1 GENERAL CONDITIONS

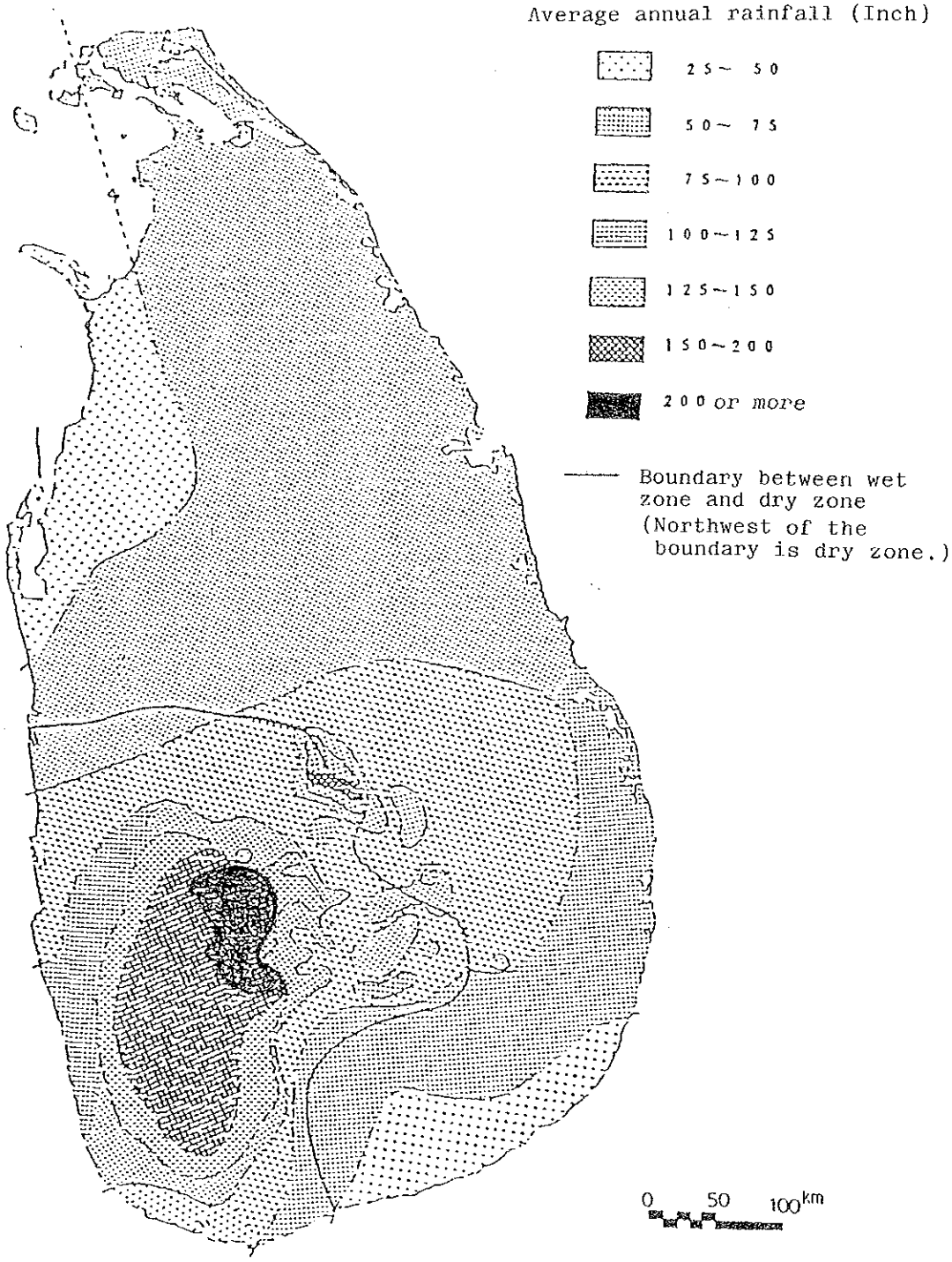
2-1-2 Natural Conditions

Sri Lanka is a tropical island country situated in the Indian Ocean between 5°55 and 9°50 North Latitude and between 79°42 and 81°52 East Longitude. The entire island lies within the tropical climate zone of high temperature and humidity. The climate is divided into the southwestern monsoon period between May and September, the northeastern monsoon period between December and February and the inter-monsoon period in between. In the southwestern monsoon period, most of the rain falls on the plains and highlands in the southwest while the northeastern monsoons hit the northeastern part of the island, during the intermediate period, ocean storms with thunder and tropical storms accompany the rainfall. The southwestern parts of the island receive abundant rainfall all year round and area called wet zones, while the northeast is called a dry zone as little rainfall is recorded except during the northeastern monsoon period.

2-1-2 Economic Conditions

The current Jayewardena Government established in 1977 introduced open economic policies and aggressively tackled the promotion of economic development and the introduction of foreign capital. As a result, an annual average growth rate of 5.6% was achieved between 1977 and 1985 in addition to other remarkable accomplishments including a sharp growth in employment (unemployment rate in 1977, 25.9%; 12% (pred.) in 1983) and nearly complete self-sufficiency in rice supply. On the other hand, a sharp increase in imports, stagnant export growth, a worsening financial position and international balance of payments and spiraling inflation also occurred.

Average Annual Rainfall (Average annual rainfall from 1911 to 1940)



Source: The Ceylon Economic Atlas
Dept. of Census and Statistics

The principal items of export from Sri Lanka consist of agricultural products including tea, rubber and coconuts and industrial products including apparel and oil products. In particular, tea is the largest single export item and represents 33.2% (in 1985) of the total export figure.
Following a sharp decrease in the international price of tea after February 1985, however, Sri Lanka's international balance of trade once again deteriorated.

Principal Items of Trade (1985)

(Unit: 1 mil. Rupees)

Export			Import		
Tea	12,003	(33.2)	Oil	10,986	(20.8)
Clothing	7,899	(21.8)	Food	5,908	(11.2)
Oil products	3,877	(10.7)	Machinery/equipment	4,769	(9.0)
Coconuts	3,093	(8.5)	Textile products	3,799	(7.2)
Rubber	2,566	(7.1)	Transportation equipment	2,499	(4.7)
Mineral products	1,177	(3.2)	Wheat	2,765	(5.2)
Others	5,592	(15.4)	Others	22,191	(41.9)
Total	36,207	(100.0)	Total	52,917	(100.0)

Source: Statistics of Central Bank of Sri Lanka

In addition, military expenditures soared (47.2% increase, 1984), creating a big drain on the Government's finances. The next biggest foreign currency earner after tea, the revenue remitted by laborers working in the Middle East oil-producing nations, is also slumping because of the fall in oil prices.

On the other hand, major import items include oil, food and machinery. Imports from Japan amount to roughly 790 million Rupees and represent a composite ratio of 16.7% (1984), making Japan the largest exporter to Sri Lanka.

Leading Trading Partners of Sri Lanka (1984)

(Unit: 1 mil. Rupees)

Export			Import		
Country	Value	(Composite Ratio, %)		Value	(Composite Ratio, %)
U.S.	7,207.2	17.5	Japan	7,939.3	16.7
Iraq	2,651.4	7.1	Saudi Arabia	7,891.8	16.6
Egypt	2,352.6	6.3	U.S.	4,231.1	8.9
U.K.	2,203.2	5.9	India	2,852.5	6.0
W. Germany	1,829.8	4.9	Singapore	2,614.8	5.5
U.S.S.R.	1.643.1	4.4	W. Germany	2,282.0	4.8
Japan	1,605.7	4.3	U.K.	2,234.4	4.7
Saudi Arabia	1,307.0	3.5	Hong Kong	1,521.3	3.2
Syria	933.6	2.5	Iran	1,378.7	2.9
Iran	896.2	2.4	Taiwan	1,283.6	2.7
Total	37,343	100.0	Total	47,541	100.0

Source: Statistics of Central Bank of Sri Lankan

Principal imports from Japan are industrial products including automobiles and electrical equipment. Imports of auto-related items represent 26.2%, the biggest share.

Major Trade Items of Japan with Sri Lanka (1985)

To Sri Lanka		To Japan	
Transportation equipment (incl. cars)	26.2%	Tea	16.8%
Electric equipment	21.8%	Precious/semi-precious stones	15.7%
General machinery	12.5%	Natural rubber	14.1%
Textile products	8.6%	Prawns	12.3%
Chemical products (chemical fertilizers, etc.)	6.3%	Fossil fuel	10.0%
Iron and steel	6.1%	Metallic ore	4.7%

Source: Statistics of Customs Clearance

2-2 TRANSPORTATION CONDITIONS

The major means of traffic and transportation in Sri Lanka are railways and automobiles.

2-2-1 Railways

The railway is operated by the Ceylon Government Railway (CGR) alone and the total networks covers 1,453 km. It starts from the capital Colombo and serves all key cities in the country. Nearly all of the network is served by a single track and only 2 routes from Colombo covering 103 km have double tracks. Trunklines have been dieselized but there are no electric locomotives. As for passenger transportation, bus transportation networks, those of private bus operators in particular, have been expanding lately. As bus fares are quite competitive, the volume of railway transportation keeps declining every year.

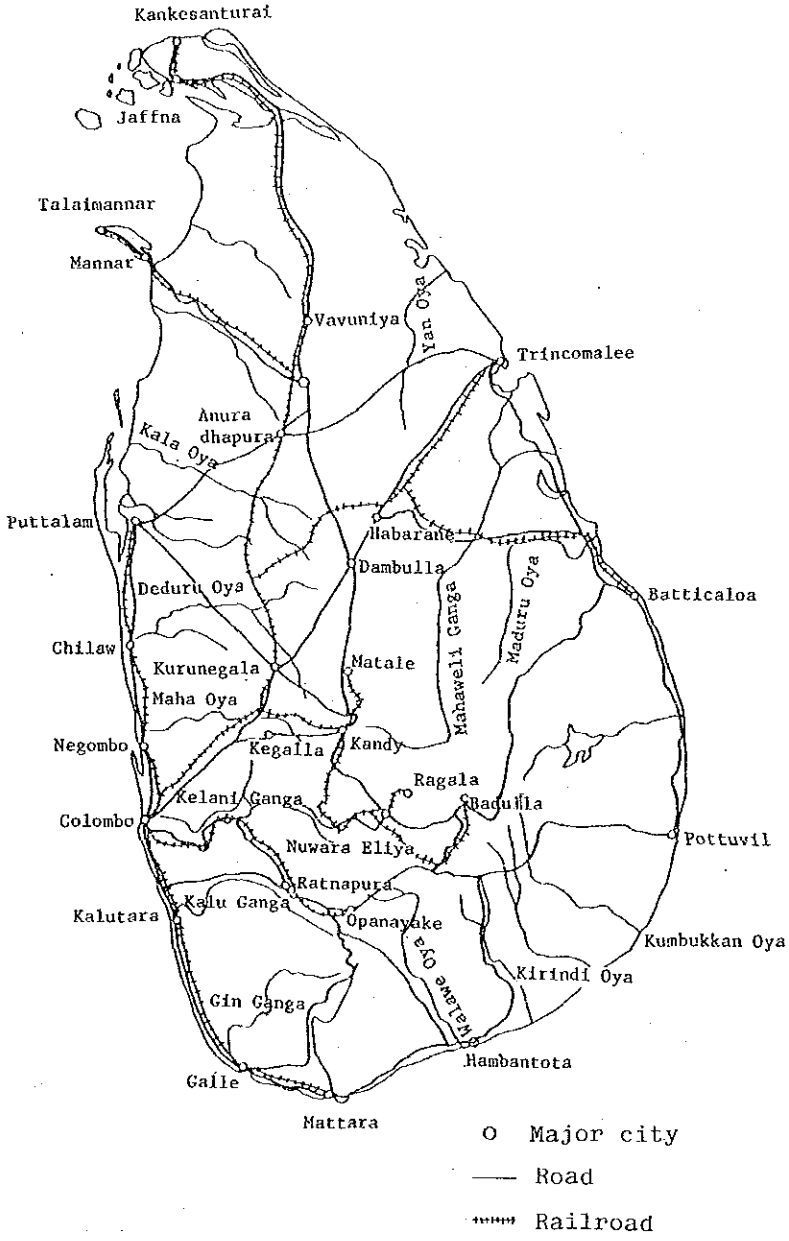
Railway Passengers and Goods

	1980	1981	1982	1983	1984
No. of passengers (1,000 passengers)	37,913	26,591	27,141	22,297	23,264
Vol. of Cargo Transportation (1,000 t)	894	1,671	1,501	1,569	1,583

Source: Ceylon Government Railway

In spite of an increase in the total volume of cargo transported, including that transported by other means, in parallel with the growth of economic activities, the volume of cargo transported by railway has been flat after recording a considerable increase in 1981 and the share has been falling year by year.

As a result, the business performance of CGR followed suit and chalked up a deficit of 240 million Rupees in 1981 in spite of a fare increase, which was offset by higher fuel prices, a pay raise, etc. To overcome this slump in railway transportation, CGR has tried to provide better services including the beginning of container transportation services and the purchase of new-vehicles and is planning to repair bridges, construct a new Mahaweli line and electrify part of its network in the neighborhood of Colombo.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Kalu Ganga
Kalutara
Opanayake
Kumbukkan Oya
Kirindi Oya
Gin Ganga
Walawe Oya
Hambantota
Galle
Mattara
o Major city
Road
Railroad

2-2-2 Vehicle Traffic

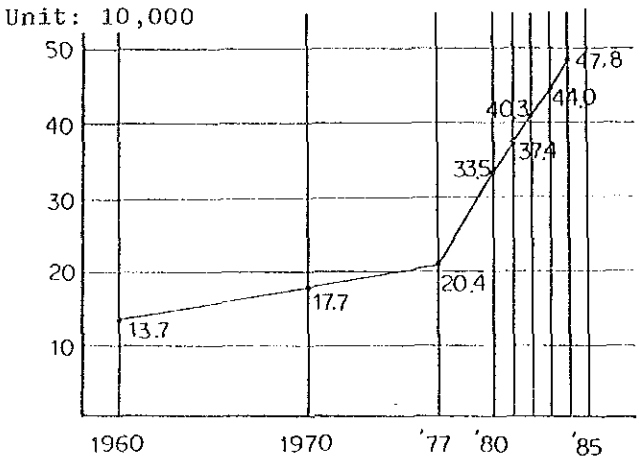
Roads

The road network of Sri Lanka covers the country from coast to coast and the total length of government roads is roughly 25,000 km with nearly all of them paved to serve key cities. In addition, the total length of trunk roads and those under the control of local governments reaches 42,000 km and almost all of them allow car traffic regardless of the weather or season.

Vehicle Traffic

As a result of the increase in demand for means of transportation caused by the encouragement of economic activities, the transportation of passengers and cargo by automobiles grew dramatically. After the decontrol of car imports in 1977, car imports rose sharply and the number of car registrations has increased accordingly.

No. of Vehicle Registrations



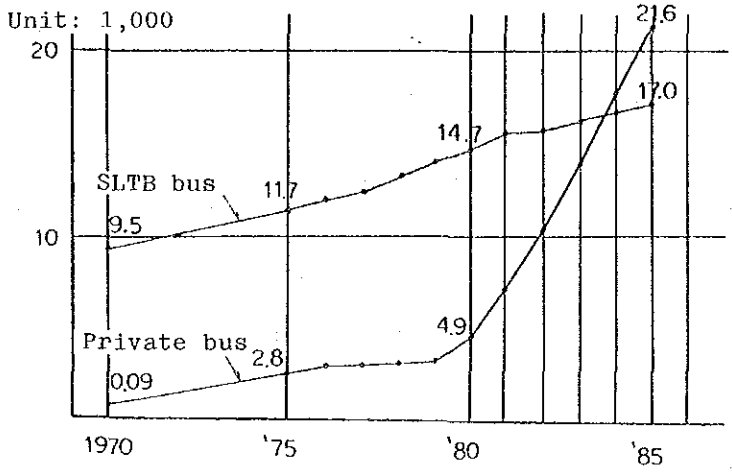
1984	
Passenger car	142,000 units
Bus	35,000
Truck	91,000
Motorcycle	139,000
Others	71,000
Total	478,000

Source: Department of Motor Traffic

The primary means of passenger transportation by vehicle include passenger cars and buses but the general public mainly depends on buses and the growth of bus networks has been sharp in recent years.

