A STUDY OF VEHICLE FLEET MANAGEMENT IN GOVERNMENT INSTITUIONS IN SRI LANKA

P. A. Ananda Weerawansa

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Department of Civil Engineering

University of Moratuwa
Sri Lanka

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DECLARATION

“I declare that this is my own work and this thesis/dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any University or other institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text”

P.A. Ananda Weerawansa

Date:

“I have supervised and accepted this thesis for the submission of the degree.”

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Prof Amal S. Kumarage
Head of the Department
Transport and Logistics Management
Faculty of Engineering
University of Moratuwa

Abstract

There are 322 government institutions under Sri Lankan government. More than 95% out of them have their own vehicle fleet. In their institutions, the vehicle fleets has been managed by one of commissioners, by a director or a transport officer appointed by the head of the department.

Though there are large vehicle fleets belong to the government institutions, there are no proper fleet management policies required in an efficient fleet management. There are about 60% - 70% of vehicles aged over 10years or 300,000km are used in active vehicle fleet without any proper replacement policy. This causes unnecessary repair costs and low reliability which leads to poor transport supply against demand.

Due to lack of proper preventive maintenance policies, vehicle repair and maintenance costs as well as downtime costs are increased. In addition; frequent occurrence of unnecessary repairs, low fleet reliability and low usage will prevail.

In recent times, the government has engaged in large scale development programs implemented through government institutions. This has increased the transport demand significantly. In order to fulfill this higher transport demand a proper vehicle fleet replacement policy, a timely preventive maintenance schedule, proper vehicle fleet data recording system and regular use of information technology should be applied to reduce the repairs and maintenance cost excessive fuel cost and the downtime.

Further to above, absence of a proper vehicle fleet replacement policy, a proper preventive maintenance plan, accurate data recording system and lack of staff training facilities may cause a deficient and poor vehicle fleet management in government institutions. If immediate solutions are not found for above deficiencies in fleet management, the entire government fleet management will be in jeopardy.

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Abbreviation

AMW – Associated Motor Ways

CC - Cubic capacity

CEYPETCO – Ceylon Petroleum Cooperation

CIF – Cost Insurance Freight

DIMO – Diesel and Motor Engineering

EFI – Electronic Fuel Injection

IOC – Indian Oil Company

NPA - National procurement agency

PM – Particular matter

SUV - Sport utility vehicle

TEC – Technical Evaluation Committee

UNO - United Nations Organization

UML - United Motors Lanka

VOC – Vehicle Operating Cost

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Chapter 1 VEHICLE FLEET MANAGEMENT IN GOVERNMENT INSTITUTIONS

1.0 Introduction

The government of Sri Lanka has a number of ministries, departments, statutory bodies and semi government institutions. The development and administration programs of these institutes are undertaken by government departments and other institutes. The mobility is playing a vital role in functioning of these institutes effectively. To facilitate for the mobility, central government has provided vehicle fleets for necessary institutes. 95% of government institutions have their own motor vehicle fleets and the rest of other institutes have outsourced for their transportation.

The fleet consistence pattern of the government institutions vary according to their needs and wants relating to their services. There are various vehicle types in these fleets and most of them have cars, jeeps, double cabs and lorries etc, while a few have motorcycles, vans and buses. 99% of these fleets are consisted of gasoline powered cars where as jeeps, double cabs and lorries powered by diesel. In each and every year, government allocates approximately 4.5% of its annual budget on fleet management according to the finance report published by the general treasury. As the state income has declined since the last decade, government has decided to cut down the expenditure for purchasing new vehicles. Especially the allocated budget does not match with the existing prices of new vehicles. When the government vehicle fleets are considered; 60% - 70% are old. This means that these old aged vehicles have exceeded the active fleet age. They are ageing up to 20 years. Due to this situation, maintenance, repair and operation costs of them have gone up remarkably. The main reason for this is that the old vehicles have to be repaired very often. The downtimes of them are very high and they take more time to travel. They are less fuel efficient as well. On the other hand, the environmental pollution caused by the emissions of these vehicles is very high. Further, these old vehicles cause incomplete combustion. Therefore, they emit more CO (Carbon Monoxide) to the atmosphere. CO is a greenhouse gas that increases the global warming and creates health problems to the society.

Though the government institutions have vehicle fleets from 1-20 years old or even more, the average age of the active and efficient fleet in Sri Lanka is 6.2 years according to Dr Jayaweera's research paper on "Vehicle inspection and maintenance policies and program".

The reason that the government institutions have to keep aging vehicle fleets is due to an investment constraint for the replacement of the vehicle fleet. It is obvious that an efficient vehicle fleet management system is very important to minimize maintenance and operation costs. An effective fleet management program should include policies and procedures on acquisition, replacement, disposal, repair and maintenance of vehicles, record keeping and labor management.

Though the general treasury deducts allocation of money on purchasing of new vehicles for the government institutions, the cost that is born for repairs of these old vehicles are marginally high in each year. As a solution to minimize the maintenance cost, it is being observed that over 50% of old aged vehicles are not worth while in the long run due to their unreliability even after their rehabilitation. Therefore, it is necessary to provide a proper vehicle replacement program and efficient fleet management system to the government institutions for more productive logistic services.

Problem of the Study

Lack of proper vehicle fleet management policies result in inefficient management of the government vehicle fleets.

1.1 Background

There are 322 government institutes island wide according to the statics of the General Treasury of Sri Lanka. Ninety five percent of these institutions have a motor vehicle fleet and it appears as this is the second capital asset of these institutions. When comparing public sector with the private sector in Sri Lanka, the private sector utilizes their fleet for business purposes while government utilizes the fleet to cater services for the general public.

The way in which the vehicle fleets of private and public sector are managed has some differences. For an example, the Seylan Bank of Sri Lanka has applied a proper maintenance schedule and also they do preventive and routing maintenance in a timely manner such as changing oil after every 5000 km and a periodical maintenance after every 10000 km, 20000 km and 80000 km intervals. Even though the manufacture's maintenance standard is to change oil after every 5000 km interval, in general, the government institutions undertake routine maintenance in between 5000 – 10000 km. In addition to that, the private sector keeps the maintenance records in their electronic data bases while the government institutions do the same thing manually. As a result, most of past maintenance records of the vehicle fleets are unavailable in the public sector and the important data like cost, km reading and fuel consumption are not recorded properly. Further, the cost per km is calculated by the private sector for each vehicle. If the cost increases than the recommended rate, they find the route cause for this problem and take some corrective action in order to prevent its recurrence. When considering the private sector, they replace the vehicles after every 150,000 km run or 7 years of age which ever occurs first. The government sector institutions use their vehicles even if they exceed 500000 km or even 20 years or more. Therefore, having a proper vehicle maintenance data base, a routine fleet replacement policy and a proper preventive maintenance schedule will result in reducing vehicle operational and maintenance cost in the government sector thus reducing the annual budgets of them.

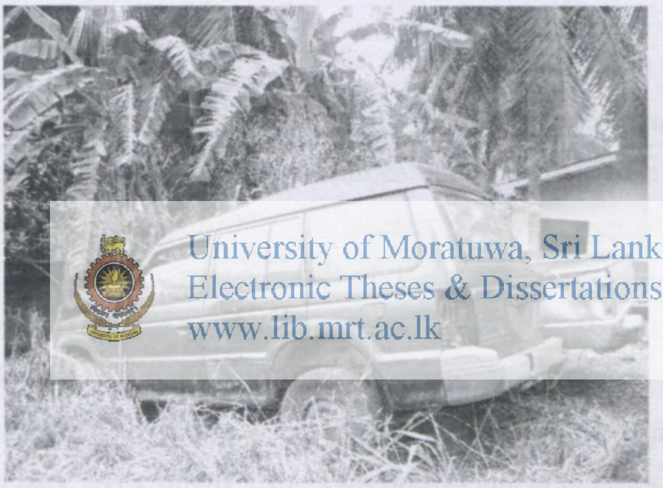

Figure 1.1: Grounded Pajero due to no proper inventory management system (Source: Ministry of Agriculture)

Above picture shows one of the Mitsubishi Pajero grounded in a vehicle yard after an accident; for the last 10years. It has been neglected due to no proper inventory management and no proper replacement policy. These cause to increase inefficiency of the government vehicle fleet management. Such cases could be seen very often in government vehicle fleets.

Figure 1.2: Grounded car due to no proper inventory management system (Source: Ministry of Agriculture)

1.2 The Objective and the scope of the study

The objective of the research is to identify the behavior of maintenance and repair cost, downtime, usage and the fuel cost of the government motor vehicle fleet against the age and to identify possible improvement methods to increase the efficiency of fleet management. And the scope of the research is to review of literature on efficiency of vehicle fleet management in Sri Lanka and other countries. The data was collected from the 20 government institutions and their head offices located in Colombo due to the reason that there are large numbers of vehicles being used by the head offices compared to their local branches. Especially cars, jeeps, double cabs, vans, lorries and mini buses were focused in the study. The scope of the study was limited to the vehicle fleet that provides services to the departments and to the public. Vehicles such as tractors, ambulances or buses were not taken into the study. The public transport sector was excluded because of the fee charged from the public.

1.3 Methodology

This section intends to describe the approach taken on rationalizing the research project. This chapter would explain the theoretical framework, on how the problems and solutions are identified;

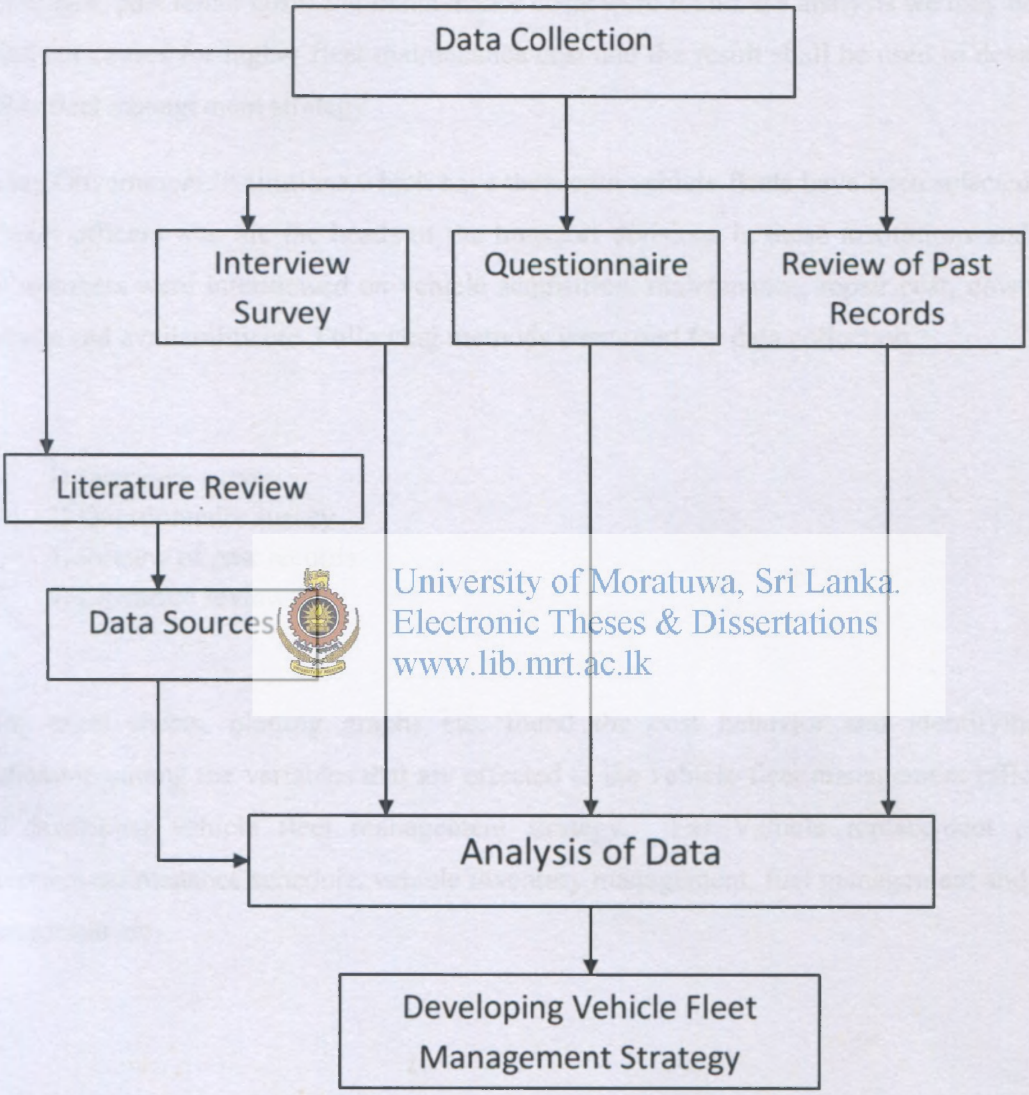

Figure 1.3: Methodology

One of the assistants and the researcher visited all the 20 institutes to collect the data for this thesis. They met heads of transport divisions and discussed about the existing situation of their fleets, problems they face in fleet management, maintenance costs, spare parts costs, their policies and procedures. Then the vehicle operators were interviewed and operational data were collected. With the support of questionnaire, the data such as downtime, major repair costs, utilization, and fuel consumption were collected. By reviewing past records, vehicle ages, past repair costs and maintenance costs were found. By analysis we may be able to find out causes for higher fleet maintenance cost and the result shall be used to develop a vehicle fleet management strategy.

Twenty Government institutions which have their own vehicle fleets have been selected. The transport officers who are the heads of the transport divisions in these institutions and their staff members were interviewed on vehicle acquisition, maintenance, repair cost, downtime, fleet size and availability etc. Following methods were used for data collection.

1) Interview survey
2) Questionnaire survey
3) Review of past records
4) Literature review

Using excel sheets, plotting graphs etc. found the cost behavior and identifying the relationship among the variables that are effected to the vehicle fleet management efficiency and developing vehicle fleet management strategy. Ex: Vehicle replacement policy, preventive maintenance schedule, vehicle inventory management, fuel management and labor management etc.

1.4 Vehicle fleet size

Different government departments have different fleet sizes. In this study actual data of sample of 20 institutions has been collected with the help of a questionnaire as mentioned below.

Table 1.1: Vehicle fleet sizes

Institute Name	Fleet Size
Ministry of Petroleum and Resource Development	13
Ministry of Land and Land Development	26
Ministry of Irrigation and Water Management	35
Ministry of Labor	42
Authority of Samurdhi	44
Department of Archaeology	34
Ministry of Provincial Council and Local Government	40
Ministry of Public Administration and Home Affairs	61
Agriculture Insurance Board	62
Sri Lanka Customs	64
Department of Inland Revenue	68
Department of Wild Life	96
Department of Education	94
Postal Department	98
Department of Agrarian Development	113
Forest Department	180
Survey Department	196
Peoples Bank	201
Presidents Secretariat	206
Department of Agriculture	280

Replacement vehicles may be purchased on a one for one basis but based on the financial constraints of the government. Purchasing of new vehicles is very rare. Fleet size should increase to match with the operational requirements of the institutional mission. But, year by year, the government fleet size is decreased due to written off old vehicles and addition of only a few new vehicles due to higher prices of new vehicles.

1.5 Type of Vehicles

According to questionnaire survey held for this study among the 20 institutions; it was reported that different types of vehicles are used to satisfy their operational needs. Total units of vehicles are 1933 in these 20 fleets.

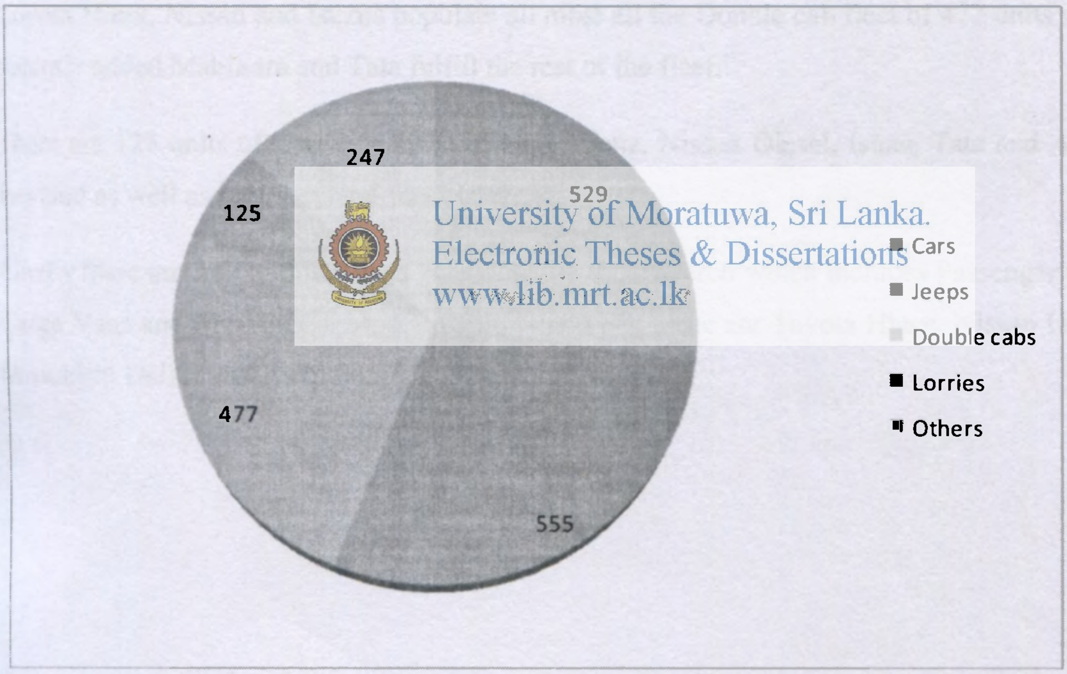

Figure 1.4: Fleet Size

Fleet Consistence as follows:

There are 529 cars which belong to different makes and models such as Toyota Corolla, Nissan Sunny, and Mazda Familia which fill about 2/3rd of the fleet and which are dense among the other models such as Mercedes Bens S Class, E Class, C Class, Volvo S80, S60, BMW 5series, 7series, Jaguar X type and few cars of Indian and Korean brands added very recently.

Among 555 units of Sports Utility Vehicle (SUV) Mitsubishi Pajero is one of the most popular models. As well Toyota Land Cruisers with an amazing engine power supports the fleets in a reasonable way. And Land Rover defenders which are made for off road purposes give a fullest contribution to the fleets as an individual performer as well as a backup vehicle. The newer members of the SUV fleet such as Mahindra Bolero and Scorpio come from India and Ssang Yong Musso and Kyron come from Korea also play a good role.

Toyota Hilux, Nissan and Isuzus populate all most all the Double cab fleet of 477 units while recently added Mahindra and Tata fulfill the rest of the fleet.

There are 125 units of Lorries consist of Hino, Benz, Nissan Diesel, Isuzu, Tata and Ashok Leyland as well as ERF Leyland from UK.

Finally there are 247 of other units considered in the research which includes Passenger vans, Cargo Vans and Mini buses. Most common makes of these are Toyota Hiace, Nissan Urvan, Mitsubishi Delica and Isuzu Fargo.

1.6 Staffing

There are various staffing levels in different institutions to match with the size of their vehicle fleets. In this study, the staffing levels taken into consideration are 1-6, and their duties are shown below;

Record keeping
Dispatching and purchasing
Inventory management
Costing
Budgeting
Labor management
Repair and maintenance

Typical organization chart of the vehicle fleet management division in a government institution.

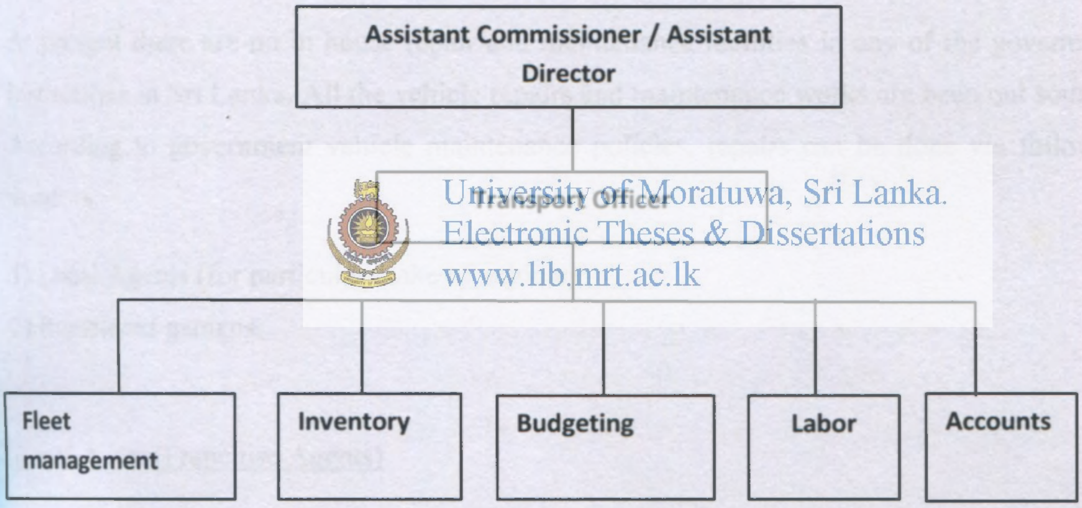

Figure 1.5

1.7 Recruitment of Drivers

Normal procedure is recruitment of drivers from the available short list at the recruitment period. There are no selection criteria to check the technical knowledge or skills of the driver recruits when they are selected. If there is a valid driving license and they can take the vehicle on the road, they will be selected.

1.8 Diagnosis of repairs

If there is any fault in the vehicle its driver's responsibility to inform it to the transport officer. Then the transport officer forwards it to the technical officer to diagnose the fault. But only 20% of the government institutions have technical officers attached to transport sections. Rests of the institutions send their breakdown vehicles directly to the contracted garages for repairs.

1.9 Out-sourcing of Repair and Maintenance

At present there are no in house repair and maintenance facilities in any of the government institutions in Sri Lanka. All the vehicle repairs and maintenance works are been out sourced. According to government vehicle maintenance policies, repairs can be done via following vendors.

1) Local Agents (for particular make of vehicle)

2) Registered garages.

Local Agent (Franchise Agents)

Toyota Lanka Pvt. Ltd, United Motors Lanka PLC, Sathosa Motors PLC and Diesel and Motor Engineering PLC are some of the local agents for various vehicle makes in the world.