Bus transportation is provided by both the Sri Lnaka Transport Board (SLTB), a public corporation controlled by the Ministry of Transport and private operators. Operations of the latter have been growing sharply since 1980 to complement the SLTB bus network. The toral length of routes operated by both the former and the latter is about 60,000 km and the distance covered by operational service is roughly 400 mil. bus-km/year. A billion passengers are carried annually. While SLTB primarily uses large buses made by Ashok Leyland of India, private bus companies depend chiefly on Japanese microbuses made by Toyota, Mitsubishi, Nissan and Isuzu.

No. of Bus Registrations



Source: Based on SLTB data and Dept. of Motor Traffic materials

As for cargo transportation, private truck services can be cited. Like buses, the number of trucks is growing sharply pace with the expansion of the Sri Lankan economy and at the end of 1984, the number of truck registrations reached roughly 91,000.

Passenger cars have also exhibited the same tendency. An authentic age of motorization started in Sri Lanka during the 1980s and the proportion of vehicle transportation is expected to keep rising for some years.

2-3 VEHICLE CONDITIONS

2-3-1 Motor Vehicle Imports

No vehicles are manufactured in Sri Lanka at all and so vehicles and their spare parts are all imported with more than 80% of such imports coming from Japan. The demand for used cars is strong because of their low cost and the number imported is as much as 4 times that of new vehicles.

Japanese Vehicle Exports to Sri Lanka (1984)

	New Vehicles (units)	Used Vehicles (units)	Total (units)
Passenger Car	753	2,008	2,761
Van, Wagon	503	4,815	5,318
Truck, Bus	768	2,948	3,716
Large Truck/Bus	193	2,127	2,320
Others	667	78	745
Total	2,884	11,976	14,860

Source: Japan Auto Appraisal Institute

Imports from Japan cover nearly all types of vehicles from lightweight vehicles to large buses and trucks, and spare parts for them are also imported in large quantities. Exports to Sri Lanka by various manufacturers are as listed below:

Actual New Vehicle Exports to Sri Lanka by Manufacturers

	1982	1983	1984	1985	1986	Average
Toyota	481	438	294	362	395	394
Nissan	615	551	844	919	515	689
Mazda	147	122	141	81	164	131
Mitsubishi	587	462	699	1,575	670	800
Isuzu	203	538	634	551	652	516
Daihatsu	114	93	144	255	103	142
Honda	10	11	67	454	40	116
Fuji Juko	22	14	8	11	18	15
Nissan Diesel	31	22	10	6	50	24
Hino	6	20	8	18	11	13
Suzuki	24	74	35	71	38	48
Total	2,240	2,345	2,884	4,303	2,656	2,886

Source: Japan Automobile Manufacturers Association Inc.

Besides Japanese vehicles, many European cars made by Daimler Benz (West Germany), Pugeot (France), Ford (U.K.), etc. are also imported.

Actual Sri Lankan Vehicle Imports from Countries Other Than Japan

	1982	1983	1984	1985	1986	Average
Great Britain						
Ford	24	122	73	84	86	
Morris	25	11	2	8	2	
Others	17	8	8	11	6	
Subtotal	66	141	83	103	94	97.4
France						
Pugeot	65	102	85	88	92	
Renault	31	26	21	33	13	
Subtotal	96	128	106	121	105	111

West Germany						
Daimler Benz	76	84	62	91	127	
Volkswagen	39	23	10	11	12	
Others	2	4	4	4	4	
Subtotal	117	111	76	106	143	111
Italy						
Fiat	23	18	6	22	53	
Others	5	3	-	-	3	
Subtotal	28	21	6	22	56	28.6
South Korea						
Hyundai	-	-	-	-	173	34.6
USA						
-	29	48	50	33	17	35.4
Sweden						
Volvo	2	12	6	38	25	16.6
Others (1)	53	47	14	9	22	29.0
Total	391	508	341	432	645	463

Note: (1) indicates India, Rumania, Soviet Union, Austria, etc.

Source: Data of United Motors

2-3-2 Car Repair Conditions

Auto repair shops in Sri Lanka can be roughly divided into two groups, large-scale repair facilities operated by importer-distributors and medium and small repair shops run by independent operators.

In the capital Colombo, such repair facilities operated by importer-distributors include the following:

a) United Motors -------- A public corporation belonging to the Ministry of Industries & Scientific Affairs, also the importer-distributor of Mitsubishi Motors, is also in possession of three repair facilities in Colombo and its vicinity to repair Mitsubishi cars.
Total employees: 390

b) Associated Motorways - The dealer of Nissan and Honda cars, has full-scale repair facilities in the city and its vicinity to repair Nissan and Honda cars.

c) Diesel & Motor Eng. -- The dealer of Daimler Benz and Subaru (Fuji Juko) cars, has authorized repair facilities to repair Benz passenger cars and buses, and Subarus. Total employees: 117

d) Car Mart Ltd. -------- The dealer of Pugeot (France), Mazda (Toyo Kogyo), Volkswagen (W. Germany), Audi (W. Germany) and Hino, engages in the repair of the above cars.

e) Freudenburg Industries Ltd. --- The Toyota dealer which also repairs Toyota cars but its scale is limited.

These dealer-affiliated repair facilities have reasonable maintenance equipment and their technical level is considered fairly high for a developing nation partly because of the instruction received from the foreign car manufacturers. The number of these facilities however remains small.

Medium and small independent repair shops are innumerable if those run by individuals are included. As far as the total number of shops is concerned, these small shops represent the great majority. They don't posses sufficient knowledge, skill and equipment to repair cars well, only repairing what's specified by car owners, the repair work itself often being sloppy. In the worst case, they reportedly sometimes cause additional trouble or damage.

In addition to these general repair shops, there are specialized facilities that engage in machining to repair parts, sheet metal work, painting and the repair of electrical equipment and diesel engine fuel injection pumps.

In addition, the following can be cited as characteristics of the car repair situation in Sri Lanka:

a) As vehicles are used to the greatest extent possible, the demand for machining including crank-shaft griding and cylinder boring and disassembly/repair of electrical equipment is high.

b) As totally wrecked vehicles are brought to life again, the demand for body-repair and painting is strong.

The importer affiliated repair shops mentioned above do have machines to repair parts but they ask outside specialized shops to do the machining because of the shortage of machinists. Medium and small repair shops follow suit as they are not in possession of the required machines.

Major machining shops total seven across the country and four of them are located in Colombo. Three of the four were surveyed. Each was in full steam operation. Generally, machinists are trained through employment as apprentices and are said to master the handling of their assigned machines within a year and a half to two years after their apprenticeship begins. They cannot be expected, however, to master such advanced techniques as machining that requires accuracy or machining dependent on their own judgement. As each of the machining shops surveyed was badly in need of competent machinists, the demand for graduates from the automobile machinist training school is immense.

This equally applies to general mechanics because skillful mechanics remain in short supply. The demand for graduates from this part of the training center is also considered to be strong. When surveyed, repair shops were asked if they would send their employees to training courses provided by the center. The majority answered in the affirmative. Therefore, the desire for such training courses is also strong.

Though the technical level of dealer-affiliated repair facilities in Sri Lanka is fairly high, the level of the medium and small repair shops that represent the great majority remains low. Also, car owners tend to be reluctant to pay for repair jobs and, in extreme cases, they repair their cars tentatively by themselves and go back on the roads. Therefore, the maintenance condition of many vehicles is extremely unsatisfactory; a car

with a poorly maintained engine runs emitting black smoke another runs askew because of an unbalanced suspension, some have bald tires, others are exceptionally noisy because of the shortage of oil. There are many other examples.

Consequently, many cars stall on the road and trigger traffic congestion. Such a situation invites traffic accidents.

No. of Traffic Accidents Reported to the Police and Other Data

	1980	1981	1982	1983	1984
Total No. of traffic accidents	23,711	24,656	24,002	24,162	24,535
Total No. of deaths	1,105	1,247	1,257	1,365	1,310
Drivers	69	72	57	110	74
Passengers	237	283	287	299	281
Pedestrians	563	581	599	654	633
Pedal cyclists	110	165	176	193	203
Motorcycle riders	114	137	130	115	111
Others	12	9	8	3	8
No. of injured	13,511	13,507	12,565	11,904	11,692

Source: Plice Department

2-4 EDUCATIONAL SYSTEM

In Sri Lanka, a schematic educational system was established in the relatively early days. The Free Education System was introduced in the second half of 1940, and the mother languages, Sinhala and Tamil, were adopted in place of English as the media of education at general education schools commencing with Grade 1 and gradually moving in stages up to Grade 12 in 1967. There has been, however, a concomitant drop in English competency among students and the government has been making efforts to put more emphasis on English education.

The educational system of Sri Lanka can be divided into the following three groups:

a) General education controlled by the Ministry of Education;
b) Higher education controlled by the Ministry of Higher Education; and
c) Vocational education and training controlled by the relevant ministry.

2-4-1 General Education

General education, under the jurisdiction of the Ministry of Education, has been reformed several times in recent years until the present educational system was established. Prior to 1972 the three-tier school system consisted of elementary education (Grades 1-8), junior secondary education (Grades 9-10), and senior secondary education (Grades 11-12). The reforms introduced in 1972 reduced the years of school by one year and restructured the system into primary education (Grades 1-5), junior secondary education (Grades 6-9), and senior secondary education (Grades 10-11).
The period of junior secondary education was increased by one year in 1977, the educational system thus being primary education (Grades 1-5), junior secondary education (Grades 6-10), and senior secondary education (Grades 11-12).

Under the present educational system, general education including that offered by some privately assisted schools is given free of charge. Pupils are admitted to schools at the age of six and all who wish to remain in the school system are allowed to receive primary and junior secondary educations. Entry into the senior secondary cycle, however, is dependent on the level of performance on the G.C.E.(O/L)[1] Examination, which marks the terminal point of the junior secondary cycle. Unlike the previous two cycles,the senior secondary cycle has a curriculum differentiated into subject categories (Arts and Science) leading to the G.C.E, (A/L)[2] Examination. Those who pass the examination are qualified to enter universities or other institutes of higher education.

Note] (1) G.C.E. (O/L): General Certificate of Education, Ordinary Level
(2) G.C.E. (A/L): General Certificate of Education, Advanced Level

10,051 schools provided general education in 1985, among which 9,634 schools were government operated, and some 3.7 million students were studying.

2-4-2 Higher Education

Higher education is under the jurisdiction of the Ministry of Higher Education. With the establishment of the Ministry in 1978, a new Universities Act (No. 16) was promulgated. Under this law, the university system was restructured and the following universities were established.

a) University of Colombo, Sri Lanka
b) University of Sri Jayawardenapura, Sri Lanka
c) University of Kelaniya, Sri Lanka
d) University of Moratuwa, Sri Lanka
e) University of Peradeniya, Sri Lanka
f) University of Jaffna, Sri Lanka

In addition, the Ruhuna University College and the Dumbara Campus of the University of Peradeniya were established thereafter. Currently, therefore, nine universities are being operated and some 18,000 students are studying at them. Admission to universities is open to those who have passed the G.C.E. (A/L). The courses provided by the universities are divided into science courses and art courses, each consisting of the following subjects:

Science courses: Engineering, physical science, medicine, dental surgery, veterinary science, agriculture, biological science, architecture, and applied science.
Art courses: Cultural courses, law, education, commerce, and arts.

2-4-3 Vocational Education

In addition to the above-mentioned educational systems controlled by the Ministry of Education and the Ministry of Higher Education, various types of vocational education are extensively offered by some other ministries. Some of the major educational institutions include the following:

a) Technical education offered by the Ministry of Higher Education
b) NAB[1] and the National Youth Committee operated under the jurisdiction of the Ministry of Youth Affairs & Employment
c) CGTTI[2] operated under the jurisdiction of the Ministry of Transport
d) Foreman Training Center operated under the jurisdiction of the Ministry of Labour
e) Agricultural school affiliated with the Ministry of Agriculture

(1) Technical Education Controlled by the Ministry of Higher Education

The technical education system operated under the control of the Ministry of Higher Education offers a total of eighty courses (excluding short courses offered to other institutions) for a variety of trades according to skill levels. These courses are available at a total of 23 Technical colleges and at the University of Moratuwa, where some 20,000 students are studying. The courses are divided into the following five groups, each with different qualifications for admission and periods of education.

	Course	No. of courses	Fields	Period	Entry qualifications
1	Higher National Diploma Courses (H.N.D.)	2	Accounting, for those engaged in business Commerce	Evening: 4 years Day course: 4 years	G.C.E. (A/L), etc. G.C.E. (A/L), etc.
2	National Diploma Courses (N.D.)	15	Mechanical engineering technology (General), Mechanical engineering technology (Automotive), Electrical engineering technology, Chemical engineering technology, Agriculture, Business studies, etc.	Day course: 2-3 years	G.C.E. (O/L), G.C.E. (A/L), etc. according to the courses
3	National Certificate Courses (N.C.)	18	Business studies, Stenographer, Salesmanship, Civil engineering technology, Mechanical engineering technology, Gem industry, etc.	Day and evening courses: 1-3 years each	G.C.E. (O/L) etc. according to the courses

Note] (1) NAB: National Apprentice Board
(2) CGTTI: Ceylon-German Technical Training Center

	Course	No. of courses	Fields	Period	Entry qualifications
4	National Craft Certificate Courses (N.C.C.)	23	Machine shop practice, Automotive mechanics, Electrical mechanics, carpentry, Radio, etc.	Day and evening courses: 1-3 years	G.C.E. (O/L), Grade 9, etc. according to the courses
5	Short courses	22	Wood carving, Radio, Blacksmith work, Motorcycle and scooter maintenance/ repair, etc.	Part time day course: 3 months - 1 year	Grade 8, grade 9, etc. according to the courses

(2) NAB (National Apprentice Board)

NAB, affiliated with the Ministry of Youth Affairs and Employment, was established in 1971 with the aim of cultivating human resources for various types of trades to meet the needs of industry. It provides some 200 different types of apprenticeship training. The ourses are divided into the following eight levels, each with different qualifications for admission and training periods.

	Course	No. of courses	Fields	Age of admission	Admission qualification
1	Craft apprenticeship	152	Practical training and related instruction in a specific categorized trade are given to those who wish to be employed by factories or plants so as to train skilled craftsmen.	16-20	C.G.E. (O/L), etc.
2	Technician apprenticeship	10	This level of apprenticeship training is reserved for the 3rd year in-plant and/or worksite training of technical students who have completed the two-year study course for the National Diploma.	-	Those who have completed two years of the N.D.
3	Special apprenticeship	10	Special apprenticeship training is given to those who are undergoing apprenticeship training in an industry and/or manufacturing organization but wish to be recruited to supervisory or junior managerial grade.	16-22	G.C.E. (O/L), G.C.E. (A/L), etc.

	Course	No. of Courses	Fields	Age of admission	Addmission qualification
4	Engineering undergraduate apprenticeship	11	This training is given to the undergraduates of Moratuwa or Peradeniya Universities of Sri Lanka while they are students to provide practical training and work orientation.	-	Undergraduates
5	Craft (Situational) apprenticeship	-	This training is given to those who are undergoing apprenticeship training to train them in specific occupational requirements, with the assurance of employment from the employer.	Over 16	Those who have completed Grade 7
6	Artisan apprenticeship	11	This training is aimed at training skilled workers for a limited number of tasks out of the various tasks of a specific trade.	Over 16	Those who have graduated from primary school
7	Sub-technician apprenticeship	1	This training is aimed at providing practical training and theoretical knowledge in labour control and work supervision to develop workers of the foreman level.	16-22	G.C.E. (O/L), etc.
8	Special (situational) apprenticeship	-	Same as (5) above.	-	-

2-5 AUTOMOBILE MECHANIC TRAINING FACILITIES

Except for the programs provided at the engineering departments of universities, instruction and training in the field of automobile engineering are provided through the following organizations:

1) Technical education offered by the Ministry of Higher Education
2) NAB affiliated with the Ministry of Youth Affairs and Employment
3) CGTTI affiliated with the Ministry of Transport

2-5-1 Technical Education System of the Ministry of Higher Education

With regard to the programs related to automobile engineering, the following are available through the Technical Education System offered by the Ministry of Higher Education.

	Course	Certificate	Fields and objectives	Period	Qualifications for admission
1	National Diploma Courses	(1) N.D.T.	Mechanical engineering technology (automobile), Training of middle level engineers	2 years for lectures and 1 year for practical training	16-20 years old, G.C.E. (O/L)
2	National Certificate Courses	(2) N.C.T.	Mechanical engineering technology, Training of middle level engineers for those employed in relevant fields	3 years	17 years old or older G.C.E. (O/L)
3	National Craft Certificate Courses	N.C.C.	Automotive mechanics	2 years	Those 19 years old or under, and those who have completed Grade 9
4	Short Courses	—	Motorcycle and scooter maintenance/repair	1 year, part time	Those 17 years old or under, and who have completed Grade 8
			Maintenance and repair of motor vehicles	6 months, part time	Same as the above
			Owner drivers	6 months, part time	Same as the above

As the Ministry of Higher Education does not have its own facilities where practical training can be conducted, it commits the training to NAB, CGTTI, United Motors, or other private repair shops.

Note] (1) N.D.T.: National Diploma in Technology
(2) N.C.T.: National Certificate in Technology

2-5-2 NAB (National Apprentice Board)

Among the aforementioned courses provided by NAB, the following programs are available as automobile engineering related programs.

	Course	Code No.	Trade	Period	Qualifications for admission
1	Craft Apprenticeship	A-1-11	Automobile Mechanic	4 years	G.C.E. (O/L)
		A-1-12	Automobile Electrician	4 years	"
		A-2-18	Automobile Painter	3 years	Grade 8
		A-2-56	Tinker/Welder	2 years	"
2	Technician Apprenticeship	B-3	Mechanical Engineering (Automotive)	1 year	Completion of 2 years of N.D.T.
3	Special Apprenticeship	C-5	Automobile Engineering	4 years	G.C.E. (A/L)
4	Engineering Undergraduate Apprenticeship	D-1	Mechanical Engineering Undergraduate Apprentice	9 months	Undergraduates

Practical contents of the above programs for example, are as follows:

A-1-11 Automobile Mechanic's Course

1st year: Practical training at repair shops

2nd year: Theoretical instruction at a technical college (6 months)

Practical training at repair shops (6 months)

3rd year: English education (2 weeks)

Practical training at repair shops (11 months)

4th year: Theoretical training at NAB (1 month)

Practical training at repair shops (11 months)

C-5 Automobile Engineering

1st year: Theoretical instruction at TTI[(1)] (6 months)

Practical training at repair shops (6 months)

2nd year: Practical training at repair shops

3rd year: Practical training at repair shops
4th year: Theoretical instruction at TTI(1) (6 months)
Practical training at repair shops (6 months)

For B-3 Mechanical Engineering, NAB provides the practical training of N.D.T., a part of the aforementioned technical education system controlled by the Ministry of Higher Education.

Since NAB does not have its own facilities, it also commits practical training to the CGTTI, United Motors, or private repair shops.

2-5-3 CGTTI (Ceylon-German Technical Training Institute)

The CGTTI, affiliated with the Ministry of Transport, was established in 1959 under a technical assistance agreement concluded with the Federal Republic of Germany with the objective of training the skilled mechanics required for the Sri Lanka Transport Board (SLTB). After the completion of a new building in 1974, the management of the Institute was handed over to Sri Lankans in 1976, having been managed by Germans up to that time. The Institute is now completely under the operation of Sri Lankan staff members.

The training period at the Institute is four years. Trainees undergo a basic training course in the 1st year and then take one of the specialized training courses from the 2nd year. The following are the six specialized training courses. Painter training courses are not available.

1. Automobile mechanic training course
2. Machinist training course (general)
3. Welder training course
4. Tinker training course (vehicle sheet metal work)
5. Electrician training course (maintenance)
6. Electrician training course (automotive)

Note] (1) TTI: Technical Training Institute, Katunayaka

For each course, students receive practical training at the SLTB repair shop in the 4th year. In addition to the above courses, the following courses are available for those who have been engaged in actual work:

7. Vocational training course (Top level engineers such as the instructors at NAB)
8. Special courses (8 months, for formen and instructors)
9. Part-time courses (evening and weekend courses for 3 to 6 months)

The number of trainees enrolled in the full-time courses 1 to 6 mentioned above are as follows:

Year		Number of students
1960	:	60
1961	:	100
1978	:	175
1980	:	200
1987	:	275

Although the CGTTI had admitted only male trainees, it began to receive female trainees beginning two years ago. For admission, those who have passed the GCE (A/L) can apply. Admission tests must be taken by all the applicants who have amounted to 3,000 from all over the country.
No tuition is asked of the trainees admitted to the daytime (full-time) courses 1 to 6 mentioned above. For the part-time courses, tuition of 300 to 400 Rs/month is asked of each trainee.

The facilities of the CGTTI have all the necessary equipment for sufficient practical training such as machine tools and measuring instruments. Most of the training materials used at the Institute are made in West Germany. The training staff consists of 143 Sri Lankan personnel and they are sometimes dispatched to West Germany for training. Short-time seminars are also held by West German personnel.

The organization of the teaching staff is as follows:

Lectures

↓

Training engineers

↓

Senior instructors

↓

Junior instructors

↓

Senior demonstrators

↓

Junior demonstrators

Lectures are given by lectures. Practical training is given by instructors with the assistance of demonstrators and assistant demonstrators, at a ratio of one instructor to 12 trainees on a rotating basis. Instruction and training provided at the Institute focus on large-size buses.

With regard to operational expenses, the CGTTI receives a government subsidy of 300 Rs/month/daytime trainee. Except for the government subsidy, the CGTTI subcontracts bus repair work from the SLTB to obtain the revenue for its operational expenses.

Some graduates of the CGTTI are employed by the SLTB, some are employed by repair shops, and some go overseas to work.

Summary of CGTTI's Training Courses

Course	General Basic Training Course (I)	Basic Training Course in Allied Trade (II)	Automobile Mechanic Training Course	Machinist Training Course (General)	Welder Training Course	Tinker Training Course	Electrician Training Course (Maintenance)	Electrician Training Course (Automotive)
Period	6 months	6 months	4 years	4 years	4 years	4 years	4 years	4 years
Contents	Acquisition of basic knowledge [Lathing, welding, electricity, machining in general (cutting, chipping drilling, screwing, etc.)]	Training for desired trade [Machining (grinding, lathing, shaping, etc.) welding, soldering, etc.]	1st year Basic training I and II 2nd year Acquisition of a basic knowledge of automobile components [Training using model bus engines, bus chassis, etc.] Theoretical instruction on the above subjects	1st year Same as the left 2nd year Training in the operation of different kinds of tools [Calipers, micrometers, lathes, milling machines, shaping machines, grinders] Theoretical instruction on the above	1st year Same as the left 2nd year Training in gas welding, arc welding Theoretical instruction on the above	1st year Same as the left 2nd year Training in soldering, gas welding, gas cutting, spot welding, tinkering Theoretical instruction on the above	1st year Same as the left 2nd year Basic training [Wiring of switches, relays, contactors, etc.] Theoretical instruction on the above	1st year Same as the left 2nd year General training on models of engines and chassis General study of the auto-electrical units in vehicles.
			3rd year Same as the above	3rd year On-the-job training for the above	3rd year On-the-job training [Forging, welding of engine parts, manufacture of cylinder blocks and engine heads, etc.]	3rd year On-the-job training in repair of automobile bodies	3rd year On-the-job training for various types of electrical equipment	3rd year Specialized study on auto-electrical units
			4th year On-the-job training at the SLTB's repair shop	4th year Same as the left	4th year Same as the left	4th year Same as the left	4th year Same as the left	4th year Same as the left

2-5-4 Position of the National Training Center for Automobile Engineering

As mentioned earlier, the educational facilities related to automobile engineering available in Sri Lanka at present are:

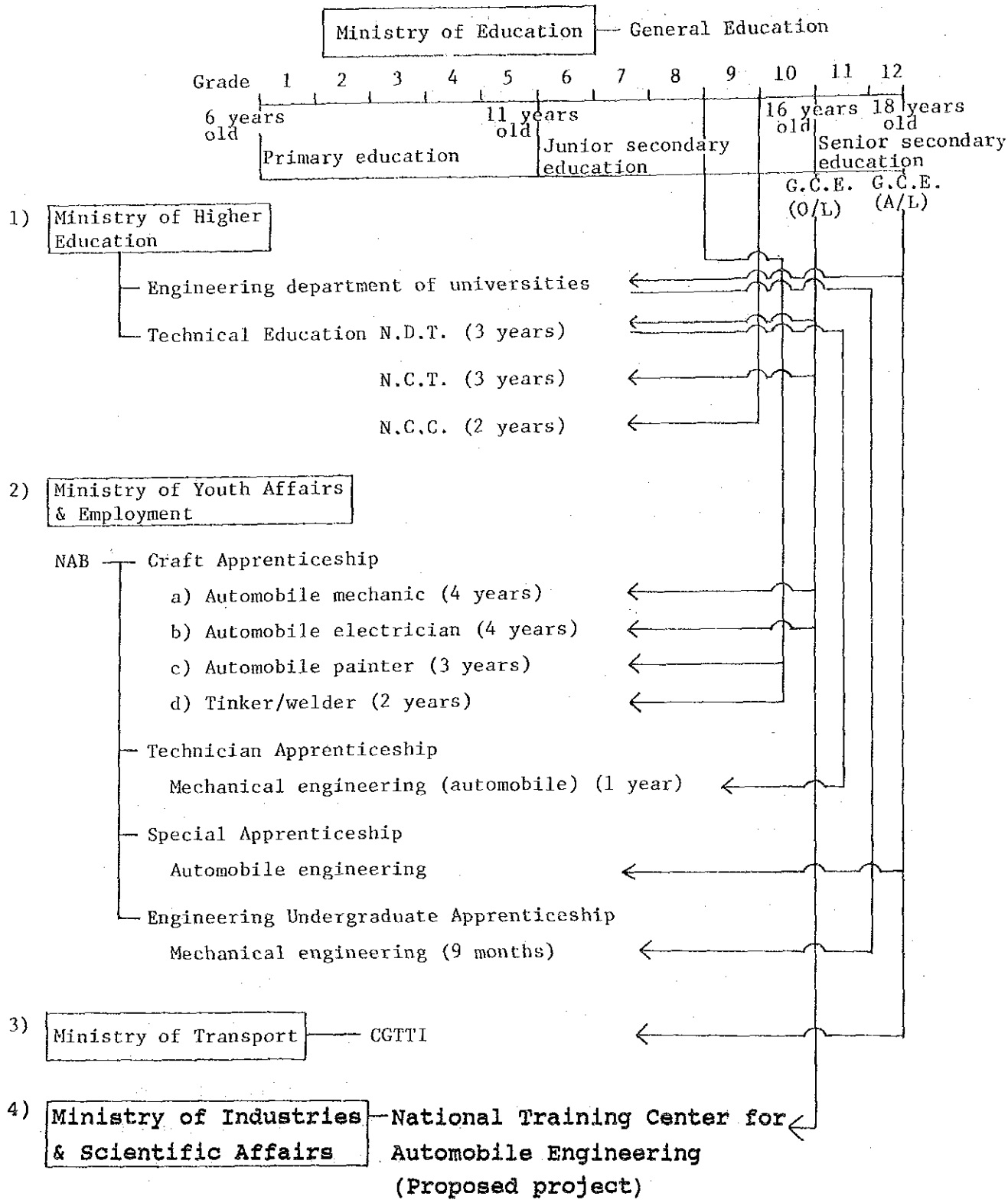
a) University engineering departments;
b) Technical education controlled by the Ministry of Higher Education;
c) NAB affiliated with the Ministry of Youth Affairs and Employment; and
d) CGTTI affiliated with the Ministry of Transport.

Among these, only the CGTTI is fully equipped with the facilities and equipment necessary for practical training. The Ministry of Higher Education commits the practical training of those admitted to technical education courses to the NAB. However, as the NAB has no facilities where practical training can be conducted, it also commits practical training to private repair shops, the CGTTI, or United Motors, a public corporation affiliated with the Ministry of Industries & Scientific Affairs.

The on-the-job training at actual repair shops, however, is not based on consistent training policies, and therefore it is hard to say whether it produces sound effects as an educational system.

The CGTTI, on the other hand, provides integrated training using well-established systematic facilities. However, the CGTTI focuses mainly on training for engineering work related to large-scale buses and does not provide adequate training for mechanics specializing in the repair of passenger cars, which amount to more than half of all the vehicles in Sri Lanka. It is, therefore, urgent to establish an automobile mechanic training center by using passenger cars as the training objects.

The proposed training center will be operated under the control of the Ministry of Industries & Scientific Affairs. The figure below shows the positioning of the proposed training center in relation to the existing educational institutes.


Ministry of Education
General Education
Grade 1 2 3 4 5 6 7 8 9 10 11 12
6 years old
11 years old
16 years old
18 years old
Primary education
Junior secondary education
Senior secondary education
G.C.E. (O/L)
G.C.E. (A/L)
1) Ministry of Higher Education
Engineering department of universities
Technical Education N.D.T. (3 years)
N.C.T. (3 years)
N.C.C. (2 years)
2) Ministry of Youth Affairs & Employment
NAB
Craft Apprenticeship
a) Automobile mechanic (4 years)
b) Automobile electrician (4 years)
c) Automobile painter (3 years)
d) Tinker/welder (2 years)
Technician Apprenticeship
Mechanical engineering (automobile) (1 year)
Special Apprenticeship
Automobile engineering
Engineering Undergraduate Apprenticeship
Mechanical engineering (9 months)
3) Ministry of Transport
CGTTI
4) Ministry of Industries & Scientific Affairs
National Training Center for Automobile Engineering
(Proposed project)

2-6 BACKGROUND AND CONTENTS OF REQUEST

2-6-1 Background of Request

With the arrival of the 1980s, car imports in Sri Lanka have risen sharply and an era of motorization has begun with roughly 480,000 motor vehicle registrations by the end of 1985. The CGTTI mentioned earlier is however the only fully-equipped vehicle mechanic training school and is primarily designed to handle buses. In addition, as recently developed cars incorporate new materials and new technology including electronics, the technical level of Sri Lankan automobile mechanics tends to fall behind such new advances making the car repair situation of the country rather chaotic.

Moreover, employment conditions in Sri Lanka are not good because of its slumping economy and many go abroad to find jobs; some 100,000 young workers are estimated to have gone to the Middle East, etc. to work. Therefore, developing young men with dependable automotive repair techniques is a national policy and the statement of the request cities the fostering of engineers for foreign markets as one of its objectives.