- Toyota Lanka for Toyota vehicles
- U.M.L. PLC for Mitsubishi vehicles
- DIMO for Mercedes Benz and Tata vehicles
- AMW PLC for Nissan vehicles

All the local agents use genuine parts for new vehicles. But sometimes local agent also uses reconditioned or used parts for vehicles beyond 10years of age cause of lack of new parts for aged vehicles. It obvious that local agent's prices are very high. Therefore 75% of government vehicle repairs and maintenance are done via registered garages.

Registered garages

National Procurement Agency (NPA) has a registry for motor vehicle repair vendors. NPA don't have any scientific criteria to select suitable garages. They publish a paper notice in national news papers; call for registration and register all the applicants. According to interview survey done with the transport officers there are 90% of garages which use non genuine parts for the repairs and repairs are very low standard as well.

1.10 Costing and Budgeting

In every 3rd quarter of the year the transport officers have to prepare a cost estimate for the major repairs (Capital Expenditure), Minor repairs (Recurrent expenditure) and fuel cost. These estimates are sent to the Treasury to get the approval for the budget of the upcoming year. But as it's usual, that less amount from the budget has been allocated than requested for the whole year.

1.11 Engine capacities and Different makes

Eighty five percent (85%) of the government fleets consist of Japanese vehicles and rest of them are Indian, Korean, British, German, American and Swedish vehicles. There is no standardization in fleet and therefore they mix with different makes, models and types. Eg: Toyota, Nissan, Mitsubishi, Isuzu, Daihatsu, Mazda, Tata, Mahindra, Benz, Land Rover, Volvo and Jeep etc.

There are different classes of vehicles mixed among the fleets as sedans, dual purpose vehicles, SUV's and lorries.

Engine Capacities as follows

- Double cabs 2500cc – 2800cc
- SUVs 2500cc – 4500cc
- Cars 1300cc – 2500cc

- Lorries 4500cc – 6800cc
- Vans 2500cc – 3800cc

1.12 Fleet Fuelling Policy

a) Use of gasoline for cars

b) Use of diesel for Double cabs, SUVs, Jeeps, Vans and Lorries

c) Refueling at IOC or CEYPETCO fuel stations (Registered at NPA)

d) Use of fuel orders

Fuel orders are used when the vehicles are refueled. This voucher is categorized as gmeral231. It has triplicate; one for fuel station, one for accountant for payment and the rest for audits. A cash deposit is needed to be paid to the fuel depot before issuing a fuel order in each and every year. The orders can only be issued within the limits.

1.13 Training

It is a must that there should have continuous training for the transport staff and the drivers to improve vehicle fleet efficiency and cut down unnecessary cost. In Government institutions, sometimes there is some limited staff training available. But most of them are not related to vehicles fleet management. Driver training programmes also are held very rarely.

1.14 Vehicle Assignment

In according to circular NO 22/90, head of the departments and the similar class officers are eligible for private use of the government vehicles at that time. Accordingly, some of the vehicles are assigned to eligible officers and rests of the vehicles are assigned to the individual drivers.

1.15 Prices and Availability of Parts and Labour

It is difficult to bear the high prices of genuine spare parts and high labour charges at present. Prices of some parts are 100% higher than that of the time which vehicle was purchased. Labour charges are also rapidly increased. There are several factors influenced to the increase of spare part prices. Some of these price hikes are due to the depreciation of Sri Lankan rupee against Yen, Euro, Dollar and the Indian Rupee. As well the uneven duties are charged by the government. It's difficult to manage the fleet in good condition since prices are very high.

Therefore, it causes to select not only qualified garages but unsuitable garages as well which become troublesome when vehicles are sent there for repairs.

Figure 1.6: Active Truck Fleet 15-20 years old
(Source: Dep. of Agrarian Development)

Above picture is the truck fleet of Department of Agrarian Development. It consists of trucks which are older than 15 years of age. These cause to low fleet efficiency and high vehicle operating cost. The main reason to use such old trucks in active fleet is the lack of proper vehicle replacement policy.

Figure 1.7: Double Cab 0-5 years old
(Source: Dep. of Agrarian Development)

This is a brand new double cab purchased recently by the Department of Agrarian Development. This has proven high fuel efficiency, effective usage and cost effectiveness. This new vehicle has been contributing a lot to the vehicle fleet. And directly support to increase fleet management efficiency.

Figure 1.8: Grounded Car
(Source: Ministry of Public Administration & Home Affairs)

Figure 1.9 Grounded vehicles
(Source: Ministry of Public Administration & Home Affairs)

1.16 Documents in Government Institute use for Fleet Management

1.16.1 Certificate of Registration of Motor Vehicle

This is like the birth certificate of vehicle. This includes the make, model, color, engine capacity, seating capacity, weight, and fuel type, country of origin, registration number and the first registration date.

1.16.2 Running Chart

This is like a book. It includes the vehicle registration number, fuel tank capacity, odometer reading and other current details of the journey and fuel balance in the vehicle etc.

This includes repairs and payment, service, replacement of the tires and battery changes.

1.16.4 Vehicle Inventory Management System

Vehicle inventory management is one of the most important factors in proper fleet management system. To improve fleet efficiency there should be proper inventory management system to keep important records of each and every vehicle in the fleet.

Chapter 2 LITERATURE REVIEW

It was obvious that there was no previous research carried out or no articles or papers published by anybody form Sri Lanka about vehicle fleet management in government institutions. Therefore it's difficult to find out local literature about vehicle fleet management in government institutions in Sri Lanka.

2.1 Cost Verses Age

According to international literature it has been proven older vehicle having more probabilities to increase repair cost than younger generation.

For example: In Europe vehicle aged 1-5 years had a 20 to 30percent likelihood of incurring repair cost in a year. The vehicle about 13 to 15 years had likelihood closer to 68percent… The Lowest Probabilities ranging form around 10 percent in their early years to around 50 percent year age 14 [1] (Ellen M. Pint, Lisa Palled Colabella. et al. 2008.)

2.2 Downtime Verses Age

The older vehicle had a higher probability of experiencing one or more days of downtime per year. In Europe for example a new long vehicle had about a 40% likelihood of incurring downtime, where as 15 years old long vehicle likelihood was about 80%. That is an old vehicle with a high odometer reading tended to have more downtime than did a younger vehicle with a high odometer reading [2]

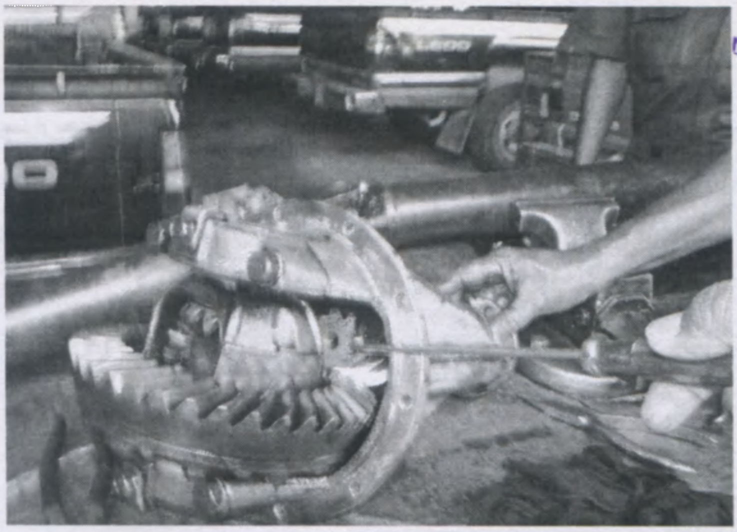

Figure 2.1: Major repairs which affect downtime
(Source: Dep. of Agrarian Development & United Motors Lanka Ltd.)

2.3 New Vehicle Purchasing Restrictions

Government intuitions have several types of vehicles cars, jeeps, double cabs and Lorries etc. according to the sample survey data, 24% were petrol powered vehicles and others 76% vehicles were diesel powered because operation cost is low. In Sri Lanka the tax burden for diesel vehicles at the time of purchase is seen to be double that of the gasoline powered vehicles. There is a comparison of diesel and petrol vehicle price for Toyota model RAV4 [3] (Munisinghe Mohan, Kumarage A. et al. 2003.) showed total of CIF + Tax for petrol vehicle Rs 2,650,092 and same diesel vehicle CIF + Tax was Rs 3,900,000 [Price in 2001]. The difference is Rs 1,249,908 between petrol and diesel vehicle. Therefore it's difficult to purchase new vehicle to the government vehicle fleets. As a result aging vehicles were increased among institutional vehicle fleets.

In Table 2.1 we show a comparison of the taxes levied on diesel and petrol cars, using the same Toyota model differing only by type of engine. The tax burdens for the diesel vehicle at the time of purchase is seen to be double that of the gasoline-powered car.

Table 2.1: Comparison of vehicle prices (Diesel Vs. Petrol)

Toyota model RAV4

	Cost in Rs		
Gasoline	Diesel	Difference:	diesel less Gasoline
Costs at purchase			
CIF	1800000	2200000	400000
Import duty	267000	534000	267000
Defense levy	217000	108511	108489
Excise duty	254400	508800	254400
GST	198721	397400	198679
Stamp duty	21380	42800	21420
Total tax	850092	1700000	849908
Total CIF + tax	2650092	3900000	1249908
Tax[as percent of total]	32%	44%	12%
Annual taxes			
Registration	3500	6500	3000
Diesel tax	10000	10000	
Luxury tax	50000	50000	
Annual fuel cost	0		
Km/year	15000	15000	0
Km/litre	10	10	0
Litres/year	1500	1500	0
Price/litre	50	21.5	-28.5
Annual fuel cost	75000	32250	-42750

Note: Imported as reconditioned, three-year-old vehicles. Luxury tax declines by Rs 10,000/year, reaching zero in the sixth year. Figures are tabulated for taxes and typical prices as of April 2001.

2.4 Fleet Vehicle Purchasing Process is Competition but Vehicle Selecting Criteria could be improved

When all the government institutions purchase vehicles, they set the specification and go for competitive contract bids from vendors. But later a considerable amount of money that has to be paid for the repairs and maintenance. Therefore when preparing specifications for purchasing of vehicles it should be considered the estimated life cycle cost as well [4](JLARC of The Virginia General Assembly, 2004.). As a result of this method it can be selected most cost effective vehicles.

When it was reviewing government institution's past records, big money expended as life cycle cost for SUVs. Example: Jeeps - The average fuel economy is published by the vehicle manufacturers for new vehicles and therefore expected fuel costs on the vehicle can be calculated based on current price of fuels (petrol or diesel) and the number of miles will be driven before it is replaced. Maintenance expenditure can be estimated based on recommended service intervals for the vehicles maintenance. The resale value of the vehicles may be estimated based on their expected depreciation. One automotive research company published expected life cycle costs for various vehicle models of the year 2003 within several different vehicle classes. This analysis based on a 96,000km replacement schedule. Per kilometer cost were based on following equation.

$$\text{Cost per Km} = \frac{\text{Total fuel cost} + \text{Total maintenance cost} + \text{Depreciation}}{96{,}000\text{km}}$$

Figure 2.2: Toyota Land Cruiser with high fuel consumption and VOC (Source: Dep. of Agrarian Development)

2.5 Fleet Size

Fleet size of government institutions are decided according to their mission. In this study the fleet sizes vary as 13 units to 280 units. If institutional frame work and duties are high; fleet size is also high. According to local and international literature there are two factors involve to reduce fleet size.

1) Underused vehicles
2) Aging vehicles

1) Underused vehicles

Use of annual mileage is to determine which vehicles are underused. In most situations cars age lower than 10years has been driven less than 17,600km per year should be evaluated against the minimum use criterion and be reassigned to areas in which they can be used more effectively or sold. Policy like that can reduce the fleet cost. [5] (Texas. 2003)

2) Aging vehicles to be replaced

New vehicles below 5 years age are more cost effectively than 10 year age vehicles. Same result is given comparing with 15 and 20 year age vehicles. If maintain according to manufactures service standard 150,000km can be driven without engine repairs irrespective of there make. But in order to manufacturers literature after 150,000km there is a probability to occur engine repairs and so on major component subject to repair such as gear box, differential, power steering system, break system, suspension system and electrical system. In reviewing past records a lot of money was expended for vehicles unnecessary repairs.

2.6 In South African Government; A proper fleet management has proven Cost Reduction

A project completed by Transaid within the Department of Health in North West Provinces, South Africa led to a reduction in the number of vehicles required by the department from 2.300 to 1,000. This reduced fleet was able to support the same level of service delivery and delivered massive cost savings to the Provincial Department. The same project produced the following operational achievements:

- 55% reduction in fleet size.

- 55% reduction in transport capital budget
- 35% reduction in operational transport costs
- 85% transport availability achieved
- 75% vehicle utilization achieved

[7] (http://www.transaid.org)

To the achievement of this efficient fleet management has been implemented as follows

1) Maintenance management
2) Use new vehicles for operations
3) Replacement of old vehicles
4) Operation management
5) Usage of ICT

2.7 Fuel Economy Vs Age

The automobile manufacture in worldwide use two types of fuel systems for gasoline vehicles as follows.

1) Carburettor fuel system
2) EFI system (Electronic fuel injection)

Carburettor System

This system has carburettor which has fixed to the air cleaner and engine on inlet manifold. All action in petrol flow is controlled by two jets and a floater. After 100,000 km or 3 years which occurs first; these parts should be changed. For the time being if the worn out parts are changed the fuel consumption will still be very high. It's the nature of aging vehicles.

The EFI system

This system is for petrol vehicles which is the most developed and fuel economical. This is a fuel injection system which consisted of an electric fuel injection pump and pressure type injectors. These injectors should be cleaned in every 25,000 km. According to local and international literature fuel consumption is decreasing with age.

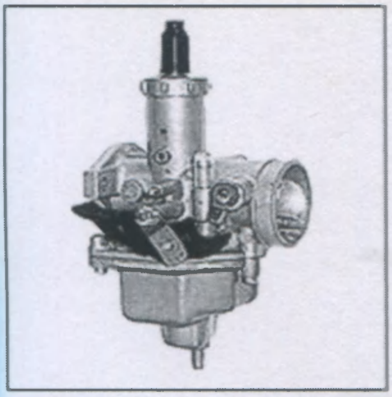

Figure 2.3 Carburettor fuel system

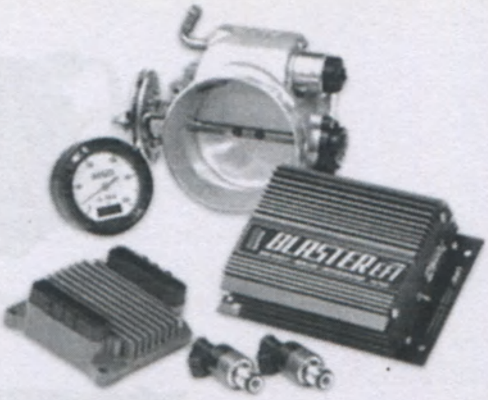

Figure 2.4 EFI System

In diesel vehicles the manufacturers are using several types of injection systems. There are three famous types in Sri Lanka as follows.

1) Inline pumps
2) Rotary type pumps
3) Common Rail Type

When we follow automobile technical data rotary type diesel pump. Fuel efficiency a per liter is better than inline pump. However the latest common rail diesel system is more fuel efficient. All types need periodical maintenance and as it ages fuel consumption increases automatically.

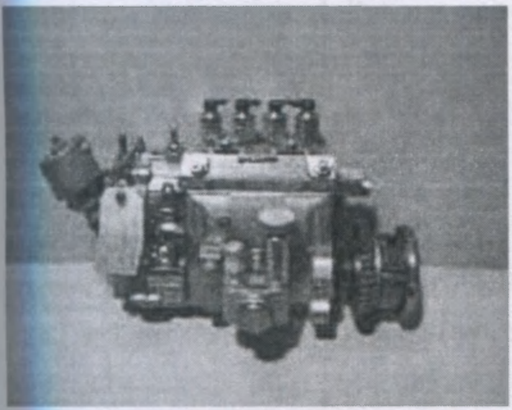

Figure 2.5 Inline pumps

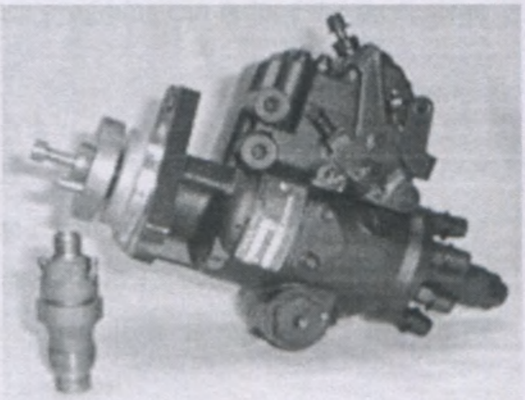

Figure 2.6 Rotary type pumps

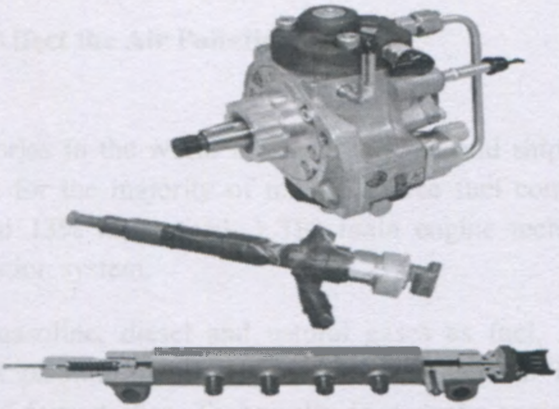

Figure 2.7 Common Rail Type

2.8 Major Repair Cost

According to vehicle manufacturers' literature; major repair cost defines as engine, gear box, differential, break, suspension and electrical repairs. In efficient fleet management process unnecessary major repair cost can be reduced.

If the fleet managers or the transport officers implement a proper preventive maintenance schedule in timely manner; younger fleet of 0 – 5 years age in the institute will not need to incur any major repairs or major repair cost. If the institute has a fleet of 5-10 years age major repairs can be commenced. But preventive maintenance programs can reduce the percentage of the amount of repairs.

2.9 Repair Cost and Age

The age of the automobiles directly involve to increase repair cost. This is a big issue for the vehicles in the active vehicle fleet, but exceeded its useful life 10years or 96,000Km In the City and County of San Francisco government's budget analyst as repair cost by age of vehicles as follows. [8] (San Francisco. n.d)

According to this analysis; vehicles aged less than 10 years has a low repair cost than the vehicles older than 10 years of age.

2.10 Old Age Vehicles Affect the Air Pollution

Leading transport categories in the world are road, air, rail and ships. The most important sources as they account for the majority of mobile source fuel consumption in the world (approximately 82% and 13% respectively.) The main engine technology use for taking power is internal combustion system.

IC engine mainly use gasoline, diesel and natural gases as fuel. All diesel engines are compression ignited and gasoline fueled engines are spark ignited. There are two types IC engines; two strokes and four strokes. Technically four stroke engines are better than two strokes as its less pollutant are emitted in automobiles.

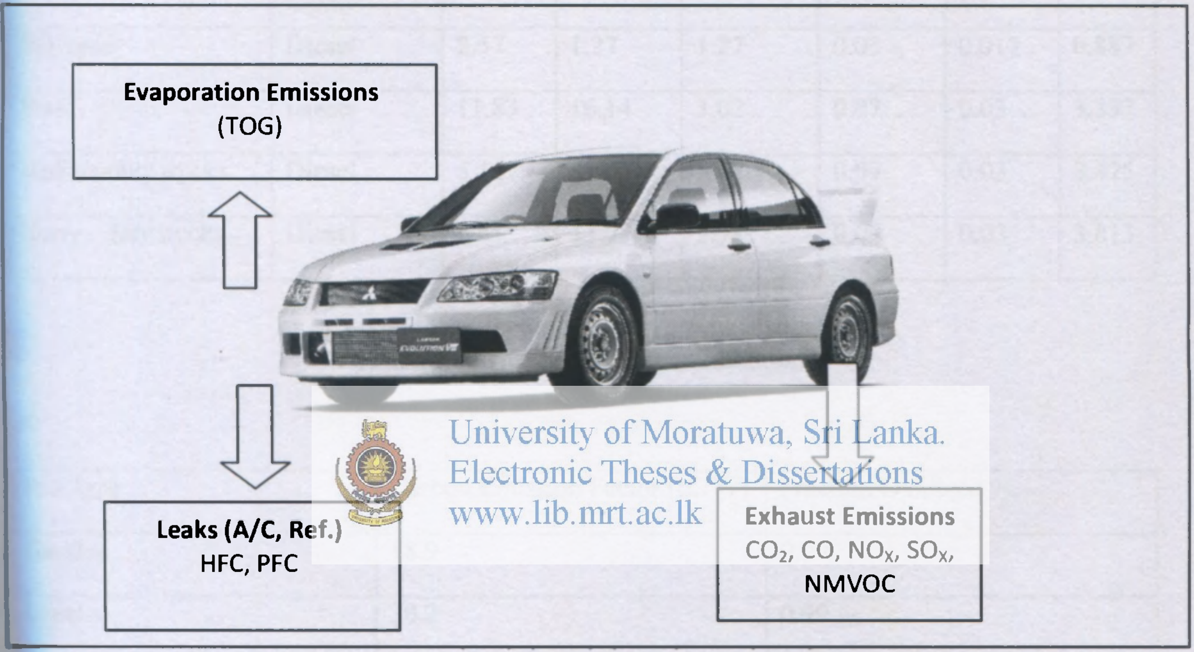

Figure 2.8

Particulate matter (PM) and (Pb) are emitted from the exhaust tip with other exhaust gases. The old and worn out engines emit un-burnt fuel with particulate matter (PM). These un-burnt fuels are visible as white, blue or black smoke with invisible particles. This incomplete combustion is caused by old or worn out engines with low technologies. And as air pollutant may be defined as any substance released to the atmosphere that alerts the air's natural composition and may result adverse effects to humans, animals, vegetation and materials.

Table 2.2: Average Emission Factors of vehicles

Vehicle Category	Fuel	Emission (g/km)					
		CO	NO_X	NMVOC	CH_4	N_2O	PM
Motorcycles 2 stroke	Gasoline	22.78	0.03	9.86	0.74	0.002	0.000
Motorcycles 4 stroke	Gasoline	24.27	0.16	1.74	0.07	0.002	0.000
Private Car	Gasoline	41.32	2.03	5.45	0.15	0.005	0.000
Private Car	Diesel	1.78	0.91	0.46	0.01	0.010	0.244
Minibuses	Diesel	2.57	1.27	1.27	0.03	0.017	0.887
Buses	Diesel	11.83	16.14	3.02	0.07	0.03	3.337
Medium-duty trucks	Diesel	5.16	8.59	3.67	0.09	0.03	3.475
Heavy – duty trucks	Diesel	6.41	13.79	3.78	0.09	0.03	3.813

Table 2.3: Estimation of CO_2 Emissions

Fuel Type	Carbon Emission Factor (tC/TJ)	Fraction Oxidized
Gasoline	18.9	0.99
Diesel	20.2	0.99
Coal	25.8	0.99
Fuel Oil	21.1	0.99
Av. Turbine Fuel/ Jet Kerosene	19.5	0.99

[9](Sugathapala. A.G.T. n.d)

According to the Department of Motor traffic in Sri Lanka there is considerable no of vehicle fleet belong to the government institutions out of the whole active fleet in Sri Lanka. It is obvious that vehicle fleet that vehicle fleet maintenance was not properly done by government institutions and old vehicles had more polluted emission. They can badly effect the environment of Sri Lanka because 90% of government fleets use diesel as fuel. [10] (Jayaweera. 2001)

Table 2.4

Table 2 - Comparison of Specification for Sulfur in Diesel Fuel (%S by weight)

ASEAN(1)	1998	1999	2000	2001	Future Plans
Brunei	0.25	0.25	0.25	0.25	
Cambodia					
Indonesia	0.5	0.5	0.5		
Laos					
Malaysia	0.5	0.5	0.3		
Myanmar	0.5	0.5	0.5		
Philippines	0.5	0.5	0.5	0.2	
Singapore	0.3	0.05	0.05	0.05	
Thailand	0.25	0.05	0.05	0.07	
Vietnam	0.5	0.5	0.5		
OTHER					
India					
Bangladesh					
China(3)				0.2-1.0	0.2(in 2002)
Pakistan (2)				1	0.5(in 2002)
Sri Lanka	1.1	1.1	1.1	1.1	0.5 (in 2003)

Source: ASEAN. Proceeding Regional Workshop on Fuel Quality and Alternative Fuels. Delhi. May 2001 : 1) G. Balce. Overview of Regional Fuel Market and Fuel Quality Standards in. (2) S.M. Zaidi. Country Experience of Pakistan in improving fuel quality: (3) Yangsheng, Improving Fuel Quality in China

One factor remain is that vehicle inspection system has to be included emission test taking sulfur level of diesel and other fuel quality.

2.11 Government Vehicle Purchasing and Repairs

There are procurement guidelines which have been approved by the cabinet of ministers. When the government institutes do repairs or purchase vehicles procurement manual and guideline should be followed... [11](Sri Lanka. 2006.) according to the procurement manual for vehicle repairs above Rs100, 000 sealed quotations has to be called and 7-14 days should be given to the bidders to submit quotations. Thereafter two committees are appointed, one to open the bids and the other for evaluation.

Later these recommended offers go to tender boards for approval. For all these work it takes 45 days approximately. Since old vehicles are getting major repairs so often the time period taken for tendering purpose should also be added to the down time.

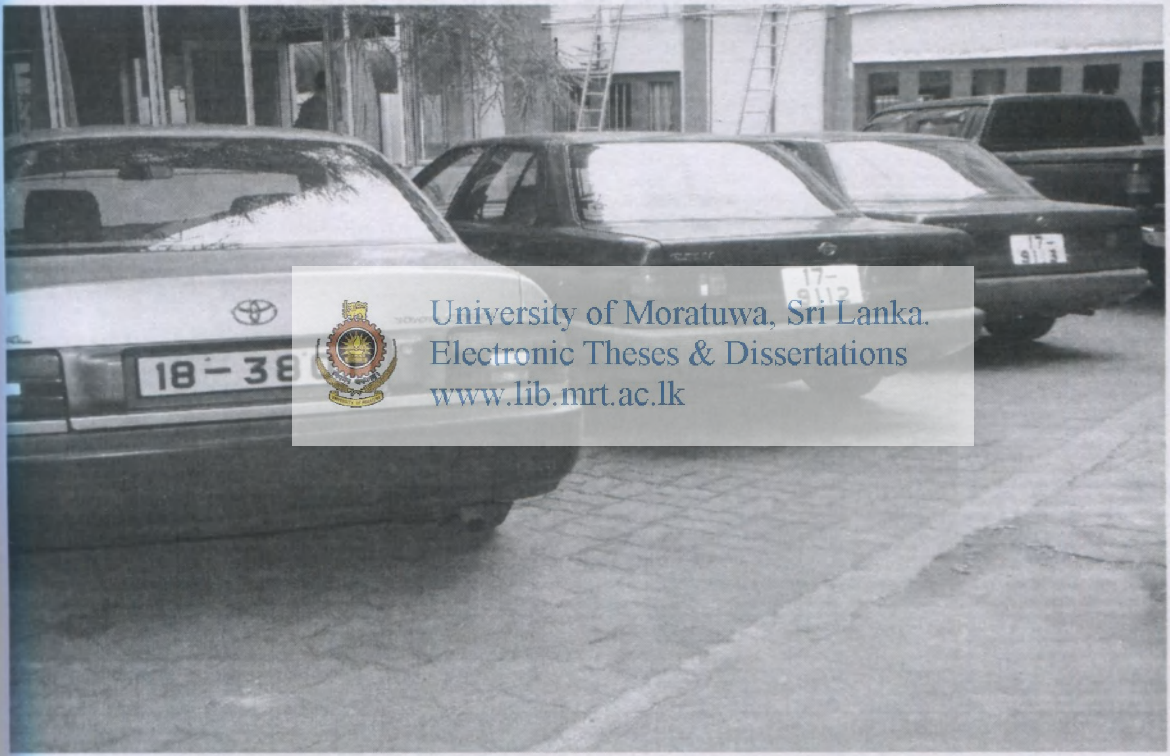

Figure 2.9

20 Year old cars - Still in active vehicle fleet.
(Source: Dep. of Agrarian Development)

Above picture shows cars purchased before 20years by the Department Of Agrarian Development. They are still in active fleet due to no proper replacement and purchasing policy in government fleet's management system.

Figure 2.10
25 Year old Jeep - still in active vehicle fleet.
(Source: Dep. of Agrarian Development)

Figure 2.11
45 Year old lorry - still in active vehicle fleet.
(Source: Dep. of Agrarian Development)

Chapter 3 DATA ON VEHICLE FLEET MANAGEMENT IN GOVERNMENT INSTITUTES

There are 322 government institutions situated island wide according to the government treasury statistics. More than 95% of them have own vehicle fleets. Eighty five (85%) of the head offices of these 322 institutions are situated in Colombo. Therefore, Colombo was selected as the research area. Twenty out of these were taken as sample institutions.

1) Ministry of Petroleum and Resource Development
2) Ministry of Irrigation and Water Management
3) Ministry of Labor
4) Authority of Samurdhis
5) Ministry of Land and Land Development
6) Department of Archaeology
7) Ministry of Provincial Council and Local Government
8) Ministry of Public Administration and Home Affairs
9) Agriculture Insurance Board
10) Sri Lanka Customs
11) Department of Inland Revenue
12) Department of Wild Life
13) Department of Education
14) Postal Department
15) Department of Agrarian Development
16) Forest Department
17) Survey Department
18) Peoples Bank
19) Presidents Secretariat
20) Department of Agriculture

All the 20 institutions have a transport section with employees according to their fleet size. The staff consists with 1-6 persons. Chief of the section is the Transport Officer. Their duties are to prepare vehicle log sheets, record keeping about fuel, repair, maintenance and dispatching and labor management. All of the 20 institutions don't have transport data bases. There are log books, maintenance and repair files and running charts for keeping records. When we reviewed the transport files and records, we were able to collect data. A number of research activities were also done as a part of this study to collect data. These activities included interviews, file reviews and questionnaire surveys.

1) Interviews

   Interviews were conducted with transport staff at all selected government institutions. And interviews were conducted with the institutional transport officers, motor vehicle dealers, fleet maintenance vendors, fleet administrators and vehicle drivers. The purposes of these interviews were to get information about how they manage their vehicle fleet.

Table 3.1: Condition and Performance ratings of the Vehicles below 5 years

Condition and Performance ratings of the Vehicles below 5 years			
	Good	Fair	Poor
Engine	92%	6%	1%
Steering	89%	10%	1%
Breaking	80%	16%	4%
Transmission	84%	12%	4%
Acceleration	75%	15%	10%
Heating	90%	9%	1%
Air Conditioner	79%	15%	6%
Lights	92%	6%	2%

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Air Conditioner	79%	15%	6%
Lights	92%	6%	2%

Fuel Economy	89%	15%	2%
Body condition	82%	13%	5%
Tires	80%	17%	3%
Source: Interview Survey of Drivers			

2) Questionnaire Survey

There were 15 questions included in these questionnaire to gather data on vehicle fleet management for which questions were designed according to four age categories as 0-5 years, 5-10 years, 10-15 years and 15-20 years. All data regarding cost were collected under these categories. Survey team visited all 20 sample institutions and filled the data forms with the surveys of all transport officers and their staff.

3) File and Document Reviews

For collected cost data it has been reviewed vehicle log books, running harts, vehicle repairs and maintenance files, inventories and accounts.

3.1 Sources of Data

An efficient vehicle fleet management system has vehicle maintenance data base and fleet management data base. But government institutes in Sri Lanka still use manual data recording systems. All 20 institutes in which I collected data have small unit for vehicle fleet management and it consists of one transport officer (in-charge) and 1 to 6 clerical staff for keeping records and office work such as vehicle inventory, Repair Log book, running charts, fuel records, costing & budgeting records, accident & maintenance records and labor management records. Since all the government institutes do not have proper data keeping systems, it was so difficult to collect data for all the sections in the questionnaire.

3.2 Vehicle Fleet Survey

Due to lack of data bases in the transport section in the government institutions, the research team had to face a lot of difficulties. There were no opportunities to collect data from email or by using electronic questionnaires. Research team had to visit each of the 20 departments and institutions. They met every transport officer, transport clerk and drivers etc. and filled the questionnaire. It revealed past records and vehicle files, log books, fuel records, vehicle inventories, running charts and repair and maintenance records.

3.3 Age

The age of the vehicle has been calculated by subtracting vehicle's year of manufacture from year of the vehicle's study period (in year 2008). The manufacturing date of a vehicle has been taken from the vehicle registration book. Vehicles were categorized in to four class intervals according to their age such as 0-5, 5-10, 10-15 and 15-20. The main reason to categorize vehicles into class intervals is that number of vehicles in a sample is very large.

3.4 Annual Usage

The data on average annual usage (km traveled) per vehicle has been collected from the running chart of a vehicle where it includes data of a vehicle about the amount of km driven, the amount of fuel has been taken per journey basis. Some Odometers of government vehicles are not working properly as well as some reading shows erroneous figures. Therefore records in the running charts have been taken as average data. Further amount of km traveled differs according to the type of vehicles. As an example, a car has driven less km than a Jeep; a Double cab has driven less km than a Jeep.

3.5 Fuel Consumption

Fuel consumption depends not only on age but also it depends on many other factors, mainly the speed, road & traffic condition, type of the vehicle and mechanical condition etc influence on the fuel consumption of a vehicle. Though the two vehicles are in a same type, records might show slightly different figures according to their brands. There are about 90% of actual data and remain is estimated since odometers of 193 vehicles out of 1933 considered were malfunctioning according to the questionnaire survey. Figure below shows the percentage of the availability of active odometers.

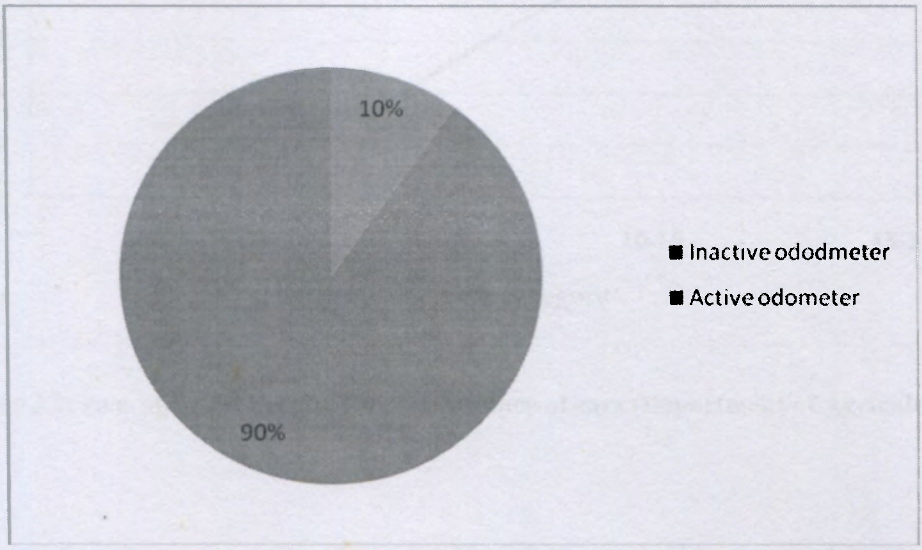


Figure 3.1: Active odometer percentage

3.6 Repair cost

The cost for repair and maintenance of vehicles increases with its age irrespective of type of vehicles. The reason is that at the very beginning (age 0-5), mostly it has to bear only the maintenance cost such as oil changing and greasing and servicing for every 5000km. Just after 5 years, in the government institutes, first rehabilitation is take place such as engines, gear box, suspensions overhauling. The second rehabilitation period of vehicles comes sooner than the first. That means the vehicle grown age needs to be repaired frequently therefore aged vehicles affect to increase of repair cost. Average cost per km for Maintenance of vehicles has been calculated by dividing average cost by number of average km traveled in year 2008.

Figure 3.2: Average Cost Per km for maintenance of cars (Department of Agriculture)

Figure 3.3: 15 years of age Nissan Patrol jeep undergoing major repairs
(Source: Ministry of Public Administration & home affairs)

3.7 Downtime

This includes number of days that a vehicle inoperative or down for any operation. In government sector vehicles, this happens because of vehicles have been parked at garages for repairs. Here, the average annual downtime has been calculated in days which were expressed by the transport officers. The number of days differs according to the aging categories. Basically downtime increases with age. The main reason to have such a high downtime is that for the repairs which exceeds Rs. 100,000; institutes have to go for tender procedure according to NPA guidelines and it takes more than 21 days to complete the legal matters. Therefore time taken for tender procedure is also added to the downtime of a vehicle.

Figure 3.4: 15 years of age vehicle undergoing major repairs
(Source: Ministry of Foreign Affairs)

Vehicles in above picture are older than 15 years of age and they are undergoing major repairs. These major repairs cause due to worn out engines, corroded body parts etc. take a lot of time. Therefore downtime of old vehicles is very high.

3.8 Vehicle Replacement

There are 60-70% of old vehicles in government vehicle fleet due to lack of proper replacement policy. Very costly repairs occur frequently. Therefore the questionnaire has been designed to collect vehicle replacement data to identify their replacement policy.

3.9 Preventive Maintenance Data

Other than age of vehicles; a considerable amount of government vehicles were grounded for long period with due major repairs. These types of repairs occur due to non availability of proper maintenance program. Therefore it is needed to identify about maintenance data. The organizations which are having vehicle fleet management systems is been maintaining database. It can be used improve vehicle fleet maintenance efficiency. In the questionnaire survey included questions about maintenance; so as to collect maintenance data.

Chapter 4 ANALYSIS OF VEHICLE FLEET MANAGEMENT IN GOVERNMENT INSTITUIONS

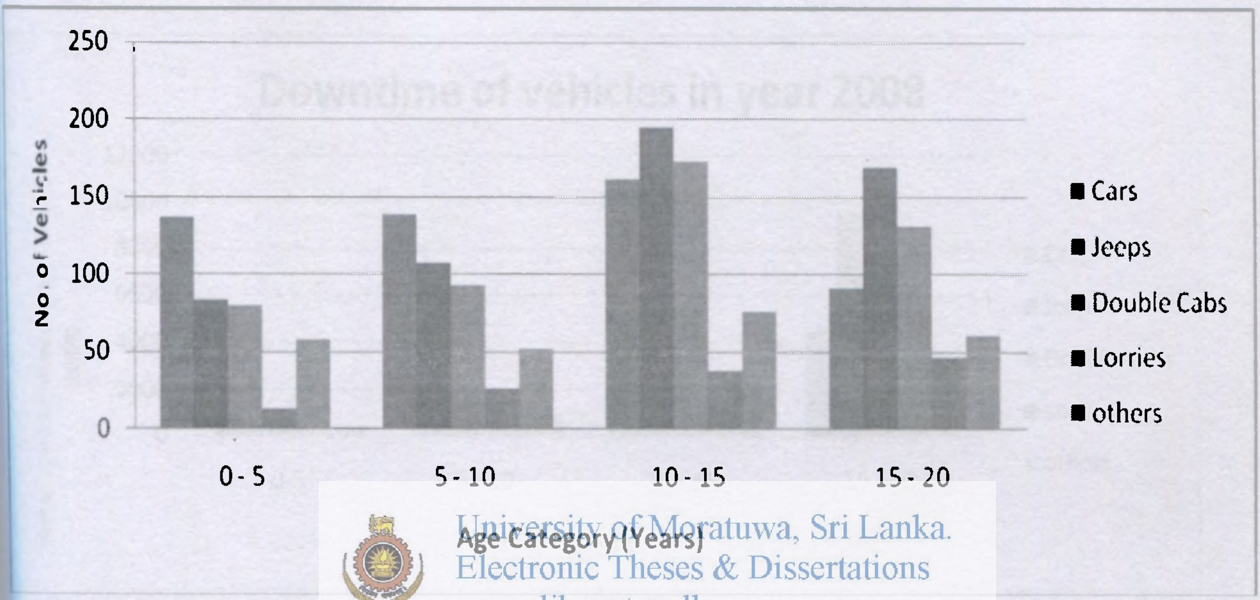
Since there were no data bases and all institutes use to keep records using manual system and important data was not recorded properly; actual average data was collected according to data collection. Firstly fleet was classified on vehicle type and age vise and then the collected data was analyzed as vehicle annual average downtime in year 2008 vs. age category, major repair cost in year 2008 vs. age category, average cost per km for maintenance, average annual usage in year 2008 vs. age category fuel consumption vs. aging category. The quantitative and qualitative data were to determine to prepare a vehicle replacement plan and a proper maintenance schedule to create good vehicle fleet management strategies.

Main variables were considered to determine the plan to prepare a good fleet management plan.

1) Downtime in days
2) Annual usage in kilometers
3) Annual repair cost
4) Fuel consumption as Km/L

4.1 Fleet Classification

There are 322 government institutions in the island. More than 95% of them have own vehicle fleets. In this study sample category was 20 institutions. And total numbers of vehicles were 1933 which consisted cars, jeeps (SUVs), double cabs, Lorries and others as vans and minibuses.



Fleet Figure 4.1: Fleet Classification

Out of total fleet 137 units were cars below 5yeras, 84units were jeeps below 5years, 80 units were double cabs below 5years, 13 units were lorries and 58 unites were vans and mini buses fleets most popular typed of vehicles were jeeps (SUVs) secondly cars and double cabs. Lorries and others were the next. According to above graph it was found that more than 64.44% of vehicles in active fleet within the survey sample were beyond their useful life; which means over 10 years of age.

4.2 Downtime vs. Age

According to the results of analysis it was obvious that vehicle downtime increase with the age of any type of vehicle. When it's compared total average downtime between the same types of cars of age category as 0 – 5 years of age and 5 - 10 years of age were 705 days and 2302 days respectively. As well when we consider the age categories 10 – 15 years of age and 15 – 20 years of age they are 4309 days and 4702 days respectively. When observing the graph; it's clear that any vehicle category give the same result.

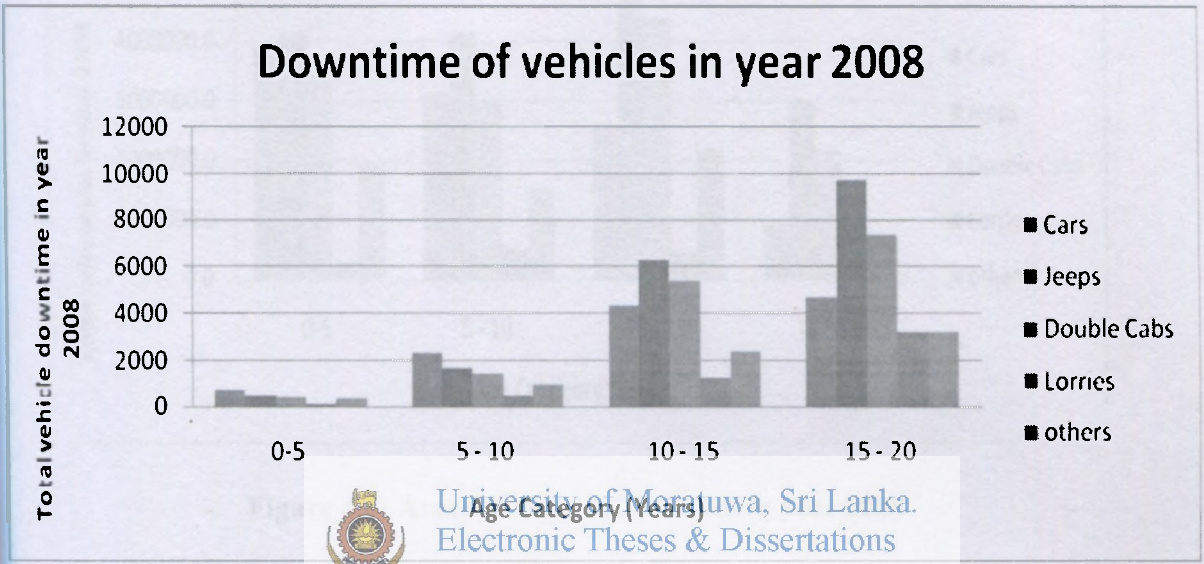


Figure 4.2: Downtime of Vehicles in year 2008

When we study the above graph we can figure the relationship between the downtime vs. age. And it could be seen that the downtime gradually increase with aging. The vehicles of age category below 10 years of age has less downtime where as vehicles of age category above 10 years of age has higher downtime. As well we can state that downtime is directly related to the availability of vehicle. Therefore aging of vehicle fleet affects the availability of vehicles.

4.3 Annual Usage vs. Age

Vehicle's annual usage rate among the vehicles of government fleets were declining according to their age categories in a significant manner. The graph below shows how the annual usage is affected by the aging.