2-6-2 Contents of Request

The contents of the request made by the Government of Sri Lanka are as follows:

1) Objectives

(a) To train automobile mechanics capable of handling new technology within a short spell of time in order to contribute to the improvement of the automobile repair industry in Sri Lanka.

(b) To provide the young with employment opportunities abroad through training sessions in this center.

2) Training Schedule

(a) Ordinary Training Course

Period	: 1 year
No. of Trainees	: 60 to 75
No. of Classes	: 3
Qualification for Entry	: Holders of G.C.E. (O/L)

(b) Special training course

Period	: 3 to 6 months
No. of Trainees	: 25
No. of Classes	: 1
Qualification for Entry	: Those already employed, irrespective of school background and age

3) Training Curriculum

Training consists of lectures and practical exercises and is designed to be sufficiently comprehensible and assisted by audio-visual facilities. The subjects are as follows:

(a) Measurement: How to use a micrometer, cylinder gauge, dial gauge, torque wrench, volt/ampere meter, circuit tester, tire gauge, etc.

(b) Inspection: How to use a wheel-alignment tester, side-slip tester, brake tester, headlight tester, speedmeter tester, dynamometer, injection pump tester, generator starter test bench, wheel balancer, etc.

(c) Gasoline Engine: Basic theories, structures, mechanisms, repairing, etc.

(d) Diesel Engine : Ditto

(e) Chassis : Ditto

(f) Engine electrical equipment : Basic theories, structures, mechanisms and repairing methods for starter motors, ignition system, etc.

(g) Chassis electrical equipment : Basic theories, structures, mechanisms and repairing methods of lighting system, wiper motors, radios, car stereos and meters.

(h) Machining : How to use a cylinder boring machine, cylinder honing machine, crankshaft grinder, surface grinder, lathe, brake drum lathe, shaping machine, milling machine, etc.

(i) Body repair : Simple metal work, welding and tinkering

(j) Painting : Painting techniques

(k) Others : How to use a tire changer, parts washing machine, tune-up tester and auto-lift.

(l) Physical training : Health and physical training

4) Facilities

The requested facilities are as follows:

(a) Training shop	:	2,254 m^2
(b) Canteen	:	306 m^2
(c) Guard house	:	30 m^2
(d) Generator house and sub station	:	60 m^2
(e) 25 students one storey building	:	592 m^2

CHAPTER 3. OUTLINE OF PROJECT

CHAPTER 3. OUTLINE OF PROJECT

3-1 OBJECTIVES

The training center, different from other existing training schools in Sri Lanka, is positioned as a national project. The training center will receive trainees who have passed G.C.E. (O/L)(1). The trainees will be given systematic instruction in the maintenance and repair of passenger cars and medium-sized buses and trucks with emphasis placed on practical training by using the authentic training facilities provided at the center. One of the primary objectives of this center is to train young people and send them out as competent maintenance workers to Sri Lanka's automobile repair industry. In addition, to further aid the mechanics and to meet the requirements of the automobile industry, evening courses will be provided which systematically re-educate mechanics who are under apprenticeship at private repair shops. The aim is to polish the skills of mechanics already employed by repair shops.

It is expected that the mechanics who have received a systematic education at the center will disseminate correct knowledge when they enter the car repair industry, which will lead to improvement in the level of automobile mechanics. Moreover, positive effects such as improvements in the operating rate of automobiles and reduction in traffic accidents are also expected.

3-2 REVIEW OF REQUEST

Prior to this survey, the Government of Japan sent a preliminary study team to Sri Lanka in February 1987 to confirm the contents of their request and then made recommendations based on the survey results. Following the preliminary survey results, this basic design study team conducted a field survey, and compiled this basic design based on the discussions with the Sri Lankan side.

Note: (1) General Certificate of Education, Ordinary Level

3-2-1 Training Courses

Based on the request made by the Government of Sri Lanka and their survey results, the preliminary study team has made the following recommendations to foster automobile mechanics coresponding to class-3 mechanics in Japan using passenger cars, middle size buses and trucks as the training materials, since the existing training school, CGTTI is carrying out training on large buses.

Proposals made by the preliminary study team

(a) General Training Course

No. of Trainees	: 100
No. of Classes	: 4, 25 trainees each
Training period	: 1 year
Age at Entry	: 15 to 16 years old
Technical Level	: Equivalent to Class-3 mechanics in Japan
Training Curriculum	: To add machining, tinkering and painting training to the Japanese Class-3 mechanic training curriculum

(b) Training Course for the Experienced

No. of Trainees	: 25
No. of Classes	: 1
Training period	: 3 to 6 months
Age at Entry	: Before 35

G.C.E. (O/L) graduates slated as trainees of the general training course are equivalent to Japanese middle school graduates and, in view of their scholastic level, it is very reasonable to aim at developing mechanics with capabilities equivalent to those of Class-3 mechanics in Japan. As for the number of trainees, a maximum of 100 trainees is also considered reasonable as CGTTI is sending out roughly 250 graduates every year and the car repair industry is not yet ready to receive many new entrants. In addition, the organization to operate this training center and financial conditions should be taken into account when deciding the number of trainees.

The addition of training in machining, tinkering and painting to the curriculum is also reasonable because in Sri Lanks, the demand for rebuilding of parts is strong and the frequency of repairing damaged cars is also high.

The need for the course for the experienced is also sizable as mechanics in Sri Lanka are mostly trained as apprentices and few mechanics are in possession of more than a basic knowledge of car repair.

Based on the proposals made by the preliminary study team, the basic design study team held discussions with the Sri Lankan government officials, reviwed the discussion results, and established the following training courses.

(a) Training materials : Passenger cars and small/medium size buses and trucks

(b) Training courses

(1) Automobile mechanic training course
No. of trainees: 3 classes x 20 = 60
Training period: A year and a half

(2) Automobile electrician training course
No. of trainees: 1 class x 25 = 25
Training period: A year and a half

(3) Automobile machinist training course
No. of trainees: 1 class x 15 = 15
Training period: A year and a half

100 trainees

(4) Automobile mechanic training course for semi-skilled
No. of trainees: 1 class x 20 = 20
Training period: Around 6 months

The training courses for automobile mechanics, automobile electricians and machinists were established separately as these job categories are clearly separated in Sri Lanka and the capacity of each course was determined in

view of the demand in each job category. The training programs are designed, however, so that the trainees in each course study the basics of the other courses with the view of developing graduates who have a broad vision of the car repair technical details needed in each particular field. In addition a course length of a year and a half was selected in consideration of the quality of trainees and the efficiency of training in Sri Lanka.

The training course for the semi-skilled under (4) was introduced as a short evening course since the further training of automobile mechanics already under employment is urgently needed. As this training course is during the evening, the facilities of the automobile mechanic training course under (1) can be used.

3-2-2 Training Curriculum

The training curriculum requested by Sri Lanka consisted of the 11 subjects of measurement, inspection, gasoline engines, diesel engines, chassis, engine electrical equipment, chassis electrical equipment, machining, body repair, painting and miscellaneous.

Based on this request, the preliminary study team added machining, body repair and painting to the Class-3 automobile mechanic training curriculum of Japan and reinforced it with training for air conditioner repair as demand for such repair work is strong in tropical Sri Lanka. Finally, the team proposed a 1,400-hour curriculum.

Based on the proposal, the basic design study team held discussions with the Sri Lankan side on them and, after the discussion results were reviewed, the following training curriculum was established within a scope appropriate for the basic design.

Details of the evening course under (4) can hardly be finalized at this point of time as the technical levels, service years, etc. of the prospective trainees are not uniform and a further review was requested of the Sri Lanka side later.

1) Automobile mechanic training course

(a) Theory (420 hours) -------- Automobile engineering

Structure of engines and chassis, structure of electrical components, theory and structural outline of air-conditioning, concept of maintenance, safety engineering, etc.

(b) Practice (1,680 hours) --- Manual work

Filing, soldering, welding, etc.

--- Machining

Re-machining of parts using basic machines such as lathes and valve refacers.

--- Measurement

Measurement of dimensions, measurement of voltage, amperes, resistance, etc., and measurement of engine horsepower.

--- Assembly/disassembly of engines

Actual assembly and disassembly of gasoline and diesel engines, guidance outlining engine structures, function, and mechanical services.

--- Assembly/disassembly of chassis

Actual assembly and disassembly of chassis parts, guidance outlining chassis structures, functions, and mechanical services.

--- Electricity and electronics

Guidance outlining electrical and electronics components.

2) Automobile electrician training course

(a) Theory (800 hours) -------- Automobile engineering (Same as that of the automobile mechanic training course)

-------- Repair and maintenance (Same as above)

------- Basic theory of electricity and electronics
Outline of theory of DC and AC, the three motions of electric current, principles of semiconductors, etc.

------- General study of electrical components
Instruction in the basics of all components including batteries, alternators, starters, regulators, etc.

------- Radios and cassette players
Explanation of circuits and structures.

------- Air-conditioning
Explanation of principles and structures.

(b) Practice (1,300 hours) --- Automobile electrical components
Disassembly, assembly, and adjustment of electrical components explained in the theory course.

--- Radios, car stereos, clocks
Disassembly and assembly.

--- Air-conditioning units
Disassembly, assembly, gas filling, and measurement of capacity.

--- Machining of electrical components
Re-machining of commutators (by mica cutter).

--- Rewinding of armatures
Rewinding practice for alternators and starter coils.

--- Manual work
(Same as that of the automobile mechanic training course.)

--- Disassembly/assembly of engines
(Same as above except for passenger cars.)

--- Disassembly/assembly of chassis
(Same as above.)

3) Automobile machinist training course

(a) Theory (700 hours) ------- Automobile engineering
(Same as that of the automobile mechanic training course.)

------- Repair and maintenance
(Same as above.)

------- Structures and functions of machines
General explanation of machines such as lathes, brake drum lathes, surface grinders, boring machines, honing machines, etc.

------- Basics of metallography
Explanation of the characteristics and purpose of materials.

------- Simple theory of metal cutting
Explanation of cutting speed, volume, oil, cutting theory, sharpening of cutting tools, etc.

(b) Practice (1,400 hours) --- Measurement devices (structure and handling methods)
Verniers, inner diameter micrometers, outer diameter micrometers, dial guages, cylinder guages, etc.

--- Operation and maintenance of machines
Explanation of handling, daily inspection, and places that need oiling of machines explained in the theory.

--- Welding and soldering
Technique required for connection of electrical parts, included in manual work.

--- Machining
Actual training in machining including regrinding of crankshafts (crankshaft grinder), grinding of cylinder inner diameters (boring machine and honing machine).

--- Disassembly/assembly of engines and chassis
(Same as that of the automobile electrician training course.)
--- Electrical components and electronic parts
(Same as that of the automobile mechanic training course.)

3-2-3 Facilities

The preliminary study team proposed the following facilities after discussions with the officials concerned of the Government of Sri Lanka and a background survey.

(1) Administration office and guard room
(2) Training building
  (a) Vehicle inspection line before/after repair
  (b) General repair training shop
  (c) Engine overhaul/component repair training shop
  (d) Car washing/oil supply yard
  (e) Tire service yard
  (f) Practice room (Engine dynamometer, injection pump tester, electric parts tester)
(3) Classrooms
(4) Actual car repair shop
(5) Warehouse (materials, tools, expendable items)
(6) Emergency generator
(7) Canteen and other facilities (recreation room, infirmary, toilet, locker rooms)
(8) Test course

Based on the above facilities plan, this basic design study team has planned the following facilities which are necessary and sufficient for the implementation of the above training courses and curriculum.

(1) Administration/ Classroom Bldg. : Rooms for the administration division, training staff room, classrooms, etc.

(2) Training Bldg. No.1 : General repair training room, parts washing training room, tire maintenance training room, electrical equipment training room, battery room, oil storage, tool room, storage and classrooms.

(3) Training Bldg. No.2 : Machinist training room, component repair training room, manual work training room, body repair training room, painting training room, engine dynamo-measuring training room, brake power booster testing training room, injection pump training room, storage, tool room and classrooms.

(4) Car washing/inspection training building

(5) Shower/toilet building

(6) Training-use car garage

(7) Canteen

(8) Guard house

(9) Substation : Emergency generator and cubicle

(10) Personal car garage

(11) Water supply system/drainage system, etc.

Of the facilities the preliminary study team had proposed, this basic design study team dropped the following after review:

Actual car repair shop : The plan for this shop was to give trainees experience by using damaged cars for which repair orders were to be taken from outside, with repair fees earned being used for operation costs. Though the same thing is done at CGTTI and its usefulness is understandable, it was excluded as adjustments to the training schedule can hardly be made and as it was judged unsuitable for short-term training of a year and a half.

Test course : This was a proposed test course for trainees to confirm the results of their repair work by driving the car in question. As high speeds are not required and the driving is not frequently done, confirmation can be made around the training buildings. Therefore, it was decided not to provide an independent test course.

3-2-4 Equipment for Training

In this basic design, too, it was decided to introduce the necessary sufficient equipment for the implementation of the training curriculum mentioned in 3-2-2. The outline of this equipment will be covered in 3-3-4, Basic Design.

3-3 OUTLINE OF PROJECT

3-3-1 Organization of Implementation and Operation of Project

The Ministry of Industries & Scientific Affairs is responsible for the implementation and management of this project.

1) Ministry of Industries and Scientific Affairs

The administration of the Government of Sri Lanka is handled by 48 ministries including the Ministry of Higher Education, the Ministry of Youth Affairs & Employment, the Ministry of Transport, etc. and their responsibilities are clearly delineated. The Ministry of Industries & Scientific Affairs is responsible for administration related with industry and science and also has a variety of research organization under its aegis. In addition, it controls many public corporations and develops various production activities.

The minister controls his administrative division consisting of a deputy minister, a secretary, (4) assistant secretaries, (15) department directors plus the following affiliated organizations.

(1) Sri Lanka Standard Institution
(2) Atomic Energy Authority
(3) Ceylon Institute of Science and Industrial Research
(4) National Engineering Research Development Center of Sri Lanka
(5) Geological Survey Department
(6) Department of Meteorology
(7) National Institute of Business Management
(8) Public Sector Industries

(a) State Mining & Mineral Development Corporation
(b) Ceylon Leather Corporation
(c) National Paper Corporation
(d) Sri Lanka National Salt Corporation
(e) Plywood Corporation
(f) Sri Lanka Tyre Corporation
(g) Paranthan Chemical Corporation
(h) Ceylon Mineral Sands Corporation
(i) State Hardware Corporation
(J) G.O.B.U.(1) Ceylon Oxygen Limited
(k) G.O.B.U. United Motors
(l) Lanka Porcelain Limited

After completion, this training center will become an organization that belongs to the Ministry of Industries and Scientific Affairs.

Note: (1) G.O.B.U.: Government Operated Business Undertaking

2) United Motors

The operation costs of this training center will be assumed by United Motors, one of the public corporations that belong to the Ministry of Industries & Scientific Affairs referred to earlier.

United Motors engages in the importing, marketing and repair of automobiles and spare parts as a public corporation belonging to the Ministry of Industries & Scientific Affairs. This is the biggest of all car distributors and repair shops including those of the private sector and one of several of the public corporations mentioned above that earns an annual profit of roughly 30 million Rupees (1985). Its annual turnover in 1985 was as follows.