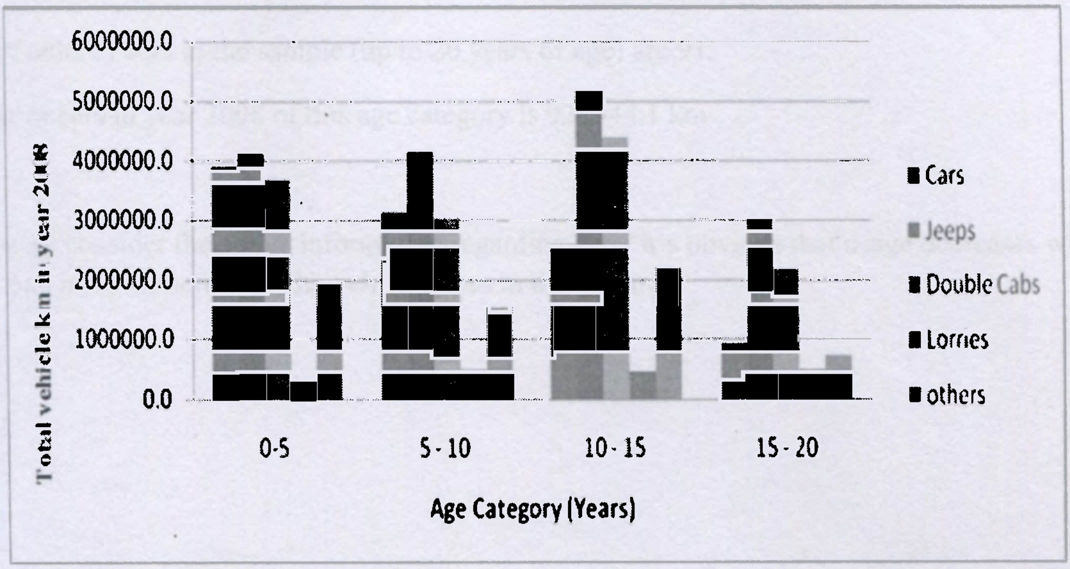


Figure 4.3: Average Usage of Vehicles in year 2008

Usage of Cars

Average usage of cars is calculated according to age category as follows.

1) 0-5 years

No of units of cars in the sample (up to 5 years of age) are 137.

Usage of cars in year 2008 of this age category is 3908392 km

2) 5-10 years

No of units of cars in the sample (up to 10 years of age) are 139.

Usage of cars in year 2008 of this age category is 3134034 km

3) 10-15 years

No of units of cars in the sample (up to 15 years of age) are 162.

Usage of cars in year 2008 of this age category is 258675.1 km

4) 15-20 years

No of units of cars in the sample (up to 20 years of age) are 91.

Usage of cars in year 2008 of this age category is 927944.1 km

When we consider the above information regarding cars; it's obvious that usage decreases with age. And it's common to all the vehicle types in the research.

4.4 Annual major repair cost vs. Age

Old vehicles show greater possibility of having high repair costs. So as to the below chart its revealed that repair cost of vehicles of 5 – 10 years of age is 39% more than that of the vehicles in 0 – 5 years of age in the type of jeeps. Then we can see that the repair cost is gradually increased with age as 42% in the 10 – 15 age category and 43% in 15 – 20 age category. According to the study it is obvious that repair costs of older vehicles are comparatively higher than that of the younger vehicles.

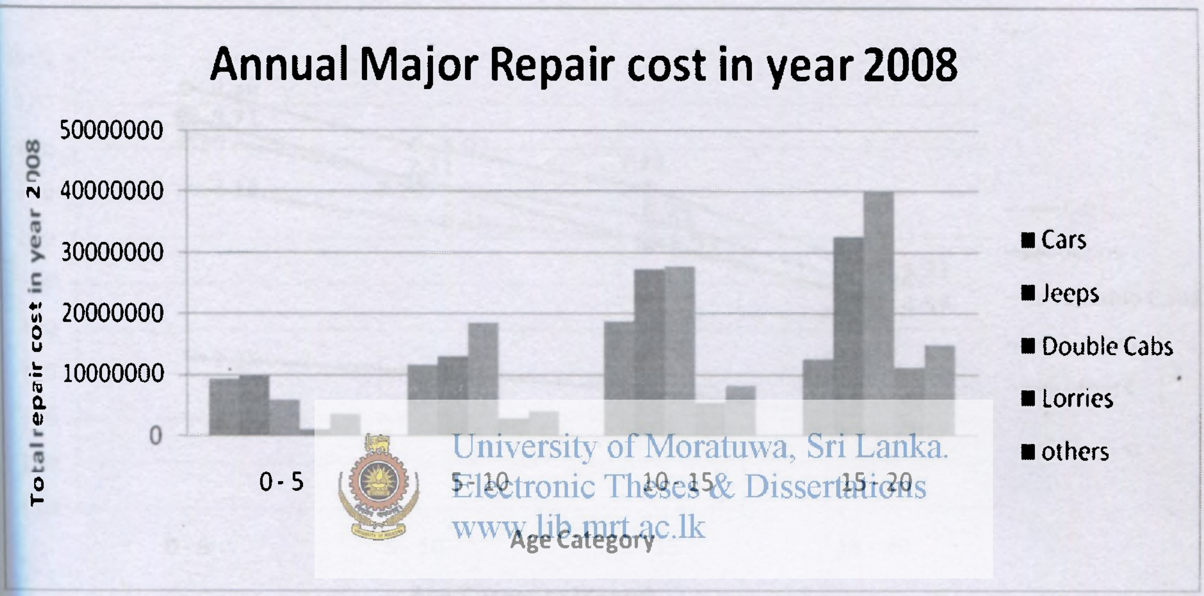


Figure 4.4: Annual Major Repair Cost in year 2008

Calculation of annual major repair cost of cars in year 2008 for age category 0-5 years

(2*50765) + (10*43125) + (20*55252) + (5*51125) + (1*75163) + (6*53125) + (5*67278) + (5*75235) + (2*75256) + (1*57565) + (18*45286) + (2*49132) + (3*56758) + (7*65278) + (2*73126) + (42*97372) + (1*60923.14) + (5*73250) = Rs 9411681

Repair costs of all the other types and age categories were calculated in same manner.

4.5 Fuel Consumption vs. Age

In this study it was identified that fuel consumption of any type of vehicle increase with aging in a significant level. Even when we consider local and international literature regarding fuel consumption; aging is given as one of the main factor influence the rise of fuel consumption of vehicles. It's clear that old vehicles are less fuel efficient when we compare with the modern and latest vehicles.

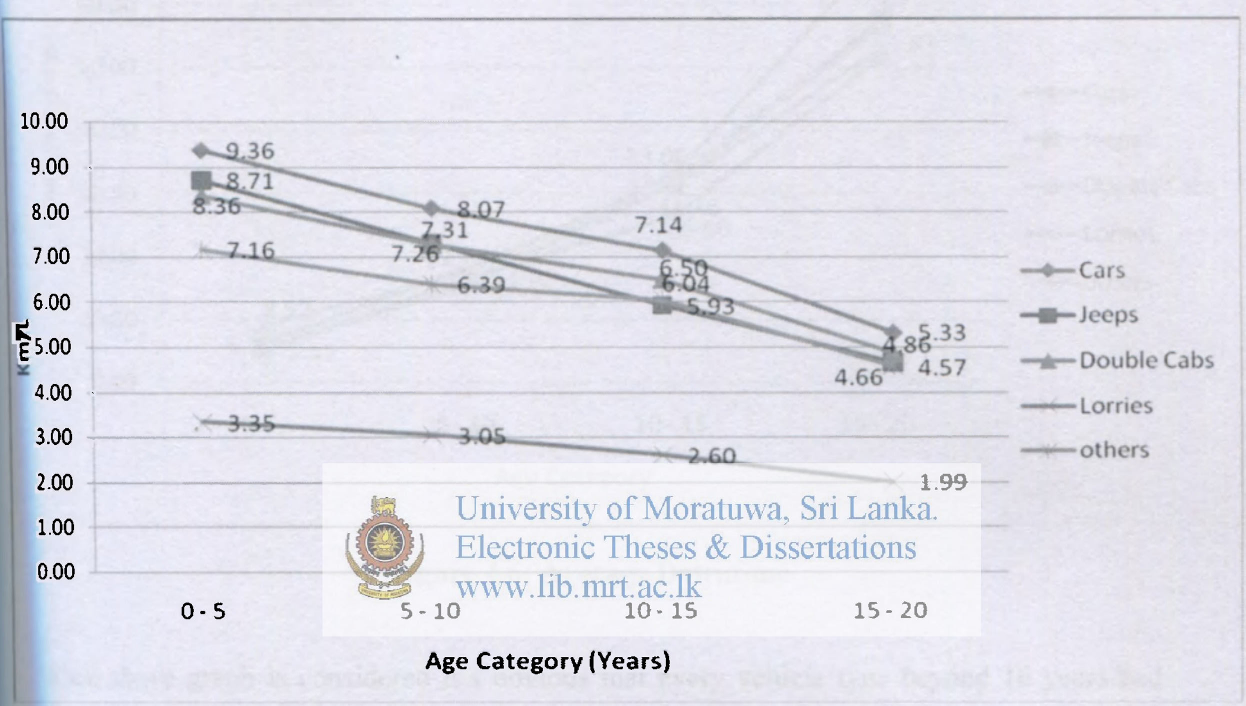


Figure 4.5: Average Km/Liter

The way which fuel consumption increase with the age is clearly appeared in the above figure. This fact is seen in all the vehicle types. Not only the age but also inadequacy of a proper fleet management also leads to increase fuel consumption. Even the literature review proves that old vehicles have less fuel efficiency compared to younger vehicles.

When we concern 10 – 15 years age category; all types of vehicles show that fuel consumption isn't economical. Remedy for this situation is overhauling the engine. A lot of money has to be spent for repairs and downtime is also high. Therefore it is better to take policy decision to improve fleet management.

4.6 Average Downtime per vehicle

The graph given below shows the average downtime per vehicle and how it affects the active fleet. Downtime in each vehicle type increase with the aging and mostly the vehicles beyond the age of 10 years has a high downtime.

Figure 4.6: Average Downtime

When above graph is considered it's obvious that every vehicle type beyond 10 years had been grounded for more than one month. Then it when we consider the age category between 15 – 20 years, all the vehicle types was grounded for 30 – 60 days. In addition to these grounded period; approximately another 45 days time should be added so as to complete tendering process. So it's better to replace vehicle than rehabilitation.

Table 4.1: Average Downtime

	0-5	5 - 10	10 - 15	15 - 20
Cars	5.15	16.56	26.60	51.67
Jeeps	5.50	15.41	32.18	57.59
Double Cabs	5.40	15.46	31.32	56.45
Lorries	8.92	17.70	33.00	68.40
others	6.17	18.31	31.16	52.97

4.7 Maintenance Cost/Km per vehicle

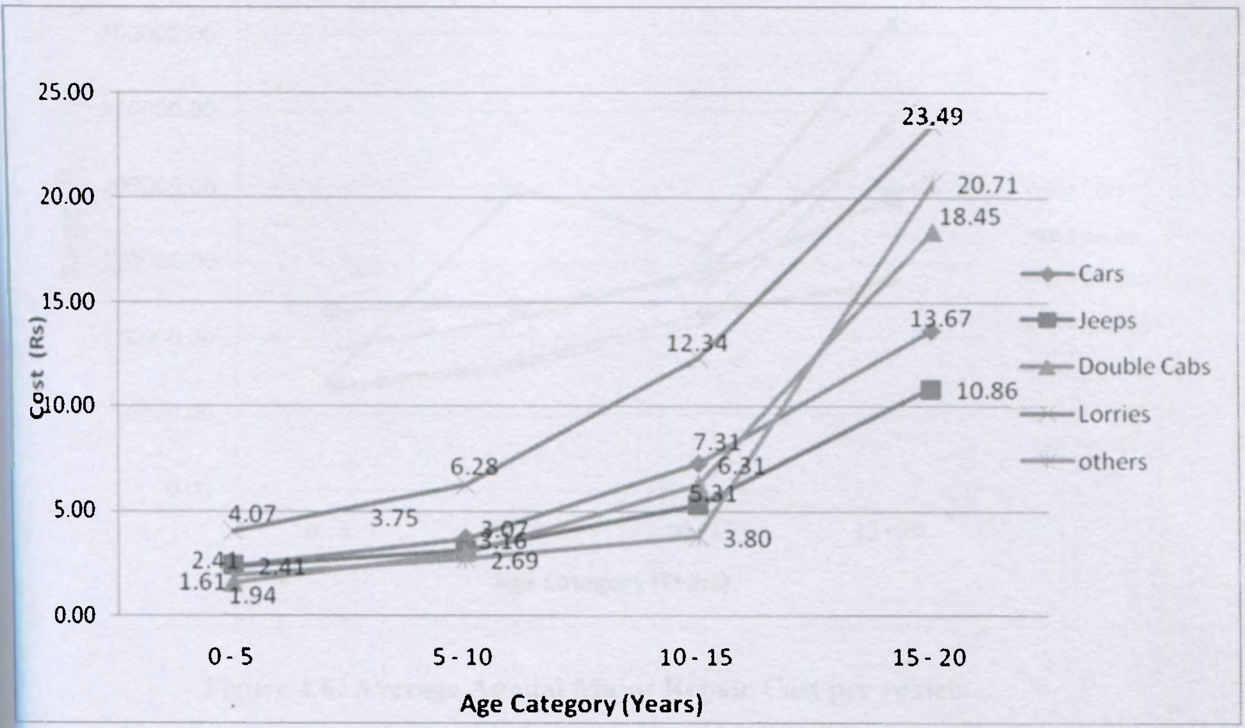


Figure 4.7: Average Maintenance Cost per Kilometer

According to above graph it was revealed that the maintenance cost per Km per a vehicle increase with aging. We can see that this cost has increased in 5 – 10 age categories than 0 –5 age category by a slight percentage in each vehicle type. But after 10 years of age we can see a rapid increase in cost. Therefore it's obvious that cost per Km increase with aging.

When 10-15 years age categories are concerned; maintenance cost/km increased approximately doubled. If we consider 15—20 years age category; it's very uneconomical. Therefore it's better to go for a replacement policy or plan.

4.8 Average Annual Major Repair Cost

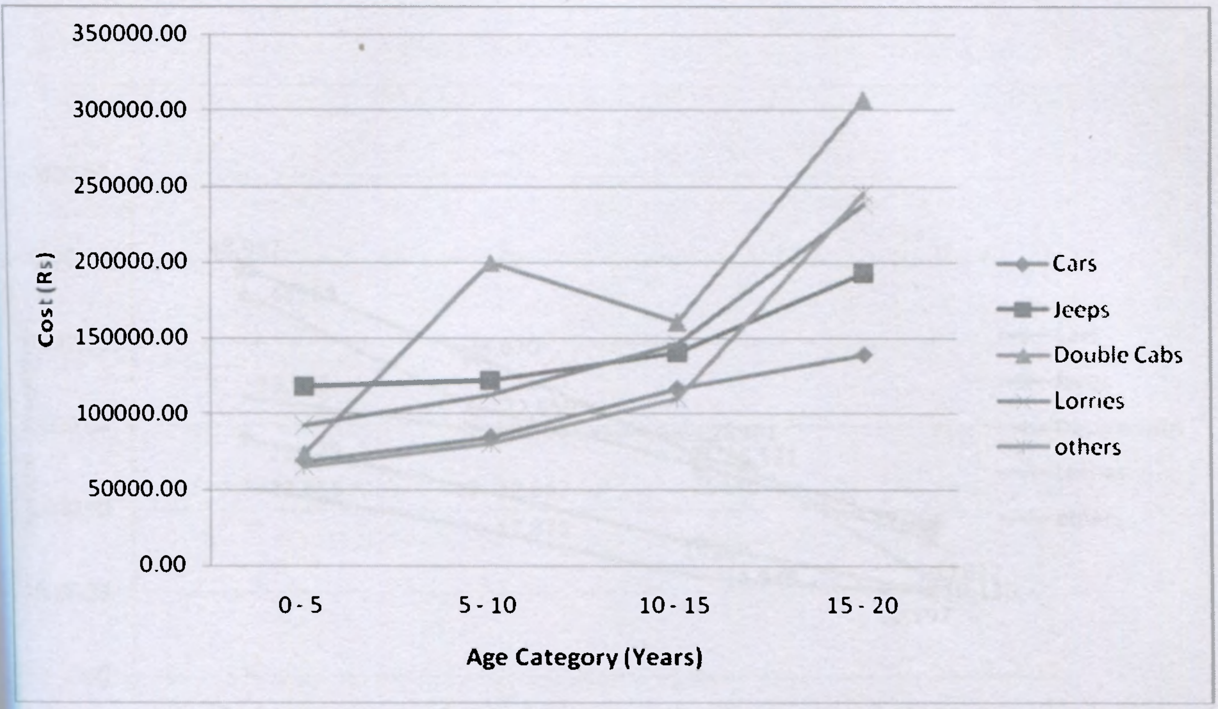


Figure 4.8: Average Annual Major Repair Cost per vehicle

Table 4.2: Average Annual Major Repair Cost per vehicle (Rs)

	0 - 5	5 - 10	10 - 15	15 - 20
Cars	68,698	84,632	116,676	139,357
Jeeps	118,116	122,208	140,948	193,016
Double Cabs	73,892	199,729	160,530	306,656
Lorries	92,315	112,179	146,553	238,030
others	65,119	80,047	110,011	245,096

As well as maintenance cost; average annual major repair cost is also increase with aging. In the above graph; only in vehicle type of Double cabs of age category 10 – 15 years of age, line graph has gone down due to the reason that no of units are greater in 10 – 15 years age category than 5 – 10 years age category when the total cost is divided by no of units average cost per unit in 10-15 years shows a less value than 0-5 years age vehicle. But actual cost of Double cabs in 10-15 age category is greater than 5-10 age category same as all the other types.

4.9 Average Annual Usage of Vehicles

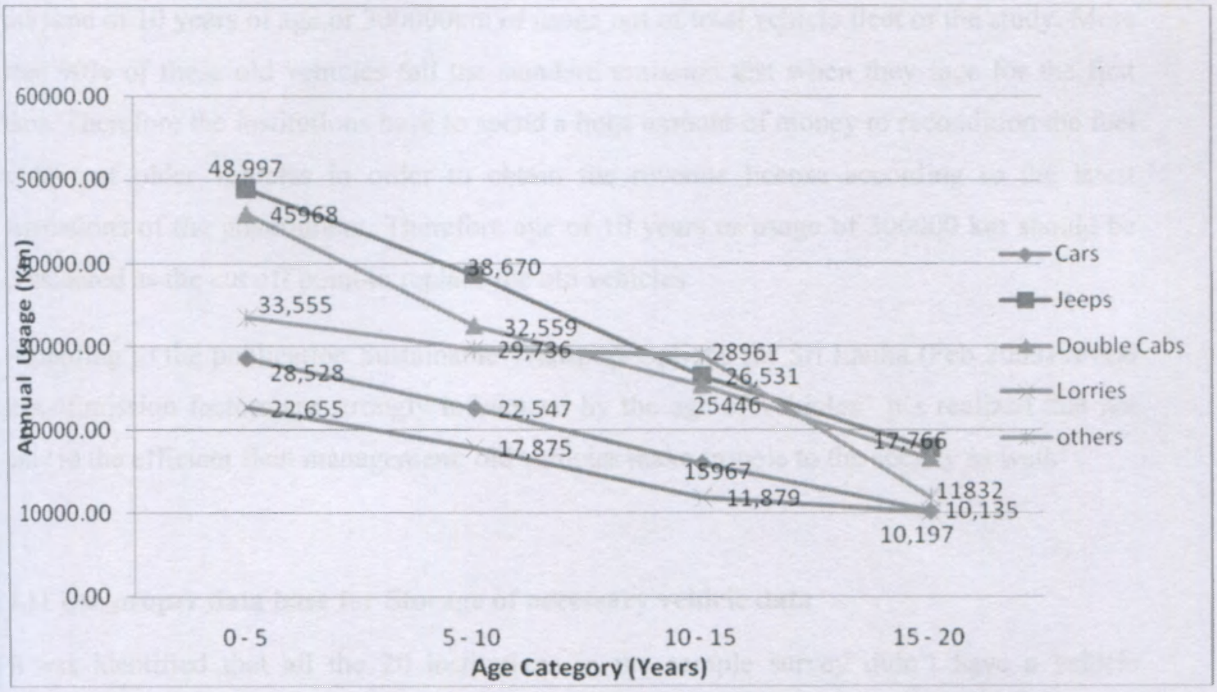


Figure 4.9: 4.9 Average Annual Usage per vehicle in year 2008

Above graph clearly shows how the annual usages of vehicles gradually decrease with age. Cars, jeeps and double cabs show a systematic or even downfall in usage while lorries and other vehicles show a downfall with uneven points. But still all the types of vehicles show the common feature that usage decrease with age.

4.10 Mobile Air Emission Standard

In this survey it has been proven that 64.44% units of vehicle exceed the point of their useful life time of 10 years of age or 300000km of usage out of total vehicle fleet of the study. More than 90% of these old vehicles fail the standard emission test when they face for the first time. Therefore the institutions have to spend a huge amount of money to recondition the fuel system of older vehicles in order to obtain the revenue license according to the latest regulations of the government. Therefore age of 10 years or usage of 300000 km should be considered as the cut off point to replace the old vehicles.

According to the publication Sustainable Transport Options for Sri Lanka (Feb 2003) reveal that "Emission factors are strongly influenced by the age of vehicles" It's realized that not only to the efficient fleet management; old vehicles make trouble to the society as well.

4.11 Use proper data base for Storage of necessary vehicle data

It was identified that all the 20 institutions in the sample survey didn't have a vehicle maintenance data base. In order to literature review of vehicle fleet maintenance it's obvious that appropriateness of a data base. Accurate data of things like odometer reading, fuel cost, repair cost, periodical maintenance data and labor management data are necessary to improve fleet efficiency.

4.12 Comparison of Variable Cost

The following table shows the comparison of variable cost (Maintenance cost & Cost of Fuel) of 15-20 years (Old) and 0-5 years (New) Double cab of Department of Agrarian Development. It was assumed that the price of a diesel liter was constant at Rs. 110. That is because price of diesel was changed during the based year.

Table 4.3: Comparison of Variable cost of Double cabs (New & Old)

Aging category	Maintenance Cost(Rs)	Total cost of fuel (Rs)	Km per liter	Annual Usage	Average Fuel Consumption	Total Variable Cost(Rs)	Variable cost per km(Rs)
0-5 (New)	62,506	288,915	10	26265	2627	351,421	13.38
15-20 (Old)	131,000	206,250	7	13125	1875	337,250	25.70

According to the above table, there is a Rs. 12.32 difference in variable cost per km. It is shown in following graph.

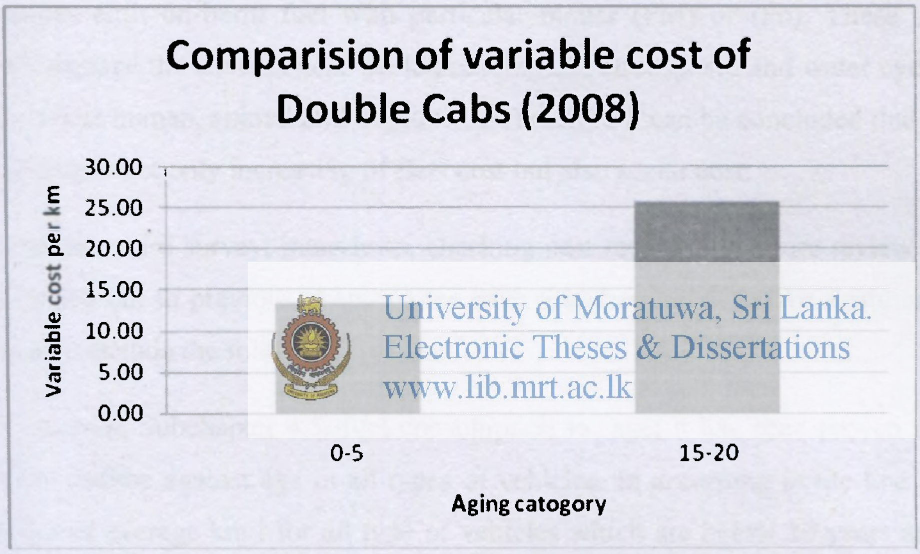


Figure 4.10: Comparison of Variable cost of Double cabs (New & Old) in year 2008

In above comparison; only maintenance and fuel costs are included to obtain vehicle cost per Km. Other costs such as repair cost, downtime cost and other operational costs are assumed as same per Km.

Chapter 5

CONCLUSION

There are 322 government institutions in Sri Lanka. Out of them 95% have their own vehicle fleets. Majority of them are Cars, Jeeps and Double cabs while rest of them is lorries and other vehicles such as vans and mini buses. If we consider all government vehicle fleet, 60 – 70% among active vehicle fleet was beyond their useful life, which means they were over 10years of age or exceed 300000km usage. Old aged vehicles caused to high repair and maintenance cost. In this study it was revealed that lack of preventive maintenance schedule and plan and proper replacement plan would have cause to increase unnecessary fleet cost.

As well in Subchapter 2.10 we discuss that old vehicles affect the air pollution. Old and worn out engines emit un-burnt fuel with particular matter (PM) or (Pb). These un-burnt fuel particles damage the environment while polluting air, atmosphere and water cycle etc. which directly affect human, animal and vegetation. Therefore it can be concluded that aged vehicle without proper not only increasing of fleet cost but also social cost.

From questionnaire survey, interviews, checking past records, literature review and research being carried out in previous chapters; we have found what our selves could have achieved and hence conclude the following.

At this study in Subchapter 4.5, fuel consumption vs. age; it has been proven that how fuel efficiency decline against age in all types of vehicles. In according to the line graph Figure 4.5 facts that average km/l for all type of vehicles which are below 10 years are reasonable which means there fuel efficient is clearly appeared. But for the vehicles beyond 10 years of age fuel consumption isn't economical for the cost effective fleet management in government institutions. In Subchapter 2.7 fuel economy is discussed, and how the fuel economy decreases with age of vehicles are elaborated. Above findings may determine that age shall be proposed to make a vehicle replacement plan for the government to improve their fleet management methods and to increase the efficiency of fleet management.

Using downtime data in Chapter 4 it can be analyzed the relationship between aging of vehicle and downtime. There the line graphs Figure 4.6 clearly shows that downtime is low in the vehicles below 10years of age and it's basically less than one month and in the vehicles above 10years downtime have increased in all the institutional fleets from 30-60 days and it's common to all the types of vehicles. In addition to these down days at least 45days should be added to it as it takes time for tender procedure [11]. This determines vehicles over 10 years of age should be replaced or rehabilitated. But at present spare part cost and labor are very much high. Therefore it is better to replace.

In Chapter 1 at introduction, it was discussed that every year government allocate approximately 4.5% out of its capital expenditure on vehicle fleet management. It's obvious that very large amount of money has been spending when comparing with other sectors like education and health. In this study we find out evidence such as aging of vehicles increased unnecessary cost. In Figure 4.7 it's seen that maintenance cost vs. age/ cost per km is high in all the vehicles beyond 10 years. So by observing the Figure 4.7 it was revealed that maintenance cost rapidly increase with age, when vehicles reach 10 years of age. And by 15 years they show sudden growth and it reach the peak. From this analysis it's observed that maintenance cost per Km is being rapidly increasing with the age of 10 -15 years. Therefore its better to consider vehicles of this age category shall be replaced

In order to the findings in this research; it was revealed that average annual major repair cost vs. age increased at the point of age 15 – 20. In Figure 4.8 this is clearly seen, cost is rapidly increased. When managing vehicle fleets the vehicles belong to 15 – 20 years should be repaired to fulfill the demand tough a high cost has to be born on these repairs. Too it takes a long downtime for these repairs. By going for such repairs government lose its fleet efficiency as well as money unnecessarily. Therefore it's better to take a decision to write off such vehicles and purchase new vehicles which are cost efficient. This will help to cut down unnecessary cost and improve fleet efficiency.

At Subchapter 4.9 it was discussed about mobile air emission standard. In this research it has been proven that 64.44% of government vehicles exceed the point of their useful life time of 10years of age or 300000km of usage out of total fleet of the study sample. According to questionnaire survey it was found that more than 90% of those old vehicles fail the standard emission test when they were tested for the first time in every year. Therefore institutions had to pay a lot of money to recondition the fuel system so as to pass the emission test to make it eligible for setting revenue license. Not only government institutions; aged vehicles effect the society also [3]. At literature reviewed "Sustainable Transport for Sri Lanka' (Feb2003) "Emission factors are strongly influenced by aged vehicles. Our study and literature both conclude that vehicles beyond 10 – 15 years old should be replaced to improve vehicle fleet management in government institutions.

To improve vehicle fleet management efficiency in government institutions it was found that following factors are also influenced.

- Less staff training regarding proper fleet management.
- Drivers less technical know how
- Absence of preventive maintenance schedule
- No proper inventory management

Staff working in the transport section should have a training to cut down unnecessary cost. They should be given a special training about technical knowhow and computer training to keep records about repair and maintenance cost (Maintain a data base), insurance data, accident data records and labor detail. It is a great support to hold drivers training about technical knowhow and road rules to improvement of vehicle fleet efficiency and cut down unnecessary fleet cost.

According to the survey 90% of institutions are doing routing maintenance only (5000 km oil changing) and they do not have a preventive maintenance schedule at least. In an efficient vehicle fleet maintenance system, there should be a preventive maintenance schedule that affect to the reduction of maintenance cost. Unlike in Sri Lankan government institutions, other foreign organizations use international standard vehicle fleet management schedule which is used for preventive maintenance and record cards which is used for keeping records about vehicles' periodical maintenance in timely manner. Especially mission of organizations for United Nations (UN) implement this system worldwide even in Sri Lanka. (Refer APENDIX II for International Standard Preventive maintenance schedule, maintenance record card and Manufacturers recommended maintenance schedule). By considering above we can suggest a similar preventive maintenance schedule and a maintenance record card for Sri Lankan government fleets; which will decrease the fleet management cost and increase fleet management efficiency.

When Chapter 1's introduction is considered; it was discussed that all the records are kept manually. It's better to introduce an electronic car log system. It'll have a better picture as accurate fuel monitoring and record keeping system, electronic maintenance management system and automated preventive maintenance schedule are implemented in such a system. This will affect a lot to cut down unnecessary repairs, cost and improve quality of fleet management.

In annual usage vs. age in the Figure 4.9 it was analyzed annual vehicle usage against age in government fleets. And the fact that usage rate of all the types of vehicles rapidly decline after their useful life time; which means 10 years of age was clearly defined. When we consider the down time, it prove that aged vehicle has more downtime. Therefore both less usage and more downtime derive the same statement which we obtained in Chapter 3, data collection via an interview with drivers regarding condition and performance of their vehicles below 5 years of age. It was revealed that these younger vehicles have a better usage. In other words they were cost effective, had a less downtime, less repair cost and fuel efficient. In this study it s observed that usage slightly decrease with age and it rapidly decrease after 10years of age in vehicle types such as cars, jeeps and double cabs. And in lorries and vans after 15 years since they've built for hard use than previously mentioned vehicle types. Finally we can give the following statements.

- Vehicles like cars, jeeps and double cabs should be replaced after 10 years
- Lorries and vans should be replaced after 15 years

In the previous Subchapter 1.12 Existing fuel policy is discussed. It has some failures when it comes to refueling because drivers can do malpractice or pilferage. When fuel order (General 231) (Refer APENDIX III) is used, drivers can refuel in specified fuel station only. And when drivers go out of the city; they cannot refuel using this orders. Therefore fleet manager have to face difficulties to avoid such problems and to improve fleet efficiency. It's better to introduce electronic fuel card system. It can be used island wide and this can minimize pilferage and accounts could be kept accurately.

As we discussed in Subchapter 2.3 and Table 2.1 new vehicle prices are very high cause of unreasonable duty structure practiced by the government. Therefore the government shall give a duty concession for government institutions so as to purchase new vehicles and to improve their fleet management fleet efficiency. Also it was discussed that spare part prices have also increased by unaffordable amounts. In APPENDIX III you can see that price of a brand new Mitsubishi double cab with 4D56 engine was Rs 863,476 in year 1995 and in 2008 price only for 4D56 engine nearly Rs 4 million. When analyzing these prices the fact that even duties for spares are excessive was revealed. So as to rehabilitate old vehicles in the government fleets; government itself has to take decision to cut down spare part prices by reducing taxes.

According to the Table 4.3, we can see that there is a significant difference in number of km driven by a new (0-5 years) and old (15-20 years) and it is 13140 km. It is more than the number of km driven by an old double cab. It should be noted that the maintenance costs incurred by both vehicles. A new double cab is having Rs. 62506 maintenance cost while an old double cab is incurring maintenance cost of Rs. 131000 for the base year 2008. Further according the calculation made for the variable cost per km was Rs. 25.70 for an old double cab and Rs. 13.38 for a new double cab. Therefore it is better to determine to take a decision to make replacement policy so as to improve the efficiency of government vehicle fleet management than rehabilitation of old vehicles.

When we study on vehicle fleet management; it's better to consider impact of depreciation cost is 10% per year for a vehicle; proportional to its purchasing value according to government procedures. After 10 years book value of the vehicle will be zero. According to this study major repairs such as engine, gear box, suspension, break system, electrical system and body repairs etc. of vehicles occur after 10 years. As an example at this stage it'll take approximately Rs 3 million to recondition a jeep and Rs 6.5 million to buy a new one. Though it seems that reconditioning the vehicle is cheap, when we consider the quality of the vehicle, fuel efficiency, safety, reliability etc. of the new vehicle is very much greater than the rehabilitated one. Since rehabilitation cost of old vehicle is added to its capital; capital costs of old and new vehicle will be nearly equal. But reselling price of rehabilitated old vehicle after 5years will be lower than reselling price of the new vehicle used for 5years or even 10years. Therefore it's clear that replacing older vehicles by new vehicles is very much cost effective than rehabilitating old vehicles.

Chapter 06

RECOMMENDATION

According to this research it was found that government fleet management system does not have a proper vehicle replacement policy. Because of that old vehicle population is high in government fleets. As well repair, maintenance, downtime and fuel costs were very high. And utilization of fleet was low. Therefore to minimize generalize cost and improve fleet efficiency; government need to introduce proper vehicle replacement criteria and make proper vehicle replacement policy. These policies may help to minimize fleet cost and following operational achievement.

- Reduction of fleet size
- Reduction of transport capital budget
- Reduction of operational transport cost
- Achieve transport availability
- Achieve utilization

When we make replacement policy it's recommended to consider vehicle age, life usage (km driven) and life time repair cost.

Recommended replacement criteria

The following guideline provide minimum replacement goal for the routine replacement of vehicles.

Vehicle Replacement Criteria
Table 6.1

Vehicle Type	Purpose	Replacement goal (Age or km)	
Cars	Staff transport	10 years	150,000km
Double cabs and SUVs (Jeeps)	Passenger transport, Light hauling	10 years	200,000km
Vans and minibuses	Staff transport and light hauling	15 years	300,000km
Lorries	Hauling	15 years	300,000 km

To achieve our main objective which is to improve vehicle fleet management in government institutions we may use the above recommendations obtained after this study.

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[10] Jayaweera. 2001. http://www.un.org/esa/gite/iandm/jayaweerapaper.pdf [September 23 2009]

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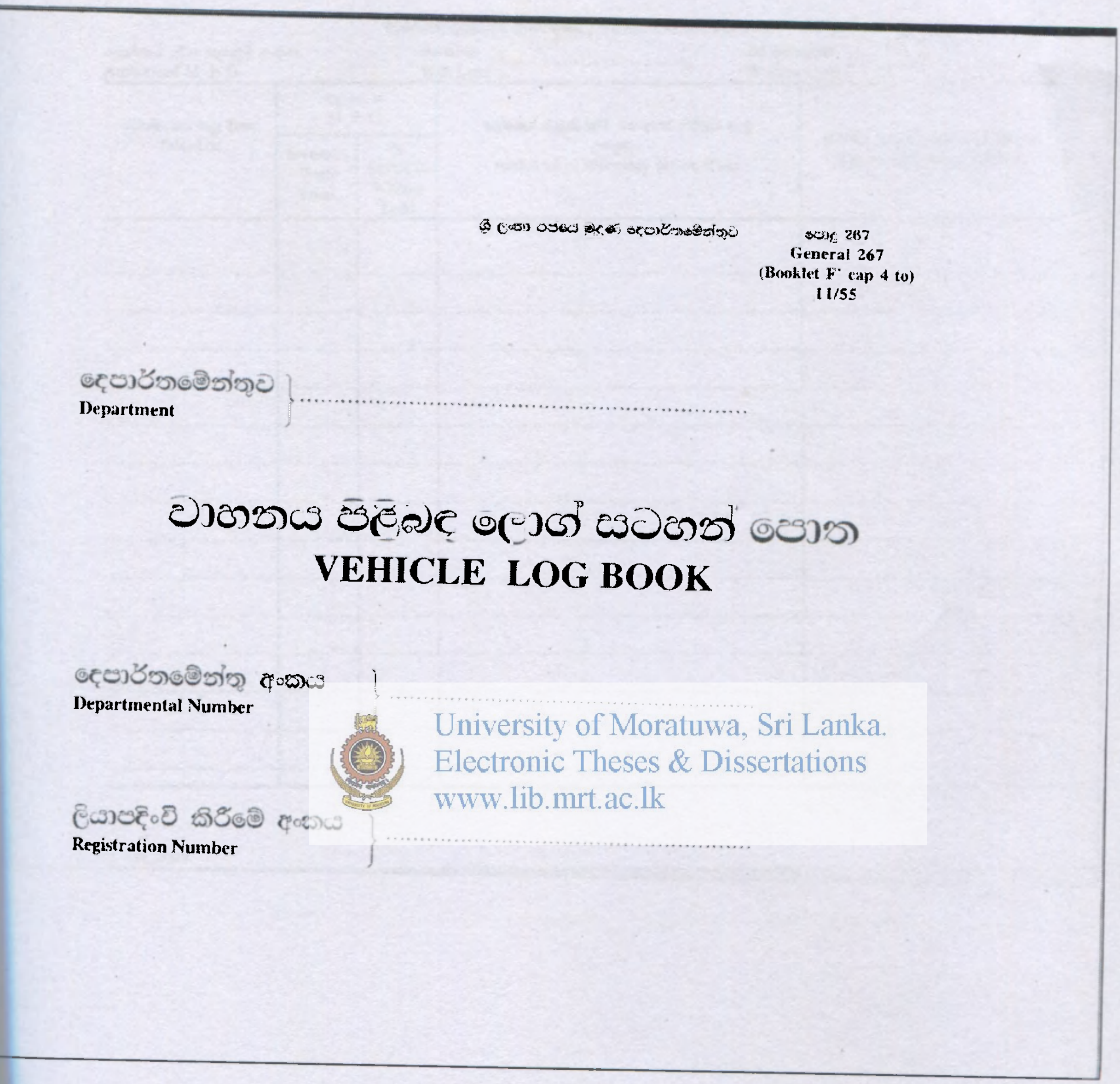
Appendix I

Vehicle Log book



ශ්‍රී ලංකා රජයේ මුද්‍රණ දෙපාර්තමේන්තුව

පොදු 267
General 267
(Booklet F' cap 4 to)
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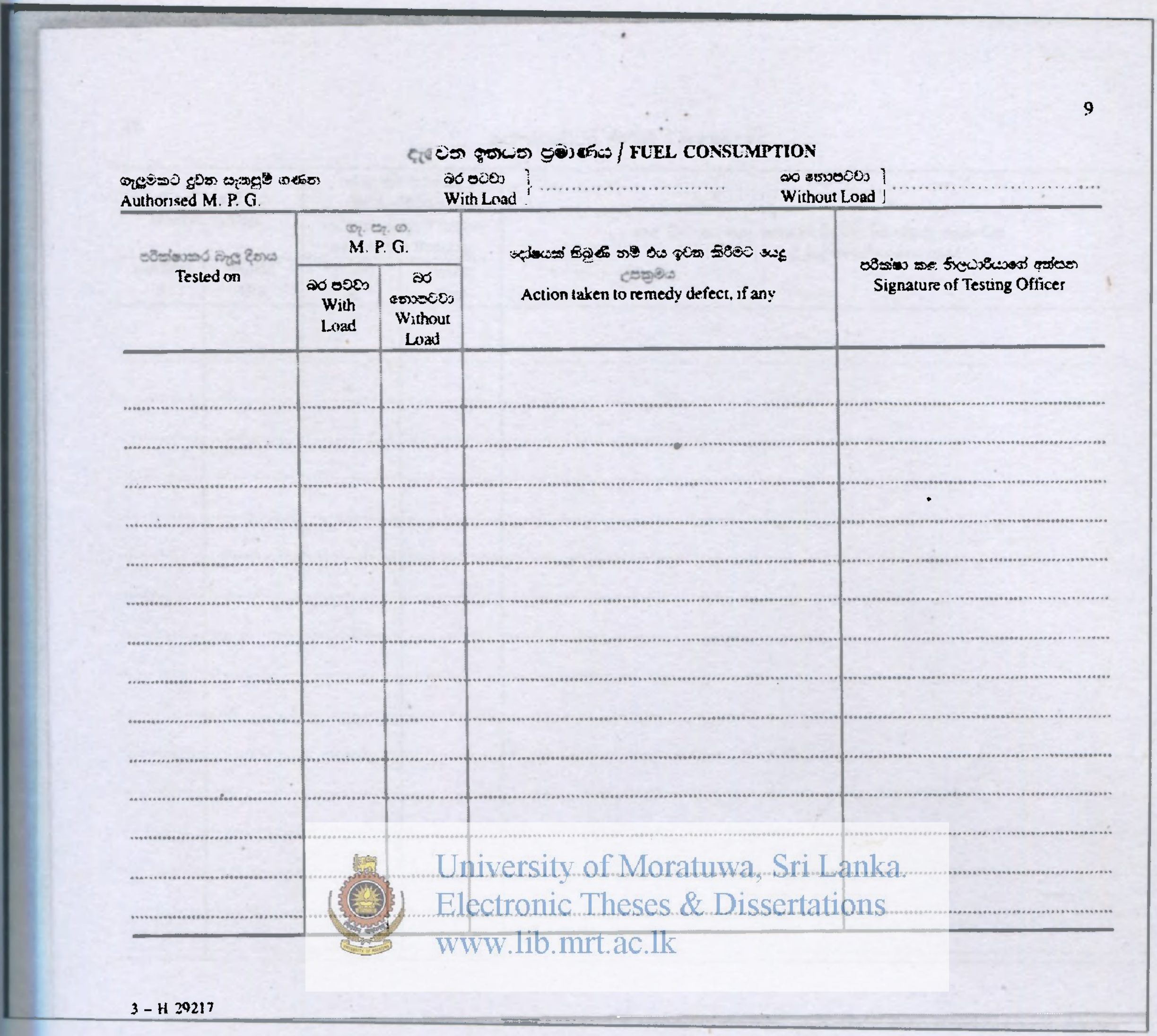
VEHICLE LOG BOOK

දෙපාර්තමේන්තු අංකය
Departmental Number } ....

ලියාපදිංචි කිරීමේ අංකය
Registration Number } ....



9

දැවෙන ඉන්ධන ප්‍රමාණය / FUEL CONSUMPTION

ගැලුමකට දුවන සැතපුම් ගණන Authorised M. P. G.   බර පටවා With Load ……………………   බර නොපටවා Without Load ……………………

පරීක්ෂාකර බැලූ දිනය Tested on	ගැ. සැ. ග. M. P. G.		දෝෂයක් තිබුණි නම් එය ඉවත් කිරීමට යෙදූ උපක්‍රමය Action taken to remedy defect, if any	පරීක්ෂා කළ නිලධාරියාගේ අත්සන Signature of Testing Officer
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3 – H 29217

අළුත්වැඩියා කිරීම් / REPAIRS

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යනවිට In	එනවිට Out	යනවිට In	එනවිට Out	

සර්විස් කිරීම

(මාසයකට වරක් බැගින් හෝ සැතැප්ම දාහෙන් දාහට හෝ සර්විස් කළ යුතුය)

SERVICING

(Servicing to be done monthly or at every 1,000 miles)

දිනය Date	මීටරයේ වැටී ඇති සැතැපුම් ගණන Meter Reading	තෙල් මාරු කිරීම, ඇන්ජිම, ගියරය, ඩිෆරින්ෂලය Oil Changes, Engine, Gear, Differential	භාර නිලධාරියාගේ කෙටි අත්සන Initials of O. I. C.	දිනය Date	මීටරයේ වැටී ඇති සැතැපුම් ගණන Meter Reading	තෙල් මාරුකිරීම, ඇන්ජිම, ගියරය, ඩිෆැරින්ෂලය Oil Changes, Engine, Gear, Differential	භාර නිලධාරියාගේ කෙටි අත්සන Initials of O. I. C.

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f Driver

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Date ..

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Fuel Position–

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Balance ..

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Engine Oil–

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Drawn Pints ..