Spare parts sales	72,511,639 Rs
Car sales	59,597,655 Rs
Repair shop revenue	32,273,002 Rs
Total	164,382,296 Rs

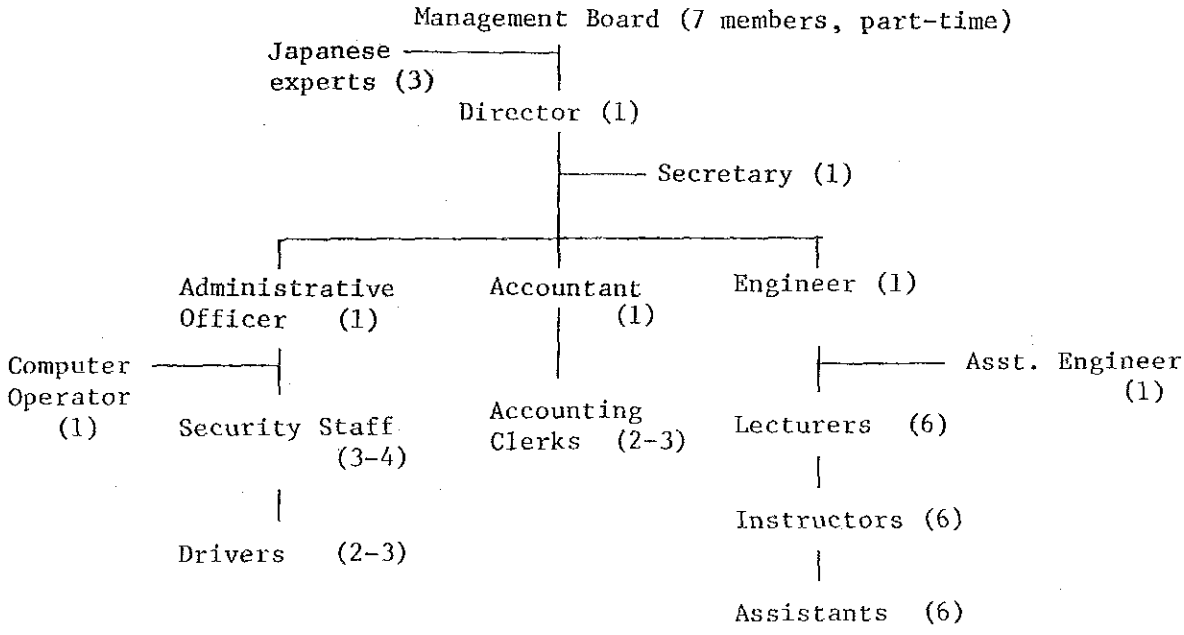
3-3-2 Management System

This training center is to be an organization independent of the technical education system of the Ministry of Higher Education, NAB of the Ministry of Youth Affairs & Employment, and CGTTI belonging to the Ministry of Transport that are related to automobile mechanics training.
Therefore, the Ministry of Industries and Scientific Affairs plans to organize a management board headed by its secretary and consisting of the following members in an attempt to emphasize the center's interrelationship with related organizations and to accommodate the opinions of car repair shops in the private sector.

Management Board

Chairman	Secretary of the Ministry of Industries & Scientific Affairs	(1)	7
Member	Ministry of Higher Education	(1)	
"	Ministry of Youth Affairs & Employment (NAB-related)	(1)	
"	Ministry of Finance and Planning	(1)	
"	United Motors	(1)	
"	Representative of private repair shops	(2)	

The training center is to be managed by the organization shown below under the management policies established by this management board.



In addition, three typists will be employed.

Breakdown of lecturers, instructors and assistants.

	Lecturer	Instructor	Assistant
a) Gasoline/diesel engines	2	2	2
b) Chassis	2	2	2
c) Electricity and electronics	1	1	1
d) Machining	1	1	1

In Sri Lanka, lectures and practical exercises are not conducted by the same person and two teachers are therefore required, with the lecturer ranked higher.

In consideration of this custom, the above organization employs 6 lecturers and 6 instructors of practical exercises. Each instructor will be helped by an assistant.

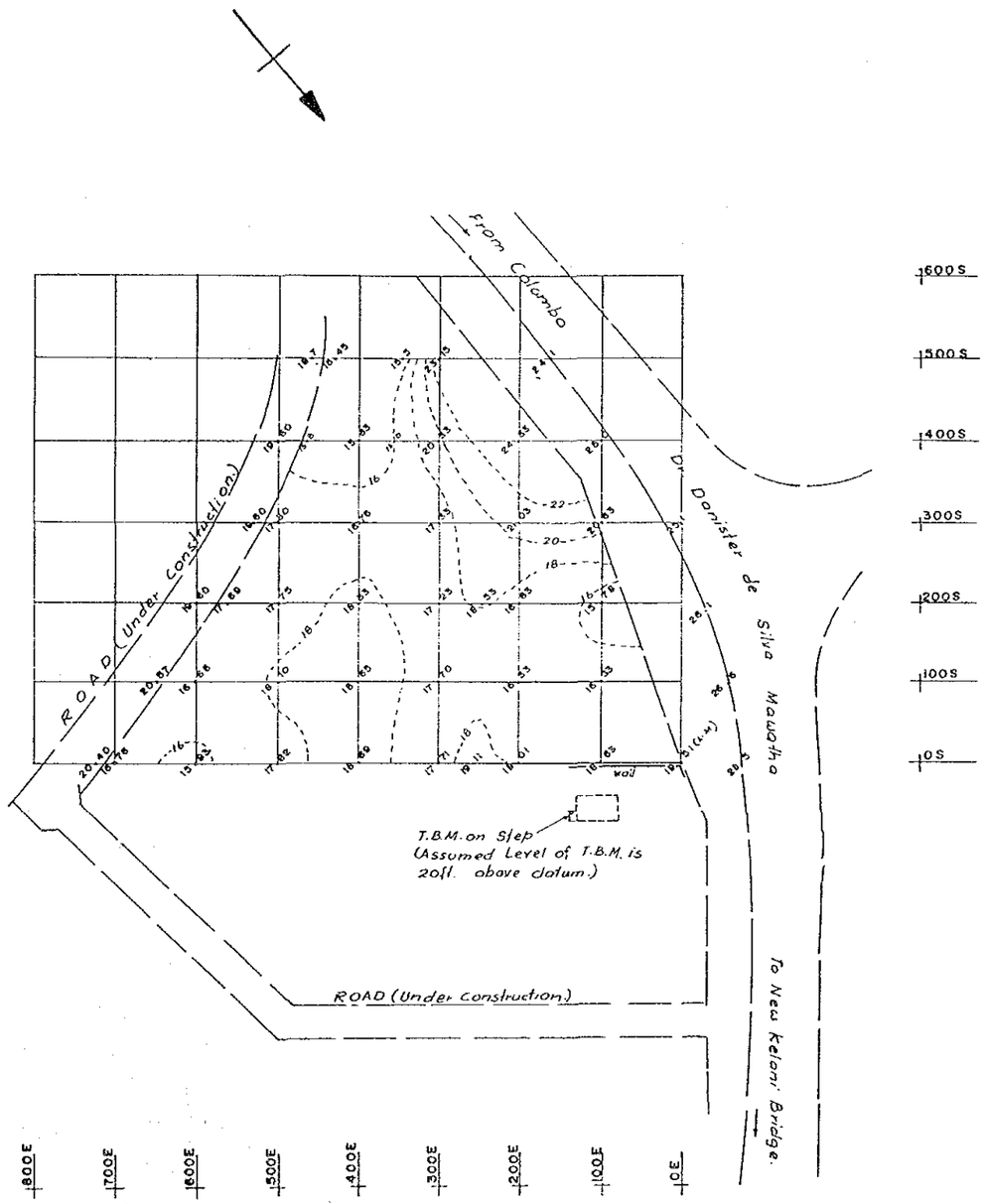
3-3-3 Proposed Site

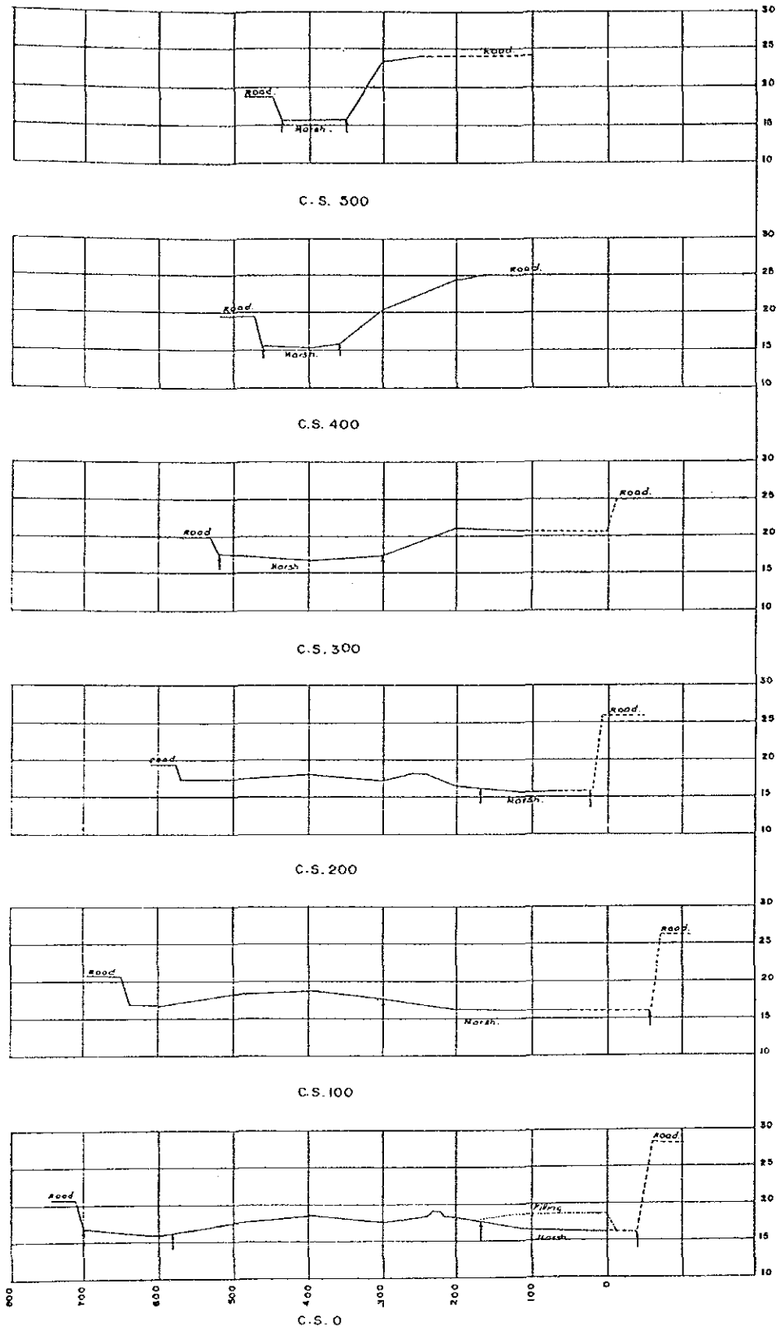
1) Proposed Site

The proposed site is located roughly 5 km NNE of the center of Colombo and is included within the Colombo District. As the west of the proposed site borders on the Baseline Road, a trunk road that leads to the international airport of Colombo and the old capital Kandy via the New Kelani Bridge, access is very easy.

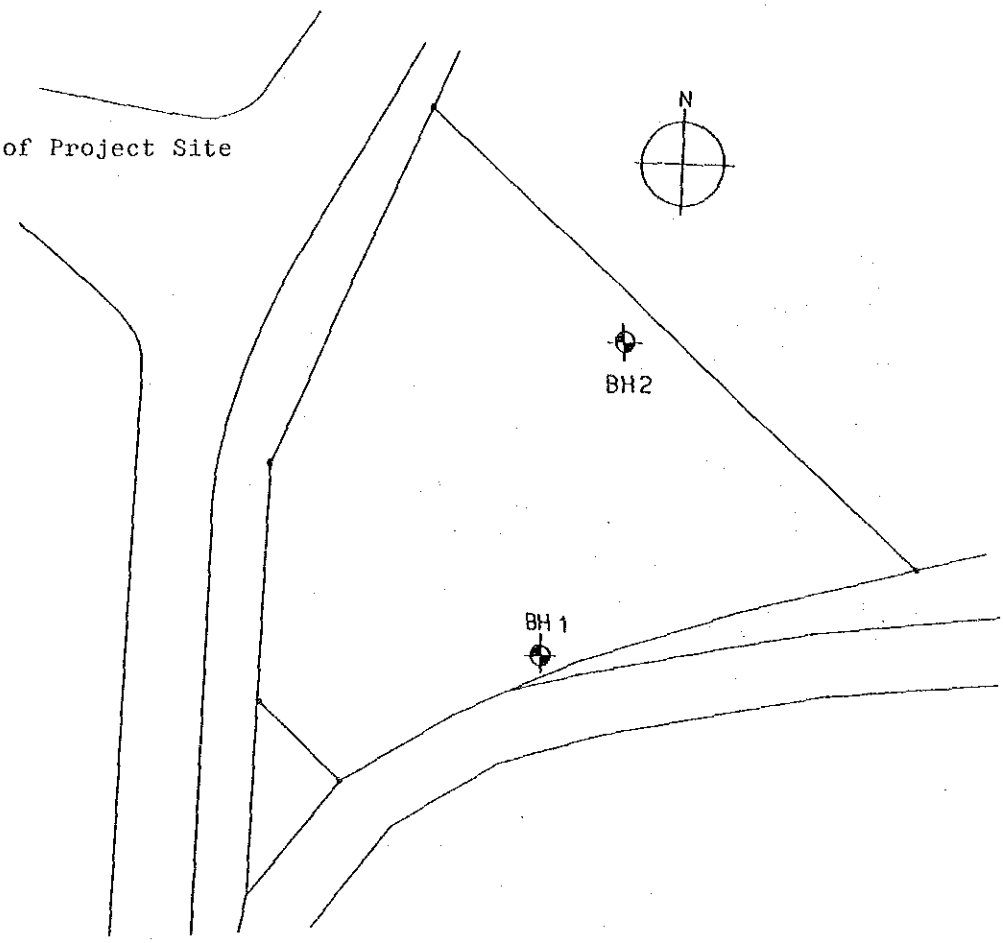
The site covers about 18,000 m^2 and is trapezoidal-shaped with the SW corner being the upper side. The western side faces the trunk Baseline Road and the southern side, faces a (proposed) branch road. The NE base of the trapezoid adjoins the immediate vicinity. The site cannot be reached from the Baseline Road but only from the branch road on the south. This southern branch road is now under construction and will be completed in 1987.

Project Site

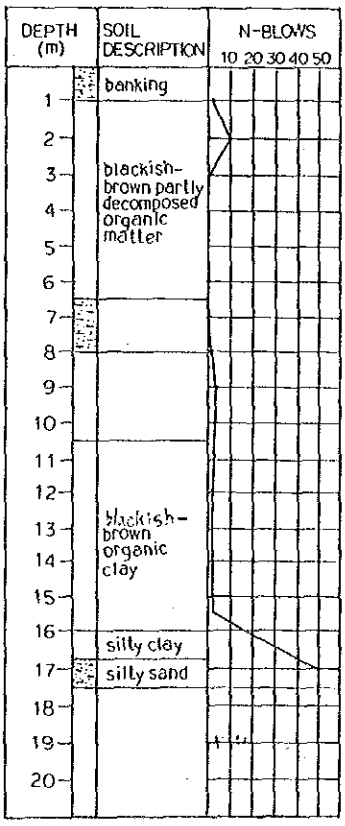




Soil Conditions of Project Site



BH 1



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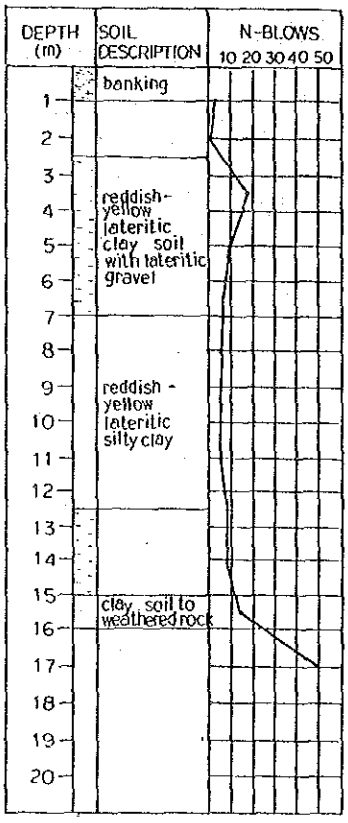


PHOTO OF PROJECT SITE 1

VIEW (A)

VIEW (B)

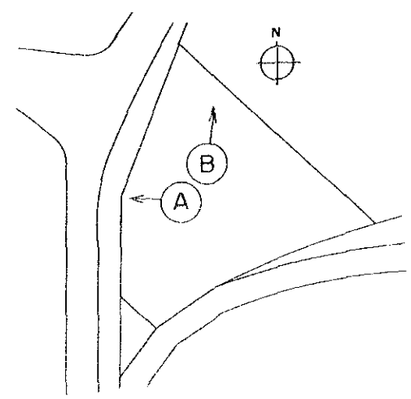
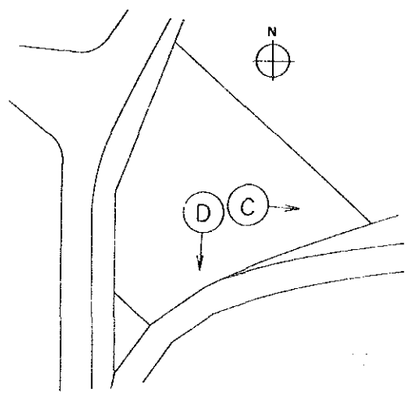


PHOTO OF PROJECT SITE 2

VIEW Ⓒ

VIEW Ⓓ



As the site and its vicinity are in the basin of the Kelani Ganga it is low and marshy and has been submerged repeatedly. The Baseline Road was reclaimed by landfilling and is 2.5 to 3 m higher than the branch road on the south. This branch was also constructed on landfill and construction is now under way but landfilling has not yet been performed on the site itself. A temporary road for construction of the branch road runs through the site and both sides of the temporary road have been filled to a certain height. The vertex and neighborhood of the trapezoidal shaped site is about 1.5 m lower than the adjacent branch road, the site is marshy.
Therefore, it has to be filled to the same height as the branch road on the south to prevent the site from being submerged during the rainy season. The cost of this landfilling will be assumed by the Government of Sri Lanaka, which will allocate 2 million Rupees for this and complete landfilling before construction of the training center is started by the Japanese side.

This area used to be a marshy area of the basin of the Kerani and the top stratum consists of very weak alluvium with bedrock located 16 to 18 m below ground level. As the top stratum is very soft and weak and is expected to cause settlement, the buildings will be supported by piles driven into the bedrock.

The weak top stratum is expected to cause settlement due to consolidation caused by the load of the filled earth. As a result of analysis of a soil investigation report, the volume of settlement is estimated to be 20 to 30 cm, 50 cm at the maximum. The speed of settlement is predicted to be fairly high and settlement due to consolidation of the site is expected to have been completed by the time construction of this training center is finished. As residual settlement of a certain degree is considered likely, roads on the premises have to be compacted sufficiently and the filled land of the entire site must be levelled before the start of construction of roads on the premises.

2) Infrastructure

(a) Electricity

Though a 400 V power line runs parallel to the trunk Baseline Road, its capacity is only sufficient for small users and it cannot be branched to cover the training center. Special high-voltage cables also run along this trunk road but they are a trunk power line and cannot be used unless a substation is inserted in between. Though branching is technically possible, it would cost a lot to build a power receiving system that steps down a high voltage of 33 kv and, in addition, its maintenance would involve difficult problems. Therefore, power will be drawn from a 11 kv high voltage route located about 1 km east of the site and the cost of lead-in will be assumed by the organizer of this project, the Ministry of Industries & Scientific Affairs.

(b) Water supply

A 4 inch municipal water supply pipe runs along the trunk road and it can be branched to reach the site. It is however necessary to have a water-receiving tank and an elevated water tank to supply water to the various facilities to insure that the volume of water will be sufficient.

(c) Water drainage

No sewers or drainage canals are found in the vicinity and none are scheduled. Therefore, waste water will have to be disposed of by seepage after being purified and diluted with rainwater in a retarding basin, etc.

(d) Telephone

Telephone cables also run along the trunk road and branch lines can be led in from them. According to the telephone exchange of the area, 5 circuits can be secured for the training center.

3-3-4 Basic Design

The necessary sufficient facilities, equipment for implementation of the established training courses and curriculum and the following items required by the training center will be introduced.

1) Administration/Classroom Building, 2 storied 2,232 m^2

Division	Room	Use	Equipment/ to be furnished
Administration	Director's room	Can also serve as a drawing room for several visitors	—
	Secretary's room	"	—
	Reception room	To receive visitors and for management meetings	—
	Office	Administrative activities including general affairs and accounting.	Personal computer for administrative use: 1 Typewriters : 3 (Also used to prepare training textbooks)
	Locker rooms	For administration and training staff members	—
	Reception Area	To receive visitors	—
	Kitchenette	Tea service for visitors and staff members	—
	Storage	—	—
Training	Training staff room	To accommodate staff members	Desks, chairs, book-shelves, etc.
	Outside lecturers' room	To accommodate outside lecturers	Desks, chairs, lockers, etc.
	Meeting room	For training staff meetings and briefings of visitors	Conference tables, chairs, blackboard, etc.

Division	Room	Use	Equipment/ to be furnished
	Classrooms	Five classrooms in all, one for each class for lectures and a homeroom. Two adjoining classrooms thereof will have movable partitions to hold entrance/ graduation ceremonies, etc.	AV equipment, personal tool racks
	Library	To accommodate about 500 books. Free access.	Bookshelves, tables, chairs, etc.
	Printing room	For training materials preparation	A compact printer, book-binder, copy machine, work benches
	Medical room	For first aid only. No doctor on duty	A bed, drug shelves, etc.
	Storage	Training materials storage	—
Common	Hall	—	—
	Corridor/ staircases	—	—
	Toilets	—	—

2) Training Building No. 1 One storied 1,767 m^2

Room	Use	Major equipment/ to be furnished
General repair training room	For training in assembly/disassembly of engines, transmissions, etc. by using real cars and conditioning of engines, brakes, etc.	Auto-lifts, baby cranes, garage jacks, engine tune-up testers, turning radius gauges.
Parts washing training room	For training in car parts washing.	Parts washing stands.
Tire maintenance training room	For training in tire changing and wheel balancing.	Tire changers, wheel balancers.
Electrical equipment training room	For training in starter/generator handling, coil rewinding, discovery of electrical equipment malfunctions.	Generator and starter test benches, armature testers, mica cutters, coil rewinders, work benches
Battery room	For charging batteries used in training and training in actual charging.	Training-use battery chargers.
Classrooms	For briefing on the day's subject before or during practical training.	Folding chairs with writing tables, a blackboard, OHP
Tool room	To store training-use tools.	Tool shelves, a desk for recording, a blackboard.
Oil storage	To store engine/brake oil (in drums)	——
Storage	To store various equipment and training materials.	——
Air compressor room	To house a compressor that supplies compressed air required by various tools.	An air compressor

3) Training Building No. 2, One-storied 2,107 m^2

Room	Use	Major equipment/ to be furnished
Machinist training room	For training in machining necessary for rebuilding parts including cylinders, cylinder heads, crankshafts, etc.	Crankshaft grinders, surface grinders, boring machines, line boring machines, brake drum lathes, brake shoe grinders, valve refacers.
Component repair training room	For training in assembly/disassembly of large components including engines, transmissions, axles, etc.	Engine stands, hydraulic presses, parts washing stands, work benches.
Manual work training room	For training in basic manual work including hammering, filing, chiseling, etc.	Work benches
Welding work training room	For training in welding	Electric/gas welding machines
Body repair training room	For training in body repair, hammering of sheets, etc.	A body repair unit, an auto-lift.
Painting work training room	For training in painting jobs including painting, bake-drying, wet sanding, etc.	A paint booth
Engine dynamo-measuring training room	To enable trainees to measure the performance of engines conditioned themselves and make them capable of judging various conditioning problems.	Hydraulic dynamometers, fuel consumption meters, sound scopes.
Brake power booster testing training room	To enable trainees to discover brake power booster failures and test performance.	Brake power booster testers.
Injection pump training room	For training in adjusting injection volume from the fuel injection pump of diesel engines, rpm, etc.	Injection pump testers, nozzle testers
Classrooms	The same as Training Building No. 1	The same as Training Building No. 1
Tool room	"	"
Material storage	To store training materials of machining work training.	Storage racks

Room	Use	Major equipment/ to be furnished
Paint storage	To store paints, solvents, etc.	Storage racks.
Storage	To store training use components, etc.	"
Air compressor room	The same as Training Bldg. No.1	The same as Training Bldg. No.1

4) Car Washing and Inspection Training Building, one storied 244 m^2

Room	Use	Major equipment to be furnished
Car washing yard	For training in car washing prior to repair.	High pressure car washing machines.
Inspection training room	For training in acceptance/ completion inspection	A brake tester, a speedmeter tester, side-slip tester, a headlight tester

5) Other Buildings

Building	No. of floors	Area	Use	Major equipment/ to be furnished
Shower and toilet building	2	132 m^2	Trainees' toilet, lockerroom and shower room.	——
Training-use car garage	1	126 m^2	To house training-use actual vehicles.	Training-use actual vehicles
Canteen	1	195 m^2	To serve lunch to staff members and trainees.	Kitchen equipment
Guard house	1	16 m^2	For security/guarding purposes. To check visitors.	——
Substation	1	90 m^2	To house transformer facilities and an emergency generator.	Equipment for power receiving system and an emergency generator
Personal car garage	1	54 m^2	To accommodate cars belonging to the center.	Personal cars to be prepared by Sri Lanka side.

6) Outdoor Facilities

Other facilities include a water-receiving tank, an elevated water tank, a septic tank, a fire-fighting water tank, an oil separator and an incinerator.

3-4 TECHNICAL COOPERATION

For this center to operate smoothly, its curriculum must be carefully prepared and implemented. To this end, the Government of Sri Lanka has requested Japan to send three experts, two automobile engineering specialists and an automobile electrical specialist, for two years. In addition, Japan was requested to accept and train their Sri Lankan counterparts.

Sri Lanka hopes to prepare the training curriculum jointly with experts sent from Japan and they will assign the following three for that task.

University/college professor	x 2
Ministry of Higher Education	x 1

In view of the fact that CGTTI is performing well with the technical cooperation of West Germany, the dispatch of experts from Japan and the acceptance of their Sri Lankan counterparts are necessary for smooth implementation of this project.

CHAPTER 4. BASIC DESIGN

CHAPTER 4. BASIC DESIGN

4-1 BASIC DESIGN POLICIES

This program is designed to construct a training center in the capital city Colombo for automobile mechanics with a primary emphasis on practical exercises. In designing the training center, the following basic policies have been established in full consideration of the current status of car repair shops, existing automobile mechanic training facilities, education systems, natural conditions, construction problems, etc. in Sri Lanka.

1) That the program shall provide the facilities and functions suitable for such a center in view of the current status of car repair shops in Sri Lanka.

2) That the program shall provide facilities which are as economical as possible by cross-referencing all the equipment held by existing automobile mechanic training facilities and avoiding duplications of car types covered.

3) That the program shall provide facilities and functions that match the training curriculum scheduled for this training center and, at the same time, provide matching contents for a technical assistance program of which implementation is being reviewed.

4) That the design of facilities shall be appropriate for the climate, history and environment of Sri Lanka. Also, as the construction site is situated at the entrance to Colombo city coming from the airport, the center's symbolic aspects as a landmark shall also be considered.

5) That the design shall be made in full consideration of safety aspects as most of the practical exercise aids are heavy-weight and/or inflammable.

6) That the design shall take due measures to make the maintenance, management and operation of facilities after construction easy and cost efficient. To this end, attention is paid to the following in the design of facilities:

(a) Electricity charges represent a sizable share of the administration costs. Consideration shall be given to the following to save cost.

(1) Equipment planning shall be such that the consumption of electric power is minimized.

(2) The design shall give consideration to saving energy: lighting system shall be used so that unnecessary lamps may be switched off easily, for example.

(3) Sufficient heat-insulating and damp-proofing measures shall be taken to minimize the load on each room that functionally requires air conditioning facilities, etc.

(b) To take full advantage of natural lighting and natural ventilation, the employment of side corridors, the use of patios, etc. shall be considered. Also, buildings shall be so designed that each private room has sufficient area, ceiling height, etc. To cope with the scorching sunshine, penetrating rain, etc. peculiar to the tropics, longer eaves, galleries, etc. shall be designed to surround each building.

(c) In the construction of facilities, local materials and construction methods shall be employed to the extent possible to facilitate maintenance work in the future.

(d) The use of such structures and materials that inhibit damage and the generation of dust and dirt shall be emphasized and facilities shall be designed for easy cleaning.

(e) Building facilities shall be designed for easy maintenance and management. Components and devices shall be selected so that their reliability is high, local after-sale services are available and service years are maximized.

4-2 BASIC DESIGN

4-2-1 Scale

The scale of this training center is based on the training program, the number of administrative and training staff members, the number of trainees, etc.

Scale of personnel

Staff numbers	:	38 to 40 persons, including outside lecturers
Trainees	:	Day course 5 classes, 100 trainees in all
		Evening course 1 class, 20 trainees

1) Administration/Classroom Building Total floor area, 2,232 m^2

(a) Administration division

(1) Director's room 31.5 m^2

To accommodate the director and up to 3 to 4 visitors.

Planned area : 4.5 m x 7 m = 31.5 m^2

(2) Secretary's room 21 m^2

To accommodate the secretary and up to 3 to 4 visitors.

Planned area : 3 m x 7 m = 21 m^2

(3) Reception room 28 m^2

To accommodate up to 10 visitors at a time

Planned area : 4 m x 7 m = 28 m^2

(4) Office 63 m^2

6.0 m^2 per person x 9 clerks = 54 m^2

Plus installation space for a personal computer, a telephone exchange, a PA system to cover the entire premises, a fire alarm signal receiver, etc.

Planned area : 9 m x 7 m = 63 m^2

(5) Locker room 31.5 m^2

For 35 administrative and training staff members (including 4 to 5 female staff members).

Planned area : 4.5 m x 7 m = 31.5 m^2

(6) Kitchenette 8 m^2

For tea service for visitors, staff members.

Plus installation space for a sink, wall cabinet and water heater.

Planned area : 4 m x 2 m = 8 m^2

(7) Storage 21 m^2

For storage of office supplies, papers, etc.

Planned area : 3 m x 7 m = 21 m^2

(b) Training division

(1) Training staff room

4.0 m^2/person x 20 = 80 m^2

Planned area : 12 m x 7 m = 84 m^2

(2) Outside lecturers' room 21 m^2

For 3 to 4 outside lecturers.

5.0 m^2/person x 4 = 20 m^2

Planned area : 3 m x 7 m = 21 m^2

(3) Meeting room

For training staff coordination meetings, briefing of visitors, etc.

Per capita area required, 2.5 to 3.5 m^2

2.8 m^2/person x 15 = 42 m^2

Planned area : 6 m x 7 m = 42 m^2

(4) Classrooms 63 m^2 x 4 rooms

84 m^2 x 1 room

As each classroom will also be used as a home room for trainees, one classroom is assigned to each course.
Each classroom will have an overhead projector, a video tape recorder, and personal tool storage racks.
One of the above classrooms will be jointly used by trainees in the evening course.
Also, two of the five classrooms will be separated by movable partitions so that they may be used as one large room, thus creating space for lecture meetings and entrance or graduation ceremonies.
See the classroom layout. If two classrooms are used as one large room, it can seat roughly 130 people with folding chairs.