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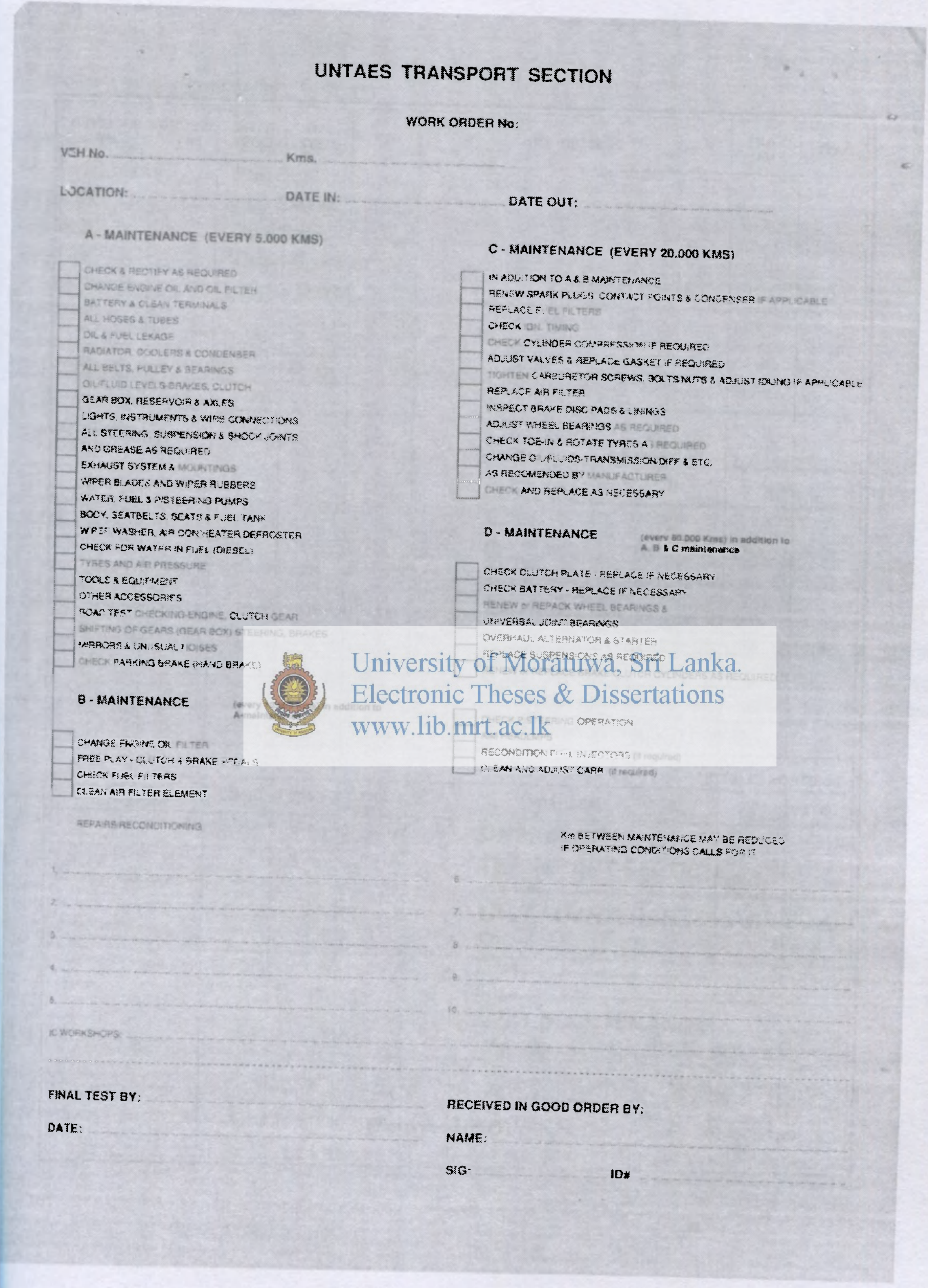
REMARKS

Appendix II

International Standard Preventive maintenance schedule for efficient fleet management



UNTAES TRANSPORT SECTION

WORK ORDER No:

VEH No. .... Kms. ....

LOCATION: .... DATE IN: .... DATE OUT: ....

A - MAINTENANCE (EVERY 5.000 KMS)

☐ CHECK & RECTIFY AS REQUIRED
☐ CHANGE ENGINE OIL AND OIL FILTER
☐ BATTERY & CLEAN TERMINALS
☐ ALL HOSES & TUBES
☐ OIL & FUEL LEKAGE
☐ RADIATOR, COOLERS & CONDENSER
☐ ALL BELTS, PULLEY & BEARINGS
☐ OIL/FLUID LEVELS-BRAKES, CLUTCH
☐ GEAR BOX, RESERVOIR & AXLES
☐ LIGHTS, INSTRUMENTS & WIRE CONNECTIONS
☐ ALL STEERING, SUSPENSION & SHOCK JOINTS
☐ AND GREASE AS REQUIRED
☐ EXHAUST SYSTEM & MOUNTINGS
☐ WIPER BLADES AND WIPER RUBBERS
☐ WATER, FUEL & P/STEERING PUMPS
☐ BODY, SEATBELTS, SEATS & FUEL TANK
☐ WIPER WASHER, AIR CON/HEATER DEFROSTER
☐ CHECK FOR WATER IN FUEL (DIESEL)
☐ TYRES AND AIR PRESSURE
☐ TOOLS & EQUIPMENT
☐ OTHER ACCESSORIES
☐ ROAD TEST CHECKING-ENGINE, CLUTCH GEAR
☐ SHIFTING OF GEARS (GEAR BOX) STEERING, BRAKES
☐ MIRRORS & UNUSUAL NOISES
☐ CHECK PARKING BRAKE (HAND BRAKE)

B - MAINTENANCE (every [illegible] in addition to A-maintenance)

☐ CHANGE ENGINE OIL FILTER
☐ FREE PLAY - CLUTCH & BRAKE PEDALS
☐ CHECK FUEL FILTERS
☐ CLEAN AIR FILTER ELEMENT

REPAIRS/RECONDITIONING

1. ....
2. ....
3. ....
4. ....
5. ....

C - MAINTENANCE (EVERY 20.000 KMS)

☐ IN ADDITION TO A & B MAINTENANCE
☐ RENEW SPARK PLUGS, CONTACT POINTS & CONDENSER IF APPLICABLE
☐ REPLACE FUEL FILTERS
☐ CHECK IGN. TIMING
☐ CHECK CYLINDER COMPRESSION IF REQUIRED
☐ ADJUST VALVES & REPLACE GASKET IF REQUIRED
☐ TIGHTEN CARBURETOR SCREWS, BOLTS/NUTS & ADJUST IDLING IF APPLICABLE
☐ REPLACE AIR FILTER
☐ INSPECT BRAKE DISC PADS & LININGS
☐ ADJUST WHEEL BEARINGS AS REQUIRED
☐ CHECK TOE-IN & ROTATE TYRES AS REQUIRED
☐ CHANGE OIL/FLUIDS-TRANSMISSION/DIFF & ETC.
☐ AS RECOMENDED BY MANUFACTURER
☐ CHECK AND REPLACE AS NECESSARY

D - MAINTENANCE (every 80.000 Kms) in addition to A, B & C maintenance

☐ CHECK CLUTCH PLATE - REPLACE IF NECESSARY
☐ CHECK BATTERY - REPLACE IF NECESSARY
☐ RENEW or REPACK WHEEL BEARINGS &
☐ UNIVERSAL JOINT BEARINGS
☐ OVERHAUL ALTERNATOR & STARTER
☐ REPLACE SUSPENSIONS AS REQUIRED
☐ RENEW or REPLACE BRAKE/CLUTCH CYLINDERS AS REQUIRED
☐ CHECK P/STEERING OPERATION
☐ AIM HEADLAMPS
☐ RECONDITION FUEL INJECTORS (if required)
☐ CLEAN AND ADJUST CARB (if required)

Km BETWEEN MAINTENANCE MAY BE REDUCED
IF OPERATING CONDITIONS CALLS FOR IT

6. ....
7. ....
8. ....
9. ....
10. ....

IC WORKSHOPS: ....

FINAL TEST BY: ....

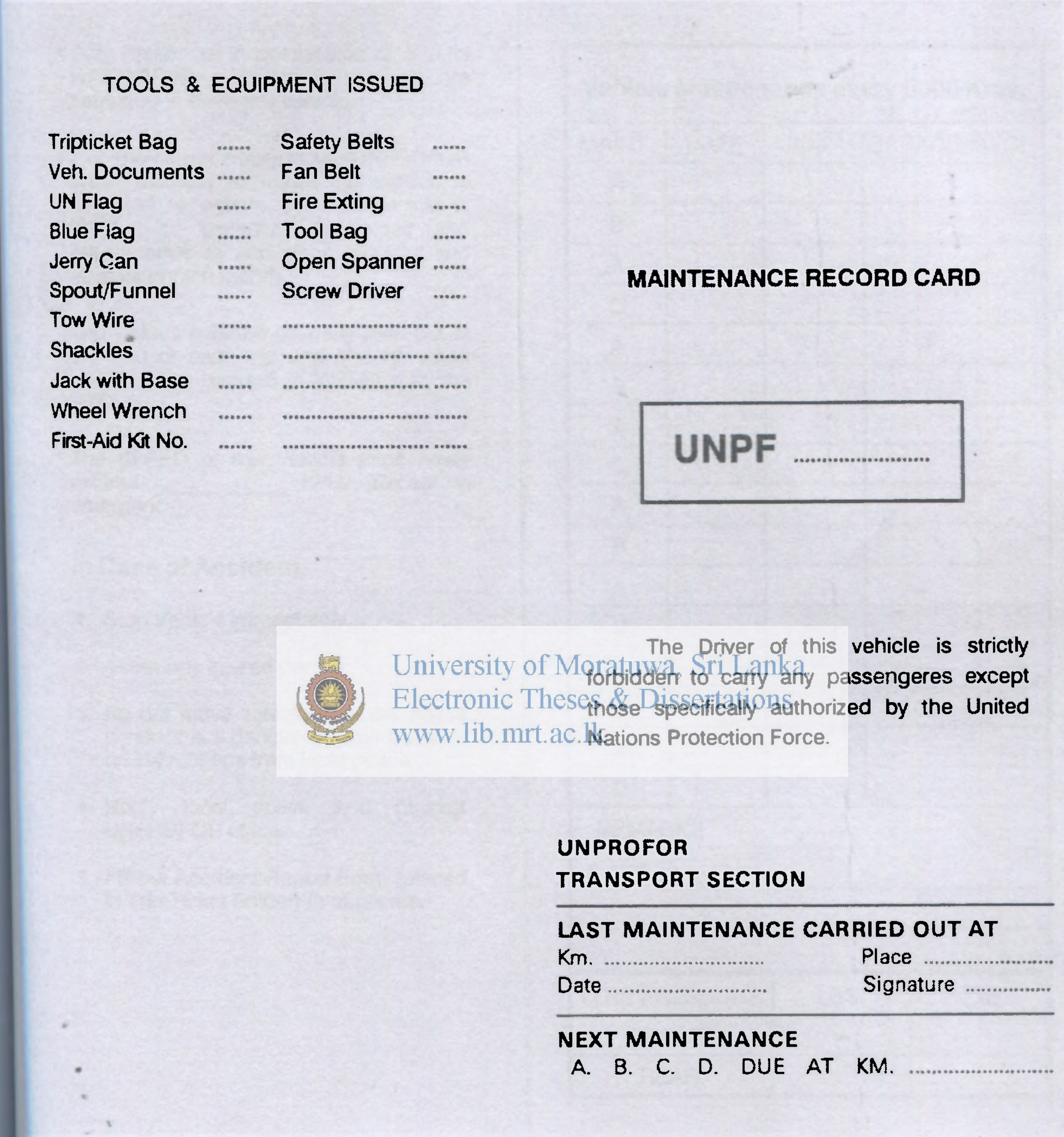
DATE: ....

RECEIVED IN GOOD ORDER BY:

NAME: ....

SIG: .... ID# ....

Maintenance Record Card



TOOLS & EQUIPMENT ISSUED

Tripticket Bag ......
Veh. Documents ......
UN Flag ......
Blue Flag ......
Jerry Can ......
Spout/Funnel ......
Tow Wire ......
Shackles ......
Jack with Base ......
Wheel Wrench ......
First-Aid Kit No. ......

Safety Belts ......
Fan Belt ......
Fire Exting ......
Tool Bag ......
Open Spanner ......
Screw Driver ......
....
....
....
....
....

MAINTENANCE RECORD CARD

UNPF ....

The Driver of this vehicle is strictly forbidden to carry any passengeres except those specifically authorized by the United Nations Protection Force.

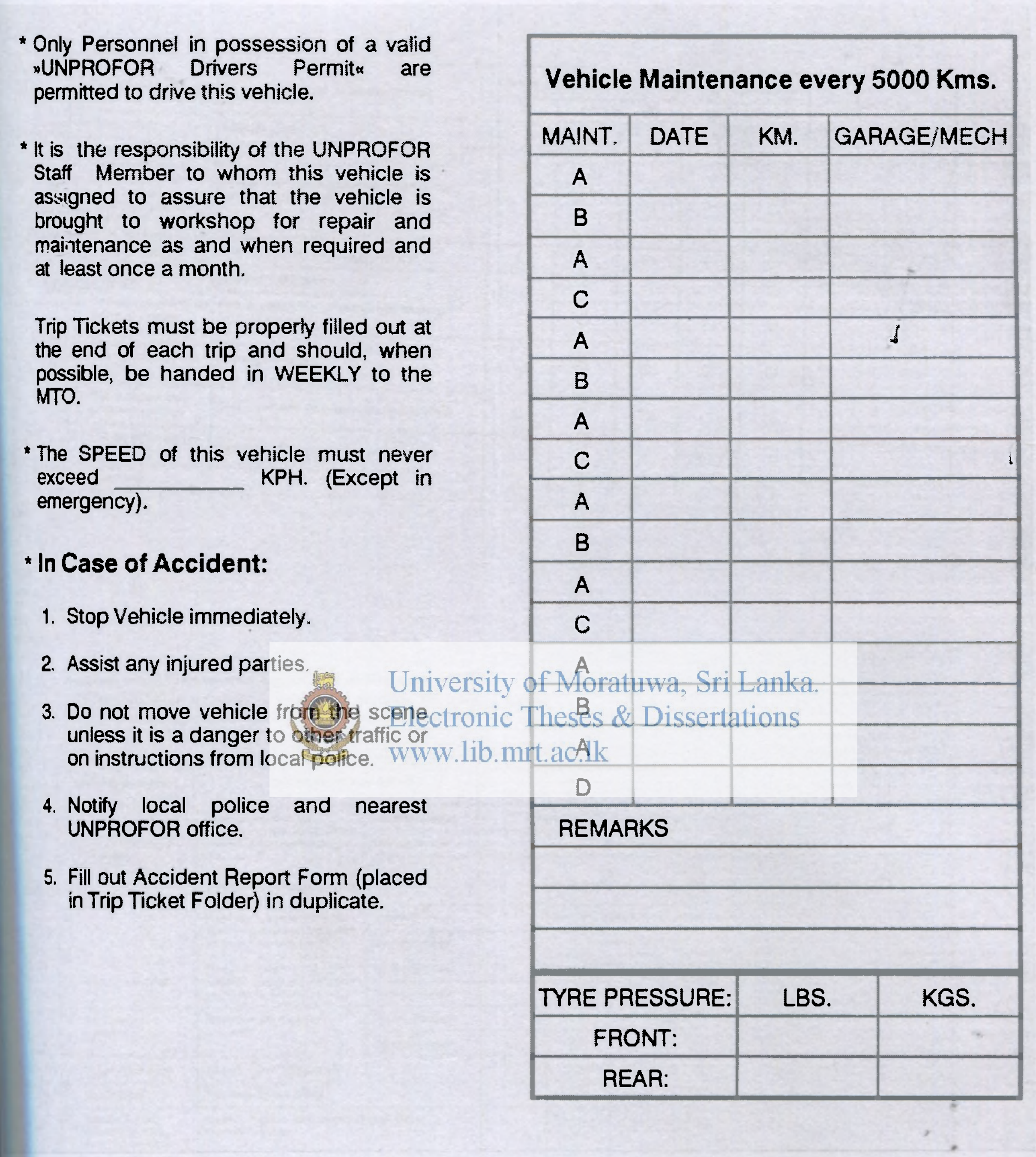
UNPROFOR
TRANSPORT SECTION

LAST MAINTENANCE CARRIED OUT AT
Km. .... Place ....
Date .... Signature ....

NEXT MAINTENANCE
A. B. C. D. DUE AT KM. ....

(Source: UNO)

Maintenance Record Card



- Only Personnel in possession of a valid »UNPROFOR Drivers Permit« are permitted to drive this vehicle.
- It is the responsibility of the UNPROFOR Staff Member to whom this vehicle is assigned to assure that the vehicle is brought to workshop for repair and maintenance as and when required and at least once a month.

Trip Tickets must be properly filled out at the end of each trip and should, when possible, be handed in WEEKLY to the MTO.

- The SPEED of this vehicle must never exceed ____________ KPH. (Except in emergency).

*** In Case of Accident:**

1. Stop Vehicle immediately.
2. Assist any injured parties.
3. Do not move vehicle from the scene unless it is a danger to other traffic or on instructions from local police.
4. Notify local police and nearest UNPROFOR office.
5. Fill out Accident Report Form (placed in Trip Ticket Folder) in duplicate.

Vehicle Maintenance every 5000 Kms.

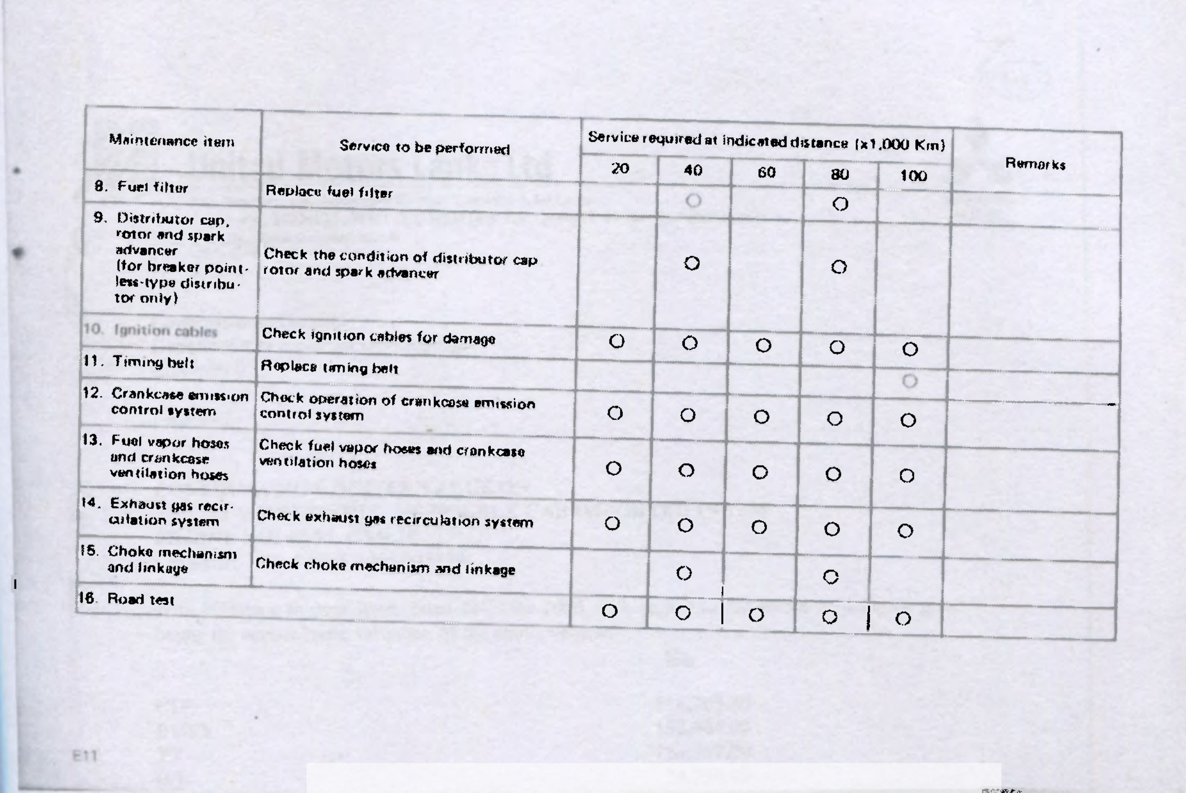
MAINT.	DATE	KM.	GARAGE/MECH
A			
B			
A			
C			
A			
B			
A			
C			
A			
B			
A			
C			
A			
B			
A			
D			

REMARKS

TYRE PRESSURE:	LBS.	KGS.
FRONT:		
REAR:		

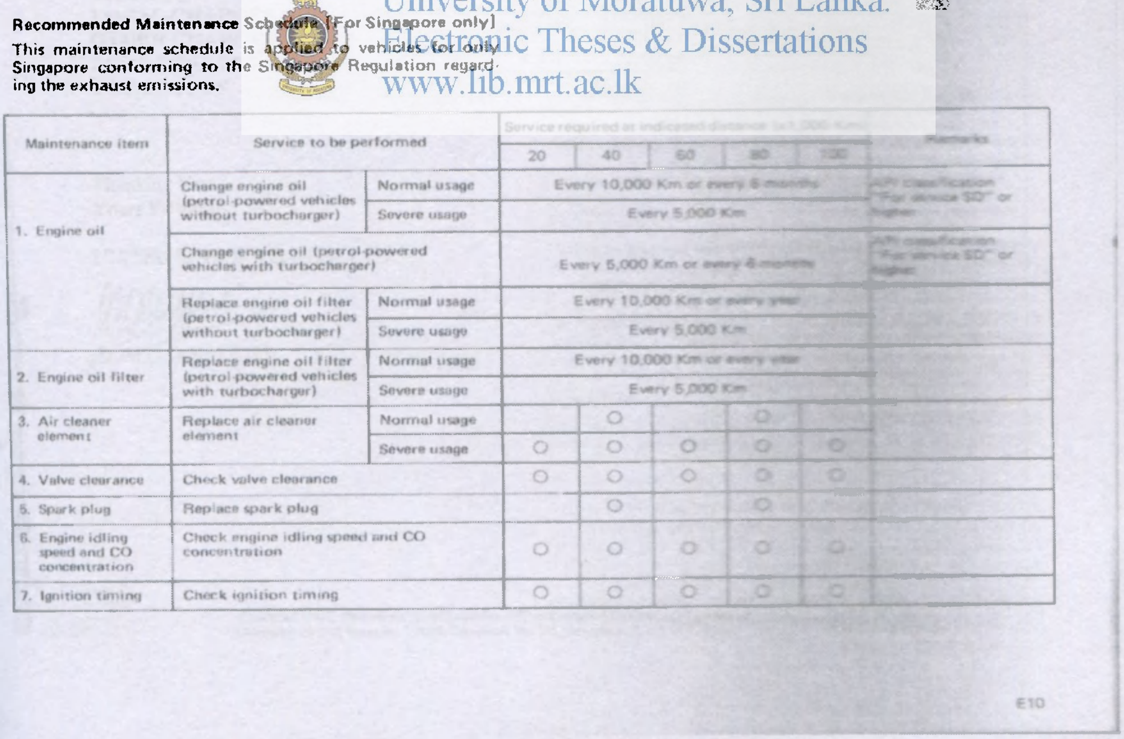
(Source: UNO)

Manufacturers recommended maintenance schedule



Maintenance item	Service to be performed	Service required at indicated distance (x1,000 Km)					Remarks
		20	40	60	80	100	
8. Fuel filter	Replace fuel filter		○		○		
9. Distributor cap, rotor and spark advancer (for breaker point-less-type distributor only)	Check the condition of distributor cap rotor and spark advancer		○		○		
10. Ignition cables	Check ignition cables for damage	○	○	○	○	○	
11. Timing belt	Replace timing belt					○	
12. Crankcase emission control system	Check operation of crankcase emission control system	○	○	○	○	○	
13. Fuel vapor hoses and crankcase ventilation hoses	Check fuel vapor hoses and crankcase ventilation hoses	○	○	○	○	○	
14. Exhaust gas recirculation system	Check exhaust gas recirculation system	○	○	○	○	○	
15. Choke mechanism and linkage	Check choke mechanism and linkage		○		○		
16. Road test		○	○	○	○	○	

E11



Recommended Maintenance Schedule [For Singapore only]

This maintenance schedule is applied to vehicles for only Singapore conforming to the Singapore Regulation regarding the exhaust emissions.