Planned area : 9 m x 7 m = 63 m^2 4 classrooms
12 m x 7 m = 84 m^2 1 classroom

(5) Library 84 m^2

For use by the training staff members and trainees and consisting of a reading room and a bookroom. About 500 books are to be stocked.

Reading desk	: 1,800 W x 1,200 D x 700 H	4
Bookshelf (closed)	: 880 W x 515 D x 1,790 H	4
Bookshelf (open)	: 1,880 W x 325 D x 1,115 H	1

Area required : $\left(\frac{500}{100} + \frac{15}{0.3}\right) \times 1.5 = 82.5\ m^2$

Planned area : 12 m x 7 m = 84 m^2

(6) Printing room 21 m^2

For textbook preparation

Work stand	: 1,200 W x 800 D x 700 H	2
Storage rack	: 1,200 W x 515 D x 880 H	2

Plus installation space for an electronic copy machine, a mimeograph, a paper folder, etc.

Planned area : 3 m x 7 m = 21 m^2

(7) Medical room 13.5 m^2

Emergency-use bed	: 2,100 W x 910 D x 1,000 H	1
Drug shelf	: 900 W x 270 D x 1,050 H	1
	900 W x 600 D x 790 H	1
Desk	: 1,200 W x 700 D x 700 H	1
Sink	: 1,800 W x 750 D x 800 H	1

No doctor is on duty.

Planned area : 3 m x 4.5 m = 13.5 m^2

(8) Storage 21 m^2

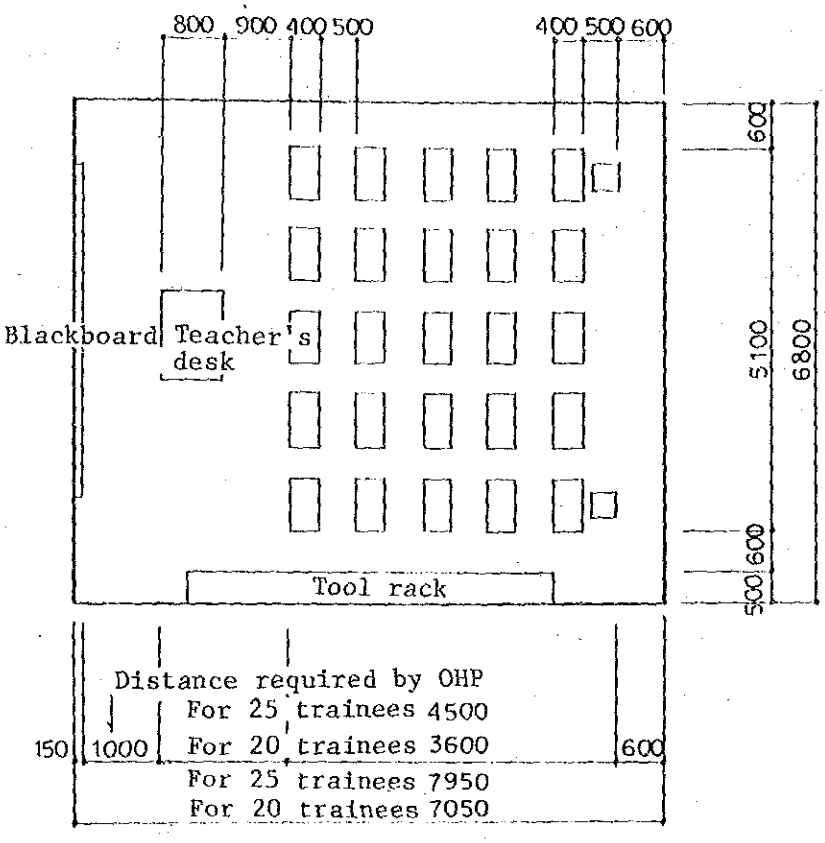
To store training aids.

Planned area : 3 m x 7 m = 21 m^2

(c) Common use areas 1,405.5 m^2

Halls, corridors, staircases and toilets are provided as common use areas.

Classroom Layout



Area : 25-trainee use $7.95 \times 6.8 = 54.06\ m^2$

20-trainee use $7.05 \times 6.8 = 47.94\ m^2$

(Note) Unless otherwise specified, figures, etc. are based on "A Collection of Architectual Design Data" edited by the Architectural Institute of Japan.

2) Training Building No.1 Total floor area 1,767 m^2

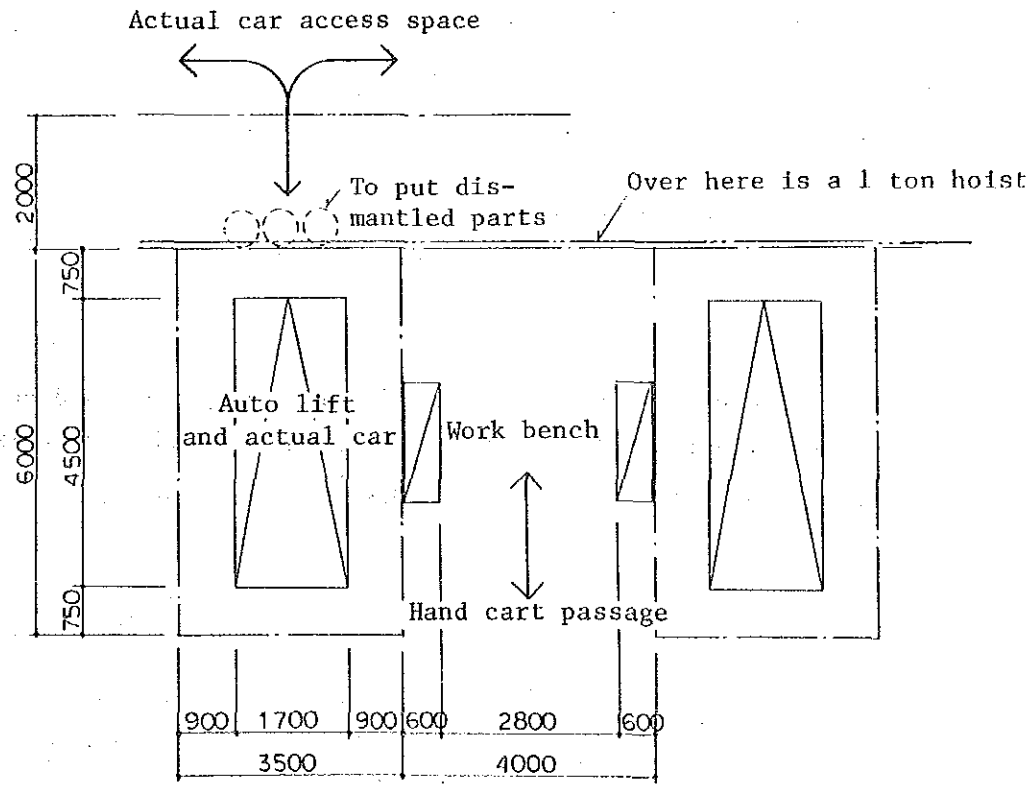
(a) General repair training room 1,105 m^2

Training in installing/removing components and adjusting engines,. brakes, etc. will be provided using actual vehicles.

If three trainees are to work on an actual vehicle (in each work area), seven actual vehicles are required to cover 20 trainees (1 class) in the automoble mechanic course. Depending on the progress of the curriculum, it is possible that two classes will engage in the same exercise simultaneously. So, 7 vehicles x 2 rows (7 work areas x 2 rows) are planned.

A 1 ton hoist is introduced to cover 7 work areas in addition to one each hydraulic auto-lift, work bench, tool stand, parts box, etc. in each work area equipped with an actual vehicle.

The basic layout of a work area is as shown below.



In addition to a vehicle passage in the center, sufficient space should be secured around each work area as the primary objective is training as far as the overall layout is concerned.

Planned area : 26 m x 42.5 m = 1,105 m^2

(b) Parts washing training room 52.5 m^2

For training in car parts washing.
Supposing a parts washing stand is required by two work areas of a general repair training room, 7 stands and a spare are required.

Parts washing stand	: 970 W x 690 D x 1,270 H	8
Planned area	: 7.5 m x 7 m = 52.5 m^2	

(c) Tire maintenance training room 52.5 m^2

For training in tire changing, wheel balance measurement, etc.
As collective training is possible, 10 trainees can be assigned to each machine.

Tire changer	: 720 W x 1,020 D x 1,340 H	2
Wheel balancer	: 800 W x 640 D x 1,080 H	2
Work bench	: 1,780 W x 600 D x 750 H	2
Planned area	: 7.5 m x 7 m = 52.5 m^2	

(d) Electrical equipment training room 105 m^2

For practical training in the inspection and repair of electrical equipment, recoiling of armature coils, etc. This will primarily be used by trainees of the automobile electrician training course but occasionally by those of the automobile mechanic courses as well.
This is equipped to train 25 trainees.

Work bench	1,780 W x 600 D x 750 H	
	Trainees'	13 benches (2 trainees/bench)
	Instructor's	1 bench
	Parts display	1 bench

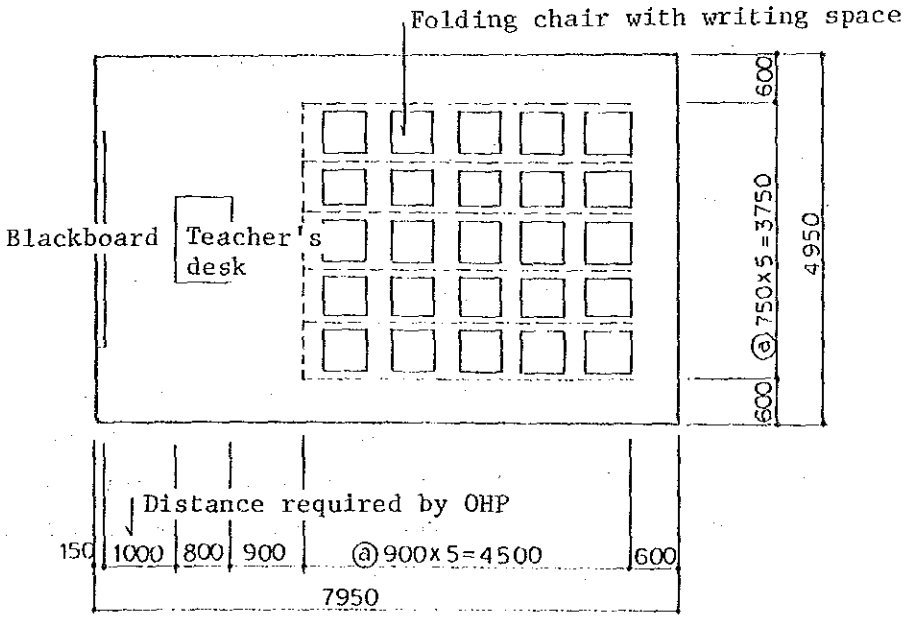
As training time is 10 to 15 minutes per person, 3 test stands are introduced so that a stand may be used by 8 or 9 trainees. As the basic training in lathe operation will be done in the machining training room and the training in the finishing of the armature commutator alone is provided here, 2 lathes are assigned to 25 trainees.

Generator/startor test bench	1,400 W x 940 D x 1,330 H	3
Distributor test bench	540 W x 620 D x 930 H	3
Mica cutting lathe	950 W x 600 D x 1,100 H	2

Planned area : 14 m x 7.5 m = 105 m^2

(e) Classrooms 50 m^2 x 2 rooms

These rooms are for explanations on practical skills in the process of practical training and Q&A sessions, etc.
They will be equipped with folding chairs with writing space, a teacher's desk, an overhead projector, a blackboard, etc.



Area : 7.95 x 4.95 = 39.35 m^2

Planned area : 10 m x 5 m = 50 m^2

(f) Oil storage 25 m^2

To store engine oil, gear oil, grease, etc.

Various oil storage drums : 17 cans

Drum can cart : 2 carts

Planned area : 5 m x 5 m = 25 m^2

(g) Tool room 35 m^2

To store tools used in the general repair training/electrical equipment training rooms.

Tool rack	: 900 W x 600 D x 1,800 H	5
	900 W x 450 D x 1,800 H	24
	875 W x 450 D x 1,800 H	4
Recording desk	: 1,370 W x 635 D x 700 H	1

Planned area : 7 m x 5 m = 35 m^2

(h) Storage 50 m^2

To store equipment and aids primarily used in the general repair training room.

Storage rack for heavy-duty components	: 2,300 W x 900 D x 3,000 H	2
Forklift, manual lift, hand cart	:	1 ea.

Planned area : 10 m x 5 m = 50 m^2

(i) Battery room 25 m^2

For training in battery charging and giving trainees basic knowledge thereof. This will be equipped with 40 stands for batteries, quick chargers, ordinary chargers, etc.

Planned area : 5 m x 5 m = 25 m^2

(j) Air compressor room 35 m^2

This will be equipped with an air compressor to supply air to tools that require compressed air.

Planned area : 5 m x 7 m = 35 m^2

(k) Common use area 182 m^2

3) Training Building No. 2 Total floor area 2,107 m^2

(a) Machinist training room 512.5 m^2

For basic training in auto parts rebuilding.
As for the machines necessary for basic training in machining (lathe, brake drum lathe, etc.), one each for 3 trainees or 5 in all will be supplied.

Though a shaper and upright drilling machine are used in basic machining, one each for 5 trainees or 3 in all will be used as their handling is easy. As for precision machines used for training in sophisticated techniques of machining (crank shaft grinder, surface grinder, line boring machine, honing machine, fine boring machine, milling machine, etc.), one each for 5 trainees or 3 in all will be used.

Crank shaft grinder	: 3,620 W x 1,600 D x 1,110 H	3
Surface grinder	: 2,350 W x 1,200 D x 1,455 H	3
Cylinder fine boring machine	: 3,220 W x 1,577 D x 2,375 H	3
Honing machine	: 2,420 W x 1,400 D x 2,300 H	3
Line boring machine	: 4,170 W x 620 D x 1,395 H	3
Crank shaft press	: 1,905 W x 635 D x 1,220 H	1
Brake drum lathe	: 770 W x 700 D x 1,030 H	5
Lathe	: 1,622 W x 725 D x 1,100 H	5
Milling machine	: 1,635 W x 1,600 D x 1,575 H	3

Shaper	: 2,080 W x 1,000 D x 1,489 H	3
Upright drilling machine	: 450 W x 370 D x 1,630 H	3
Hack saw	: 1,040 W x 430 D x 800 H	1
Pedestal grinder	: 590 W x 661 D x 1,090 H	5
Work bench	: 1,780 W x 600 D x 750 H	7
Planned area	: 20.5 m x 25 m = 512.5 m^2	

(b) Component repair training room 180 m^2

For training in assembly/disassembly of relatively large components such as engines, transmissions and axles. Seven work benches, engine stands and tool stands will be introduced to 7 work groups so that every group (3 trainees) has one each. As for hydraulic presses and parts washing stands, one each per 2.5 work group or 3 in all will be introduced.

Engine stand	: 1,125 W x 910 D x 680 H	7
Tool stand	: 600 W x 400 D x 1,050 H	7
Hydraulic press	: 955 W x 900 D x 1,800 H	3
Parts washing stand	: 1,270 W x 970 D x 690 H	3
Work bench	: 1,780 W x 600 D x 750 H	7
1 t hoist		1
Planned area	: 22.5 m x 8 m = 180 m^2	

(c) Manual work training room 120 m^2

For practical exercise in basic work including hammering, filing, chiseling, etc. Two trainees can use a work bench jointly but 13 benches will be supplied to cover trainees in the electric worker course (25 trainees).

Bench drill	: 306 W x 4,960 D x 980 H	6
Work bench	: 1,780 W x 600 D x 750 H	13
Planned area	: 15 m x 8 m = 120 m^2	

(d) Welding training room 80 m^2

For practical training in welding work. A work bench will be shared by two trainees and 10 benches will be introduced. As practical training in welding is given to pairs of trainees, 5 each gas and electric welding machines will be supplied.

Welding work bench	:	800 W x 600 D x 500 H	10
Shelf	:	1,800 W x 600 D x 1,800 H	2
Gas welding machine	:		5
Electric welding machine	:		5
MIG welding machine	:		5
Planned area	:	10 m x 8 m = 80 m^2	

(e) Body repair training room 120 m^2

For practical training in body repair, sheet metal hammering, etc.

Body repair system	:	8,040 x 5,080	1
Hydraulic auto lift	:		1
Planned area	:	15 m x 8 m = 120 m^2	

(f) Painting training room 50 m^2

For practical training in painting, bake-drying, wet sanding, etc. A prefabricated painting booth is to be introduced.

Planned area : 5 m x 10 m = 50 m^2

(g) Engine-dynamo measuring training room 70 m^2

Measurement of performance, etc. of repaired engines will be done here. As classes (20 trainees) will be divided in two for training, 2 dynamometers are needed.

Hydraulic dynamometer	:		2
Work bench	:	1,780 W x 600 D x 750 H	2
1 ton hoist	:		2
Planned area	:	10 m x 7 m = 70 m^2	

(h) Power booster testing training room 90 m^2

For practical training in maintenance, upkeep, etc. of power boosters. Three to four trainees will have one each work bench, tester, etc.

Work bench	: 1,780 W x 600 D x 750 H	6
Shelf	: 900 W x 600 D x 1,800 H	6
Planned area	: 10 m x 9 m = 90 m^2	

(i) Injection pump training room 90 m^2

For practical training in the adjustment, etc. of fuel injection pumps. As training will be given to groups of 5, 4 testers and work benches are introduced. A work bench is added for nozzle testing.

Fuel injection pump tester	: 1,610 W x 900 D x 1,650 H	4
Work bench	: 1,780 W x 600 D x 750 H	5
Parts washing stand	: 960 W x 590 D x 1,150 H	2
Shelf	: 900 W x 600 D x 1,800 H	4
Planned area	: 10 m x 9 m = 90 m^2	

(j) Classrooms 40 m^2 x 2

The same as in Training Building No. 1

Planned area : 5 m x 8 m = 40 m^2

(k) Air compressor room 30 m^2

The same as in Training Building No. 1

(ℓ) Tool room

(1) Tool Room-I, for the component repair training room 35 m^2

To store various tools and instruments.

Shelf	: 1,800 W x 600 D x 1,800 H	9
	: 900 W x 600 D x 1,800 H	3
Recording desk	: 1,370 W x 635 D x 700 H	1
Planned area	: 5 m x 7 m = 35 m^2	

(2) Tool Room-II, for the machinist training room 25 m^2

To store various tools.

Shelf	: 1,800 W x 600 D x 1,800 H	8
	: 900 W x 600 D x 1,800 H	1
Recording desk	: 1,370 W x 635 D x 700 H	1
Planned area	: 5 m x 5 m = 25 m^2	

(m) Material storage 25 m^2

To store various training aids.

Shelf	: 1,800 W x 600 D x 1,800 H	8
	: 900 W x 600 D x 1,800 H	4
Planned area	: 5 m x 5 m = 25 m^2	

(n) Paint storage 50 m^2

To store training-use paints.

Shelf	: 1,800 W x 600 D x 1,800 H	8
Hand cart	:	1
Planned area	: 5 m x 10 m = 50 m^2	

(o) Storage

(1) Storage-I for the component repair training room 80 m^2

To store large components including training-use engines, transmissions, etc.

Shelf	: 1,800 W x 600 D x 1,800 H	8
Manual lift, hand cart	:	1 ea.
Planned area	: 10 m x 8 m = 80 m^2	

(2) Storage-II for the machinist training room 35 m^2

To store various measurement devices/instruments.

Shelf	: 1,800 W x 600 D x 1,800 H	12
Planned area	: 5 m x 7 m = 35 m^2	

(p) Common use area 434.5 m^2

Places such as passages.

4) Car Washing Training Building 84 m^2

For practical training in car washing.

Car washing machine	: 1,030 W x 670 D x 930 H	3

Car washing stand of concrete

3.5 m x 8 m/car x 3 cars = 84 m^2

5) Inspection Training Building 160 m^2

For practical training in the acceptance/completion inspection, etc. of vehicles.

One each of the following

Brake tester	: 1,470 W x 707 D x 2 units (roller stand dimensions)
Speedmeter tester	: 2,820 W x 810 D x 432 H
Side slip tester	: 2,512 W x 588 D x 130 H
Headlight tester	: 710 W x 550 D x 1,250 H
Work bench	: 1,780 W x 600 D x 750 H
Planned area	: 20 m x 8 m = 160 m^2

6) Shower/Toilet Building 60 m^2

(a) Locker room 52.5 m^2

To store clothes for 120 trainees (including evening course trainees) during practical training.

3-abreast lockers : 900 W x 510 D x 1,790 H 40

Planned area : 5.5 m x 9.5 m = 52.5 m^2

(b) Toilet/shower room 66 m^2

To be used during practical training

7) Canteen 195 m^2

The scale should be sufficient to accommodate roughly 60% of the 100 trainees and 40 administrative and training staff members at the same time.

Trainee use : 64 seats

Staff use : 24 seats

Planned area : 13 m x 15 m = 195 m^2

(a) Canteen

1.5 m^2 per person x 88 individuals = 132 m

(b) Kitchen

0.5 m^2 per person x 88 individuals = 44 m

(c) Common use area 19 m^2

Places such as toilets and passages.

(Note) Figures, etc. are based on the "Collection of Architectural Design Data" edited by the Architectural Institute of Japan.

8) Training-use Car Garage 126 m^2

To house 7 training-use cars.

3 m x 6 m x 7 = 126 m^2

9) Guard's House 16 m^2

4 m x 4 m = 16 m^2

10) Substation 90 m^2

(a) Power receiving equipment 60 m^2

Transformer capacity : 500 kVA x 1

A power receiving/transforming panel is introduced.

6 m x 10 m = 60 m^2

(b) Emergency generator 30 m^2

Generator : 100 kVA x 1

6 m x 5 m = 30 m^2

11) Personal Car Garage 54 m^2

To house the 3 cars owned by this center.

3 m x 6 m x 3 = 54 m^2

4-2-2 Layout Plan

The site of this training center is shaped like a deformed trapezoid; it adjoins the neighboring area on the east, the Baseline Road from the airport to Colombo on the west and a road currently under construction and to be completed by the end of this year on the south. It is forbidden to introduce an access road to the site directly from the Baseline Road mentioned above and it is requested that the access road is introduced from the road on the south.

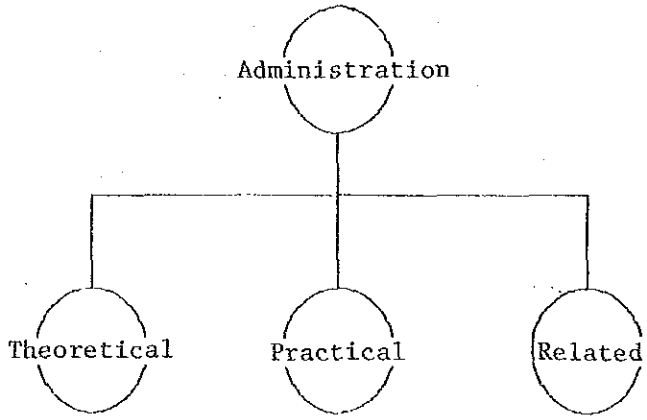
As the site adjoins the road on the south only at the southwest corner, the location of the access road is necessarily limited to the southwest of the site.

It is judged desirable, moreover, in view of the safety of people using this training center, to introduce an approach from the road on the south for which a low traffic volume is predicted rather than to introduce the access road from the Baseline Road which has heavy traffic.

That the site is shaped like a deformed trapezoid tends to result in wasted space and is a disadvantage from the viewpoint of the effective use of the site. A considerable open area will be secured to create a desirable environment for the training center. A layout plan has been reviewed in consideration of these aspects.

1) Facility Layout Plan

Roughly, the facilities of this training center are divided into the 4 divisions of ① Administration, ② Theoretical Education, ③ Practical Training and ④ Related Facilities as mentioned earlier.



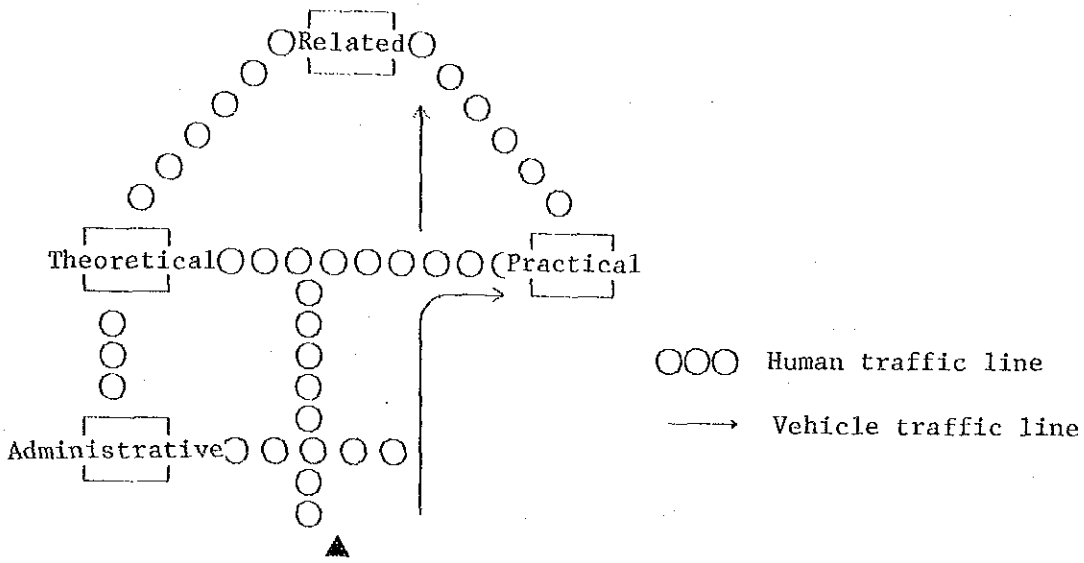
Concept Diagram of Facilities

From a different point of view, the facilities can be classified by their uses as follows:

① Facilities for activities primarily done at desks. Static pattern of use. Administration and theoretical education divisions.

② Facilities for activities dependent on training equipment and aids. Dynamic pattern of use characterized by frequent movement of actual cars, etc. Practical training division.

③ Related facilities.



Concept Diagram of Facility Use Patterns

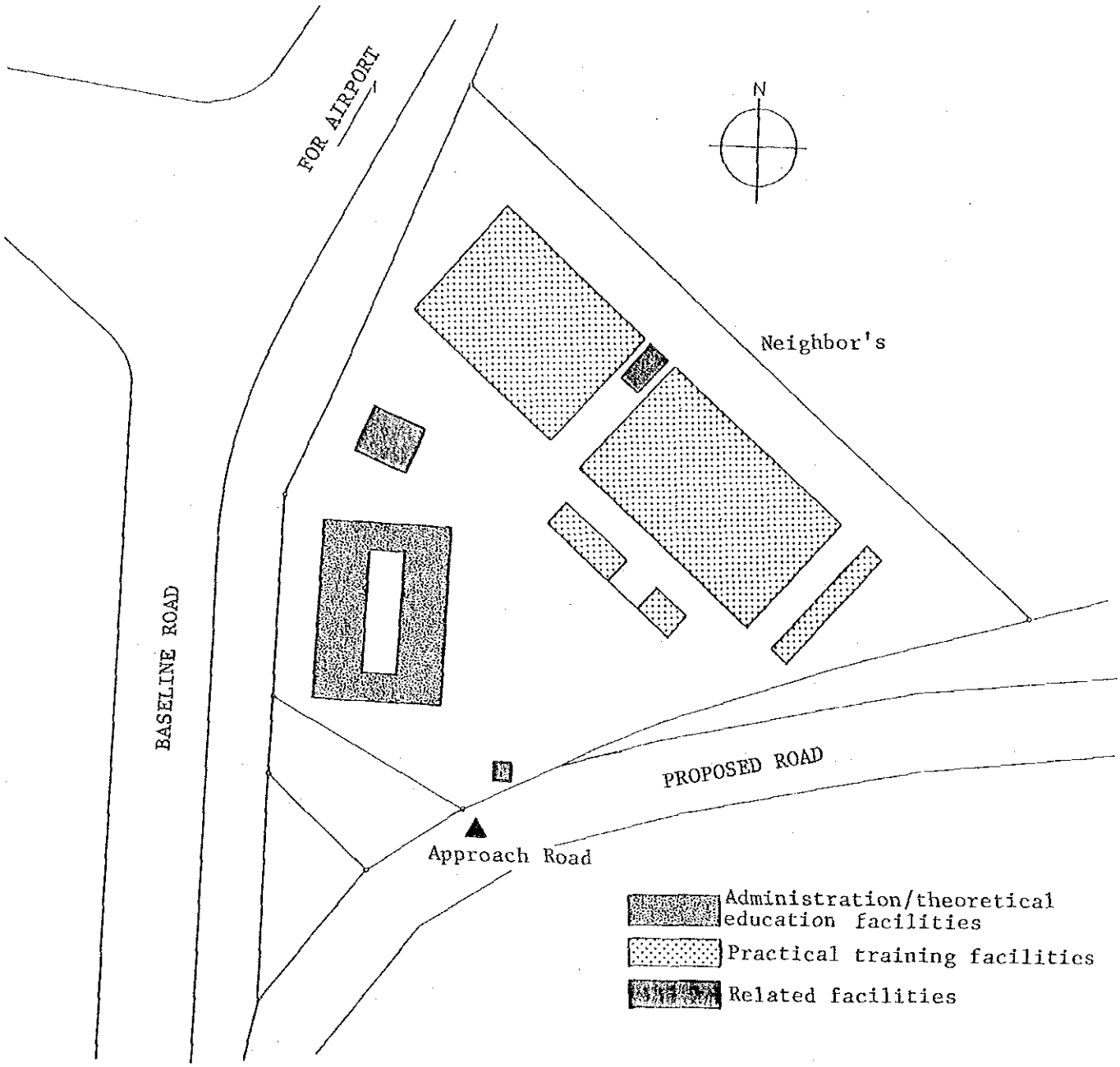
It was an original idea to construct a by-division layout of single storey buildings to accommodate these facility groups but, in view of the area and shape of the site, it is almost impossible.
Therefore, part of the facilities will be housed in a 2-storey building in accordance with facility use patterns.

① Single storey buildings are planned for the practical training division to maximize the space between building columns.

② The administration and theoretical education divisions will be jointly housed in a 2-storey building.

③ Related facilities will be housed in single storey buildings.

Base on the above policies, the following layout of building has been selected.


FOR AIRPORT
N
Neighbor's
BASELINE ROAD
PROPOSED ROAD
Approach Road
Administration/theoretical education facilities
Practical training facilities
Related facilities

2) Exterior Facilities

The site of this training center is lower than the level of the Baseline Road by 2 to 3 m and 0.6 to 1.2 m lower than the level of the road now under construction.

To ensure smooth entry along the access road and to prevent rainwater from collecting on the site, the current ground level has to be raised to at least the same level as that of the road now being built.

Even after the ground level is raised to the minimum acceptable height, a difference of 2 to 3 m between the Baseline Road level and the site level will remain. To drain rainwater coming in from around the site, it is necessary to surround the site with drainage ditches to collect and lead rainwater into a regulating pond, from which to discharge the rainwater into the brook. (No public sewage system exists in the neighboring area)