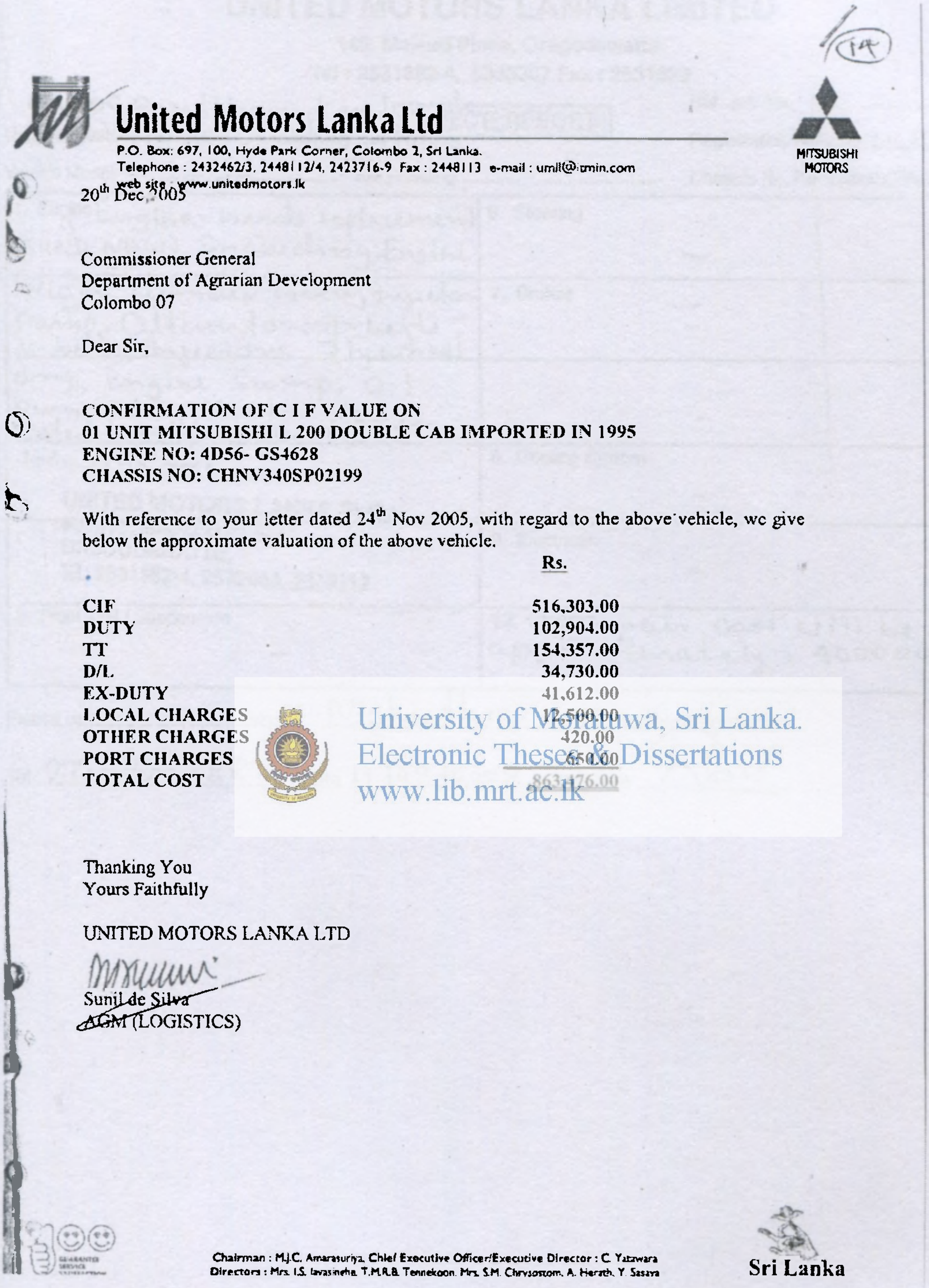
Maintenance item	Service to be performed		Service required at indicated distance (x1,000 Km)					Remarks
			20	40	60	80	100	
1. Engine oil	Change engine oil (petrol-powered vehicles without turbocharger)	Normal usage	Every 10,000 Km or every 6 months					API classification "For service SD" or higher
		Severe usage	Every 5,000 Km					
	Change engine oil (petrol-powered vehicles with turbocharger)		Every 5,000 Km or every 6 months					API classification "For service SD" or higher
	Replace engine oil filter (petrol-powered vehicles without turbocharger)	Normal usage	Every 10,000 Km or every year					
		Severe usage	Every 5,000 Km					
2. Engine oil filter	Replace engine oil filter (petrol-powered vehicles with turbocharger)	Normal usage	Every 10,000 Km or every year					
		Severe usage	Every 5,000 Km					
3. Air cleaner element	Replace air cleaner element	Normal usage		○		○		
		Severe usage	○	○	○	○	○	
4. Valve clearance	Check valve clearance		○	○	○	○	○	
5. Spark plug	Replace spark plug			○		○		
6. Engine idling speed and CO concentration	Check engine idling speed and CO concentration		○	○	○	○	○	
7. Ignition timing	Check ignition timing		○	○	○	○	○	

E10

(Source: Mitsubishi Motors Corporation – Japan)

APPENDIX III

Value of a brand new L200 4D56 double cab in year 1995



14

United Motors Lanka Ltd
P.O. Box: 697, 100, Hyde Park Corner, Colombo 2, Sri Lanka.
Telephone : 2432462/3, 2448112/4, 2423716-9 Fax : 2448113 e-mail : umll@umin.com
web site : www.unitedmotors.lk

MITSUBISHI
MOTORS

20th Dec 2005

Commissioner General
Department of Agrarian Development
Colombo 07

Dear Sir,

CONFIRMATION OF C I F VALUE ON
01 UNIT MITSUBISHI L 200 DOUBLE CAB IMPORTED IN 1995
ENGINE NO: 4D56- GS4628
CHASSIS NO: CHNV340SP02199

With reference to your letter dated 24th Nov 2005, with regard to the above vehicle, we give below the approximate valuation of the above vehicle.

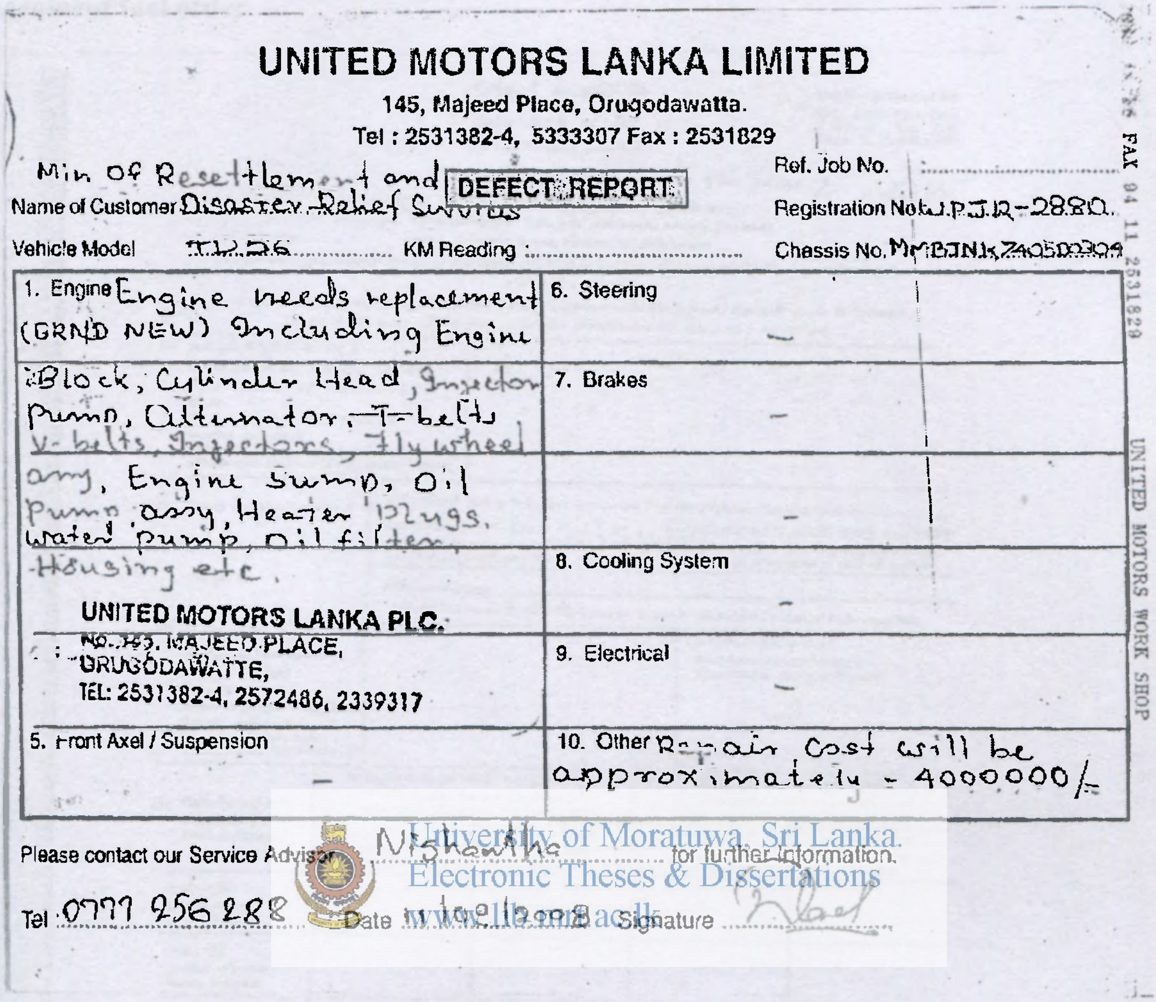
	Rs.
CIF	**516,303.00**
DUTY	**102,904.00**
TT	**154,357.00**
D/L	**34,730.00**
EX-DUTY	**41,612.00**
LOCAL CHARGES	**12,500.00**
OTHER CHARGES	**420.00**
PORT CHARGES	**650.00**
TOTAL COST	**863,476.00**

Thanking You
Yours Faithfully

UNITED MOTORS LANKA LTD

Sunil de Silva
AGM (LOGISTICS)

Value of the engine of L200 4D56 in 2008



FAX 94 11 2531829

UNITED MOTORS WORK SHOP

UNITED MOTORS LANKA LIMITED

145, Majeed Place, Orugodawatta.
Tel : 2531382-4, 5333307 Fax : 2531829

DEFECT REPORT

Name of Customer Min of Resettlement and Disaster Relief Services
Ref. Job No.
Registration No. WP JR-2880.
Vehicle Model [illegible]
KM Reading :
Chassis No. MMBJNK740500309

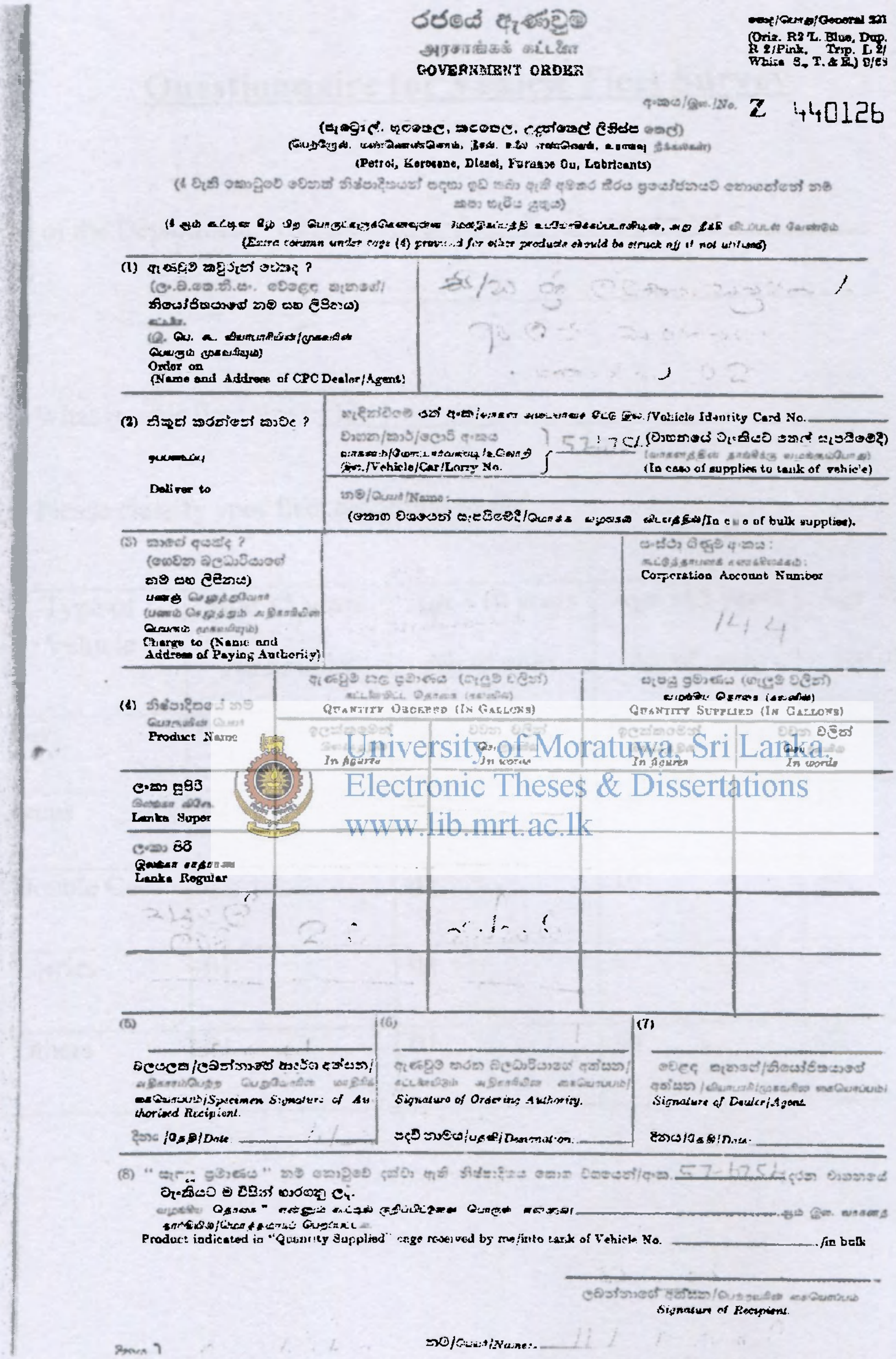
1. Engine Engine needs replacement (GRND NEW) Including Engine	6. Steering —
Block, Cylinder Head, Injector Pump, Alternator, T-belts V-belts, Injectors, Fly wheel	7. Brakes —
assy, Engine sump, Oil Pump assy, Heater plugs, water pump, Oil filter,	—
Housing etc. UNITED MOTORS LANKA PLC.	8. Cooling System —
NO. 145, MAJEED PLACE, ORUGODAWATTE, TEL: 2531382-4, 2572486, 2339317	9. Electrical —
5. Front Axel / Suspension —	10. Other Repair cost will be approximately - 4000000/=

Please contact our Service Advisor Nishantha for further information.

Tel 0777 256 288 Date 11.10.2008 Signature

APPENDIX IV

Government fuel order



රජයේ ඇණවුම

GOVERNMENT ORDER

General 231
(Orig. R2 L. Blue, Dup. R 2/Pink, Trip. L 2/White S., T. & E.) 0/63

අංකය/No. Z 440126

(පෙට්‍රල්, භූමිතෙල, ඩීසල්, උදුන්තෙල් ලිහිස්සි තෙල්)
(Petrol, Kerosene, Diesel, Furnace Oil, Lubricants)
(4 වැනි කොටුවේ වෙනත් නිෂ්පාදිතයන් සඳහා ඉඩ තබා ඇති අමතර තීරය ප්‍රයෝජනයට නොගන්නේ නම් කපා හැරිය යුතුය)
(Extra column under cage (4) provided for other products should be struck off if not utilised)

(1) ඇණවුම කවුරුන් වෙතද ?
(ලං.ඛ.තෙ.නී.සං. වෙළඳ නැතහොත්/නියෝජිතයාගේ නම සහ ලිපිනය)
Order on
(Name and Address of CPC Dealer/Agent)

(2) නිකුත් කරන්නේ කාටද ?
Deliver to

හැඳුනුම්පත් අංකය/Vehicle Identity Card No. ____________
වාහන/කාර්/ලොරි අංකය
Vehicle/Car/Lorry No. ____________ (වාහනයේ ටැංකියට සපයන විට) (In case of supplies to tank of vehicle)
නම/Name: ____________
(තොග වශයෙන් සැපයීමේදී/In case of bulk supplies).

(3) කාගේ අයට ද ?
(ගෙවන බලධාරියාගේ නම සහ ලිපිනය)
Charge to (Name and Address of Paying Authority)

සංස්ථා ගිණුම් අංකය:
Corporation Account Number

(4) නිෂ්පාදිතයේ නම Product Name	ඇණවුම් කළ ප්‍රමාණය (ගැලුම් වලින්) Quantity Ordered (In Gallons)		සැපයූ ප්‍රමාණය (ගැලුම් වලින්) Quantity Supplied (In Gallons)	
	ඉලක්කමෙන් In figures	වචන වලින් In words	ඉලක්කමෙන් In figures	වචන වලින් In words
ලංකා සුපිරි Lanka Super				
ලංකා පිරි Lanka Regular				
	2			

(5) ____________
බලපත්‍රලාභී/ලබන්නාගේ සාම්පල අත්සන/Specimen Signature of Authorised Recipient.
දිනය/Date ____________

(6) ____________
ඇණවුම කරන බලධාරියාගේ අත්සන/Signature of Ordering Authority.
පදවි නාමය/Designation ____________

(7) ____________
වෙළඳ නැතහොත්/නියෝජිතයාගේ අත්සන/Signature of Dealer/Agent.
දිනය/Date ____________

(8) "සැපයූ ප්‍රමාණය" නම් කොටුවේ දක්වා ඇති නිෂ්පාදිතය තොග වශයෙන්/අංක 57-1751 දරන වාහනයේ ටැංකියට මා විසින් භාරගනු ලදී.
Product indicated in "Quantity Supplied" cage received by me/into tank of Vehicle No. ____________/in bulk

____
ලබන්නාගේ අත්සන/Signature of Recipient.

නම/Name: ____________

APPENDIX V

Questionnaire

Questionnaire for Vehicle Fleet Survey

Name of the Department: Department of Agrarian Development

1) What is your fleet size? 113

2) Please classify your fleet according to age

Type of Vehicle	Age <5 years No of units	Age <10 years No of units	Age <15 years No of units	Age <20years No of units
Cars	01	02	03	04
Jeeps	02	03	10	15
Double Cabs	03	05	16	20
Lorries	01	04	07	09
Others	01	01	04	02

3) Average annual usage (miles traveled) in year 2008 per vehicle

Type of Vehicle	Age <5 years (Km)	Age <10 years (Km)	Age <15 years (Km)	Age <20years (Km)
Cars	20,603.5	18,663	9,683	6,205
Jeeps	27,853	20,273	15,123	11,123
Double Cabs	26,265	35,176	15,125	11,685
Lorries	18,643.3	14,997	12,873	9723
Others	24,256.04	20.635.2	16,123	10,756

4) Fuel Consumption & Cost in year 2008 per vehicle

4.1) Age below 5 years

Type of Vehicle	Average Km per liter
Cars	10
Jeeps	9.4
Double Cabs	9.5
Lorries	4.6
Others	8

4.2) Age below 10 years

Type of Vehicle	Average Km per liter
Cars	8.3
Jeeps	7.5
Double Cabs	7.4
Lorries	3.6
Others	7

4.3) Age below 15 years

Type of Vehicle	Average Km per liter
Cars	7.1
Jeeps	6.7
Double Cabs	6
Lorries	2.8
Others	6.2

4.4) Age below 20 years

Type of Vehicle	Average Km per liter
Cars	7.8
Jeeps	5.9
Double Cabs	5.1
Lorries	2.1
Others	5.2

5) Average annual major repair cost with ageing in year 2008 per vehicle

Type of Vehicle	<5 years Rs. million	<10 years Rs. million	<15 years Rs. million	<20years Rs. million
Cars	60,923.14	75,867	125,130	137,125
Jeeps	63,293	97,478	155,656	175,626
Double Cabs	62,506	66,265	131,300	243,126
Lorries	97,253.10	107,813	153,453	185,254
Others	47,856.43	63126,19	87,256	110,126

6) Average down time per vehicle

Type of Vehicle	<5 years (No of days)	<10 years (No of days)	<15 years (No of days)	<20 years (No of days)
Cars	06	11	26	40
Jeeps	09	15	28	42
Double Cabs	05	13	26	42
Lorries	15	23	31	58
Others	10	27	33	49

7) Do you implement a vehicle replacement policy?

Yes ☐ No ☒

If its yes what is your replacement method?

Year	Km

8) Do you maintain preventive maintenance program?

Yes ☐ No ☒

If its yes what type of maintenance do you apply?

You may select more than one answer

1) Maintenance in every 5000Km ☐

2) Maintenance in every 10000Km ☐

3) Maintenance in every 20000Km ☐

4) Maintenance in every 80000Km ☐

9) Please answer the questions by simply ticking in the appropriate box. Use the following criteria to rank availability of vehicles related to its age.

Criteria	Very Poor	Poor	Good	Very Good
Weightage	1	2	3	4

What is the availability of the vehicles according to age?

	1	2	3	4
9.1) Vehicle age below 5 year s	☐	☐	☐	4
9.2) Vehicle age below 10 years	☐	☐	3	☐
9.3) Vehicle age below 15 years	☐	2	☐	☐
9.4) Vehicle age below 20 years	1	☐	☐	☐

10) Do you have a maintenance data base system?

Yes ☐ No ☒

If your answer is no how you do keep records regarding maintenance and cost?

Manually

11) Do you have proper maintenance schedule?

Yes ☐ No ☒

12) What type of intelligence equipment does your organization use to improve fleet management efficiency? You may select more than one answer.

1) Car log system No

2) Car navigation system No

3) GSM No

If you don't possess an intelligence system what's the method you use to improve fleet management efficiency?

Running charts and log books, Fuel records

13) What is the percentage of vehicles pass the emission test?

Type of Vehicle	Age <5 years No of units	Age <10 years No of units	Age <15 years No of units	Age <20years No of units
Cars	90	82	45	22
Jeeps	90	82	45	22
Double Cabs	90	82	45	22
Lorries	90	82	45	22
Others	90	82	45	22

14) Please tick in the appropriate box to indicate to what extent that given statement are valid

Criterion	Very Low	Low	Medium	High	Very High
Weightage	1	2	3	4	5

14.1) Strength of purchasing new vehicles ☐ [2] ☐ ☐ ☐

14.2) Adequacy of financial facilities for vehicle rehabilitation ☐ [2] ☐ ☐ ☐

14.3) Adequacy for repair & maintenance Facilities ☐ [2] ☐ ☐ ☐

14.4) Availability of spare parts for aging vehicles ☐ [2] ☐ ☐ ☐

14.5) Technical efficiency of aging vehicle after rehabilitation ☐ [2] ☐ ☐ ☐

15) Please answer the questions by simply ticking the appropriate box. Follow the criteria to rank the driver's skill

Criterion	Very Low	Low	Medium	High	Very High
Weightage	1	2	3	4	5

15.1) Knowledge of automobile technology 1 ☐ ☐ ☐ ☐

15.2) Ability to identify defects while in operation ☐ 2 ☐ ☐ ☐

15.3) Ability to identify the causes of defects 1 ☐ ☐ ☐ ☐

15.4) Knowledge of preventive maintenance 1 ☐ ☐ ☐ ☐

15.5) Ability to identify original parts ☐ 2 ☐ ☐ ☐

APPENDIX VI

Summary of Data Collection

Data presenting order of departments

1) Department of Wild Life
2) Ministry of Public Administration and Home Affairs
3) Sri Lanka Customs
4) Postal Department
5) Ministry of Land and Land Development
6) Authority of Samurdhi
7) Ministry of Irrigation and Water Management
8) Forest Department
9) Department of Inland Revenue
10) Department of Education
11) Department of Agriculture
12) Department of Archaeology
13) Peoples Bank
14) Agriculture Insurance Board
15) Ministry of Labor
16) Ministry of Petroleum and Resource Development
17) Ministry of Provincial Council and Local Government
18) Presidents Secretariat
19) Survey Department
20) Department of Agrarian Development

Data of no. of vehicles in all sample departments according to age

Department	**0-5 years**				
	Cars	Jeeps	Double Cabs	Lorries	others
1	2	3	3	1	2
2	10	3	3	1	1
3	20	2	10	1	3
4	5	3	2	2	10
5	0	6	6	0	0
6	0	0	3	0	0
7	1	3	0	0	1
8	6	6	8	3	7
9	5	2	1	0	0
10	5	3	2	0	10
11	2	8	5	2	3
12	1	2	4	0	0
13	18	5	3	0	12
14	2	2	1	0	2
15	3	3	2	0	1
16	7	4	0	0	1
17	2	1	1	0	0
18	42	24	20	0	2
19	5	2	3	2	2
20	1	2	3	1	1
Total	137	84	80	13	58

Department	5-10 years				
	Cars	Jeeps	Double Cabs	Lorries	others
1	2	8	8	3	2
2	8	2	2	1	2
3	10	4	5	2	0
4	6	2	2	3	15
5	3	1	0	0	0
6	2	3	11	3	0
7	5	8	0	0	0
8	9	12	15	7	6
9	5	3	2	0	0
10	8	4	5	0	4
11	18	13	15	2	7
12	2	2	2	0	0
13	16	15	2	0	2
14	2	1	2	0	5
15	7	3	2	0	0
16	5	0	2	0	0
17	5	0	0	0	2
18	14	20	11	0	3
19	10	3	2	2	3
20	2	3	5	4	1
Total	139	107	93	27	52

Department	5-10 years				
	Cars	Jeeps	Double Cabs	Lorries	others
1	2	8	8	3	2
2	8	2	2	1	2
3	10	4	5	2	0
4	6	2	2	3	15
5	3	1	0	0	0
6	2	3	11	3	0
7	5	8	0	0	0
8	9	12	15	7	6
9	5	3	2	0	0
10	8	4	5	0	4
11	18	13	15	2	7
12	2	2	2	0	0
13	16	15	2	0	2
14	2	1	2	0	5
15	7	3	2	0	0
16	5	0	2	0	0
17	5	0	0	0	2
18	14	20	11	0	3
19	10	3	2	2	3
20	2	3	5	4	1
Total	139	107	93	27	52

Department	10-15 years				
	Cars	Jeeps	Double Cabs	Lorries	others
1	3	15	2	3	3
2	8	1	7	2	0
3	2	1	3	0	0
4	3	5	3	5	7
5	4	5	0	0	0
6	4	2	16	0	0
7	6	2	3	0	0
8	9	10	13	7	7
9	30	7	2	0	5
10	10	3	5	0	11
11	20	30	35	6	9
12	2	3	4	1	0
13	22	40	2	2	16
14	2	7	3	0	7
15	7	2	4	0	0
16	0	0	0	0	0
17	8	0	16	0	1
18	16	12	9	0	1
19	3	40	30	5	5
20	3	10	16	7	4
Total	162	195	173	38	76

Department	15-20 years				
	Cars	Jeeps	Double Cabs	Lorries	others
1	1	18	5	5	7
2	8	1	2	0	0
3	0	1	0	0	0
4	3	2	2	7	11
5	0	2	3	0	0
6	0	0	0	0	0
7	7	2	0	0	0
8	6	20	18	8	8
9	3	0	2	1	0
10	2	2	10	5	10
11	30	40	20	5	10
12	1	4	2	2	2
13	0	0	0	0	0
14	3	8	5	0	10
15	1	3	5	0	1
16	0	0	0	0	0
17	0	4	0	0	0
18	20	7	5	0	0
19	2	40	32	5	0
20	4	15	20	9	2
Total	91	169	131	47	61

Average per vehicle downtime data in all sample departments according to age in year 2008

0-5 years					
Department	**Down time per vehicle according to vehicle types (days)**				
	Cars	Jeeps	Double Cabs	Lorries	others
1	4	5	5	8	2
2	5	6	5	8	9
3	6	4	7	5	5
4	8	6	7	10	11
5	0	6	6	0	0
6	0	0	8	0	0
7	4	8	0	0	5
8	6	5	6	8	8
9	5	6	5	0	0
10	4	5	5	0	6
11	2	3	5	8	6
12	2	4	6	0	0
13	3	5	5	0	5
14	4	5	4	0	3
15	2	3	2	0	4
16	4	4	0	0	7
17	2	4	3	0	0
18	6	7	6	0	8
19	4	5	6	10	9
20	6	9	5	15	10

5-10 years					
Department	**Down time per vehicle according to vehicle types (days)**				
	Cars	Jeeps	Double Cabs	Lorries	others
1	9	14	18	9	15
2	19	12	11	10	27
3	15	14	15	16	0
4	13	10	12	19	20
5	16	10	0	0	0
6	12	13	15	14	0
7	15	18	0	0	0
8	10	15	16	20	15
9	15	18	18	0	0
10	15	18	16	0	16
11	11	15	16	19	16
12	10	14	12	0	0
13	14	15	11	0	13
14	16	18	18	0	15
15	10	12	14	0	0
16	0	0	18	0	0
17	16	0	0	0	27
18	18	17	17	0	19
19	15	17	16	20	21
20	11	15	13	23	27

	10-15 years				
Department	Down time per vehicle according to vehicle types (days)				
	Cars	Jeeps	Double Cabs	Lorries	others
1	20	35	28	30	30
2	28	20	30	30	0
3	30	28	30	0	0
4	24	27	26	28	30
5	28	30	0	0	0
6	27	22	30	0	0
7	28	25	26	0	0
8	22	25	28	30	21
9	25	28	27	0	40
10	26	27	28	0	36
11	28	27	34	39	30
12	25	26	24	32	0
13	28	30	24	38	30
14	27	30	29	0	32
15	30	28	29	0	0
16	0	0	0	0	0
17	8	0	39	0	35
18	28	35	30	0	29
19	35	38	36	39	31
20	26	28	26	31	33

15-20 years					
Department	**Down time per vehicle according to vehicle types (days)**				
	Cars	Jeeps	Double Cabs	Lorries	Others
1	63	50	48	58	45
2	50	45	50	0	0
3	0	60	0	0	0
4	50	45	45	55	50
5	0	50	45	0	0
6	0	0	0	0	0
7	45	40	0	0	0
8	42	50	45	65	49
9	45	0	55	67	0
10	45	45	50	60	50
11	43	51	53	67	55
12	49	53	51	75	50
13	40	45	55	68	48
14	46	50	50	0	44
15	45	45	44	0	46
16	0	0	0	0	0
17	0	50	0	0	0
18	45	48	50	0	0
19	60	55	54	75	0
20	40	42	42	58	49

Average per vehicle usage data of in all sample departments according to age in year 2008

0-5 years					
Department	Average usage per vehicle (Km)				
	Cars	Jeeps	Double Cabs	Lorries	others
1	21,665	25,344	33,336	21,863	17,963
2	18,254	28,663	25,925	18,264	16,886
3	21,683	36,587	29,956	24,100	30,365
4	26,463	48,654	35,988	18,575	36,175
5	0	40,275	35,875	0	0
6	0	0	36,264	0	0
7	29,958	59,872	0	0	47,963
8	23,676	40,154	59,265	19,263	47,859
9	27,872	47,106	54,356	0	0
10	29,695	58,996	47,987	0	46,125
11	27,276	32,975	30,365	21,628	20,863
12	30,156	48,258	42,143	0	0
13	32,975	57,463	47,956	0	48,586
14	29,663	47,785	36,175	0	16,853
15	17,952	29,663	23,256	0	36,254
16	36,163	47,875	0	0	17,856
17	36,365	42,155	38,463	0	0
18	36,252	60,256	48,385	0	17,623
19	30,636	48,223	42,063	36,726	23,156
20	20,604	71,853	26,265	18,643	24,256

5-10 years					
Department	**Average usage per vehicle (Km)**				
	Cars	Jeeps	Double Cabs	Lorries	others
1	17,161	18,465	16,764	15,850	16,375
2	16,533	23,165	22,743	15,623	7,223
3	18,756	33,624	26,724	18,963	0
4	24,155	35,943	28,822	14,482	30,890
5	18,121	32,763	0	0	0
6	21,609	54,175	30,685	26,464	0
7	20,165	35,997	0	0	0
8	17,453	23,269	35,175	14,427	45,712
9	23,956	41,935	38,126	0	0
10	24,106	53,992	35,885	0	35,875
11	22,563	27,675	38,758	18,765	17,657
12	26,233	42,363	30,365	0	0
13	26,572	54,165	35,835	0	42,163
14	26,416	35,853	35,085	0	14,958
15	16,875	23,207	38,174	0	0
16	0	0	37,873	0	0
17	33,625	0	0	0	17,823
18	33,678	54,163	35,106	0	15,166
19	24,267	42,156	38,023	30,125	20,873
20	18,663	20,273	35,176	14,977	20,635

10-15 years					
Department	Average usage per vehicle (Km)				
	Cars	Jeeps	Double Cabs	Lorries	others
1	12,804	13,992	14,916	12,852	13,496
2	12,868	20,965	16,221	12,121	0
3	14,475	26,754	18,636	0	0
4	18,953	26,421	19,321	12,175	24,325
5	15,663	25,375	0	0	0
6	18,964	36,850	24,711	0	0
7	12,225	15,257	20,753	0	0
8	15,722	17,143	35,006	12,122	87,508
9	11,171	36,158	22,663	0	17,158
10	17,567	35,922	32,763	0	32,956
11	11,270	18,163	12,758	12,256	14,403
12	14,863	30,165	26,457	12,163	0
13	19,642	27,663	33,626	12,162	33,685
14	18,663	29,925	23,992	0	12,162
15	14,173	17,864	12,785	0	0
16	0	0	0	0	0
17	24,262	0	24,634	0	15,957
18	24,252	36,728	33,672	0	11,257
19	18,156	36,023	30,176	18,356	16,811
20	11,683	15,123	15,125	12,873	16,123

15-20 years					
Department	Average usage per vehicle (Km)				
	Cars	Jeeps	Double Cabs	Lorries	others
1	10,088	10,265	11,532	9,645	11,653
2	7,262	16,992	14,765	0	0
3	0	14,383	0	0	0
4	5,960	17,575	120,217	9,675	10,875
5	0	18,375	15,243	0	0
6	0	0	0	0	0
7	6,324	12,121	0	0	0
8	9,623	11,525	15,075	9,628	10,803
9	7,935	0	18,756	8,992	0
10	12,266	23,887	20,563	9,675	11,176
11	7,263	8,156	7,956	8,950	11,802
12	9,620	18,254	14,275	9,636	9,653
13	10,656	16,103	21,675	8,775	11,257
14	9,563	23,782	17,872	0	9,711
15	10,185	9,123	8,957	0	10,175
16	0	0	0	0	0
17	0	14,465	0	0	0
18	17,428	24,758	18,321	0	0
19	9,623	24,055	18,026	9,627	0
20	6,205	11,123	11,685	9,723	10,756

Average per vehicle major repair cost data in all sample departments according to age in year 2008

0-5 years					
Department	**Average annual major repair cost per vehicle (Rs)**				
	Cars	Jeeps	Double Cabs	Lorries	others
1	50,765	66,053	65,856	110,337	72,856
2	43,125	60,256	59,853	96,255	87,953
3	55,252	63,660	62,285	89,457	110,565
4	51,125	75,863	73,945	115,263	65,576
5	0	78,256	77,282	0	0
6	0	0	80,656	0	0
7	75,163	79,865	0	0	89,226
8	53,125	76,076	71,763	115,663	65,207
9	67,278	73,882	72,899	0	0
10	75,235	77,953	75,120	0	857,570
11	75,256	76,283	80,366	47,563	45,114
12	57,565	71,570	65,248	0	0
13	45,286	64,563	57,256	0	67,287
14	49,132	73,956	110,852	0	49,256
15	56,758	62,625	60,454	0	101,296
16	65,278	956,871	0	0	76,723
17	73,126	109,206	247,213	0	0
18	97,372	87,086	103,258	0	75,356
19	73,250	75,627	85,682	115,703	87,250
20	60,923	63,293	62,506	186,433	24,256

5-10 years					
Department	Average annual major repair cost per vehicle (Rs)				
	Cars	Jeeps	Double Cabs	Lorries	others
1	65,564	125,785	78,763	135,953	77,963
2	54,823	123,482	84,902	125,886	99,823
3	67,587	135,575	85,758	125,256	0
4	87,783	119,285	88,245	127,263	75,572
5	108,725	165,758	0	0	0
6	90,263	130,121	82,857	159,256	0
7	105,626	115,364	0	0	0
8	95,662	127,032	825,675	117,163	79,175
9	75,683	132,506	85,892	0	0
10	110,672	135,275	96,300	0	110,672
11	91,806	134,922	80,423	125,861	62,163
12	95,153	101,356	76,322	0	0
13	77,356	99,535	75,726	0	101,673
14	142,032	164,933	85,683	0	61,387
15	101,656	197,258	73,320	0	0
16	0	0	170,223	0	0
17	118,255	0	0	0	123,827
18	125,843	122,763	78,893	0	87,251
19	113,325	125,853	77,226	147,263	92,156
20	18,663	20,273	66,265	18,643	24,256

10-15 years					
Department	Average annual major repair cost per vehicle (Rs)				
	Cars	Jeeps	Double Cabs	Lorries	others
1	87,763	165,655	153,165	175,145	103,257
2	190,702	271,813	165,657	215,352	0
3	143,182	175,493	155,806	0	0
4	127,952	165,683	155,128	141,121	102,862
5	135,783	197,508	0	0	0
6	110,758	175,523	197,586	0	0
7	135,784	145,763	175,560	0	0
8	110,193	143,563	163,255	131,356	87,856
9	87,585	185,634	185,156	0	268,587
10	125,756	175,228	180,156	0	125,635
11	109,902	137,853	19,087	15,620	731,304
12	125,765	165,873	160,825	350,126	0
13	84,256	115,890	195,603	320,120	116,392
14	97,552	175,756	189,985	0	79,637
15	123,273	225,672	187,758	0	0
16	0	0	0	0	0
17	14,016	0	180,500	0	175,357
18	175,160	190,576	142,176	0	110,853
19	140,165	136,123	190,205	225,080	97,883
20	19,683	15,123	13,125	12,873	16,123

15-20 years					
Department	Average annual major repair cost per vehicle (Rs)				
	Cars	Jeeps	Double Cabs	Lorries	others
1	225,673	177,257	1,944,146	190,275	117,863
2	195,702	391,800	195,657	0	0
3	0	258,763	0	0	0
4	195,651	227,423	180,158	195,246	148,236
5	0	202,501	278,583	0	0
6	0	0	0	0	0
7	191,165	225,156	0	0	0
8	167,465	161,827	211,685	143,842	111,513
9	204,683	0	215,858	318,227	0
10	274,963	410,663	264,256	425,163	135,556
11	113,826	141,506	221,301	190,267	1,038,570
12	147,256	175,352	225,763	475,163	127,834
13	144,705	193,566	205,683	470,000	215,921
14	125,235	195,801	255,483	0	110,259
15	210,865	275,163	201,464	0	309,452
16	0	0	0	0	0
17	0	215,856	0	0	0
18	183,506	210,853	243,257	0	0
19	215,636	197,763	253,785	375,076	0
20	6,205	11,123	243,126	185,256	110,126

Average per vehicle fuel consumption data in all sample departments according to age in year 2008

0-5 years					
Department	Average fuel Consumption per vehicle (km/L)				
	Cars	Jeeps	Double Cabs	Lorries	others
1	9.8	9.2	9.5	4.8	8.5
2	9.7	9.2	9.5	3.0	8.5
3	9.7	9.4	9.5	3.0	8.5
4	9.9	8.9	8.9	4.7	8.5
5	0	9.7	9.5	0	0
6	0	0	8.5	0	0
7	10.0	9.2	0.0	0	8.0
8	9.9	9.3	9.6	4.7	8.5
9	9.7	9.2	9.5	0	0.0
10	9.8	9.2	9.6	0	7.7
11	9.8	9.2	9.5	4.7	7.0
12	10.0	9.2	9.6	0	0
13	9.8	9.5	9.7	0	8.2
14	9.8	9.4	9.6	0	8.0
15	9.9	9.6	9.7	0	8.0
16	9.7	9.5	0	0	8.0
17	9.9	9.0	9.0	0	0.0
18	8.9	8.7	8.9	0	8.0
19	9.7	9.3	9.2	0.0	8.0
20	10.0	9.4	9.5	4.6	8.0

5-10 years					
Department	**Average fuel Consumption per vehicle (km/L)**				
	Cars	Jeeps	Double Cabs	Lorries	others
1	8.9	7.5	8.4	3.8	7.5
2	8.9	8.2	8.5	3.0	7.0
3	8.9	7.2	7.5	2.5	0
4	8.7	7.8	7.9	3.2	7.2
5	8.2	8.5	0	0	0
6	9.0	7.5	7.5	3.5	0
7	8.9	7.8	0	0	0
8	9.2	8.3	8.6	3.5	7.5
9	8.5	7.8	7.9	0	0
10	8.9	7.8	7.9	0	6.9
11	8.8	8.2	8.5	3.9	7.7
12	8.9	8.2	8.6	0	0
13	8.7	8.2	8.5	0	7.1
14	8.4	8.0	8.2	0	7.0
15	8.7	8.2	8.5	0	0.0
16	0.0	0	7.0	0	0.0
17	8.2	0	0	0	7.5
18	7.8	7.5	7.7	0	7.0
19	8.2	7.7	7.2	3.8	7.0
20	8.3	7.5	7.4	3.6	7.0

10-15 years					
Department	**Average fuel Consumption per vehicle (km/L)**				
	Cars	Jeeps	Double Cabs	Lorries	others
1	7.0	7.2	7.3	3.0	7.0
2	7.8	7.0	6.9	2.5	0
3	8.2	6.7	6.9	0	0
4	7.6	6.5	6.7	2.9	6.2
5	7.2	6.9	0	0	0
6	7.4	7.0	7.0	0	0
7	7.2	6.7	6.9	0	0
8	7.9	7.1	7.0	2.9	6.2
9	6.9	6.7	6.5	0	6.2
10	7.9	6.8	6.9	0	6.7
11	7.7	6.8	6.9	2.7	6.0
12	7.8	7.2	7.4	3.0	0
13	7.9	6.2	6.5	3.5	6.5
14	7.2	6.4	6.9	0	6.0
15	7.5	6.9	7.1	0	0
16	0	0	0	0	0
17	7.7	0	6.4	0	6.5
18	7.2	6.2	6.5	0	6.2
19	7.1	5.9	6.0	2.7	6.0
20	7.1	6.7	6.0	2.8	6.2

15-20 years					
Department	Average fuel Consumption per vehicle (km/L)				
	Cars	Jeeps	Double Cabs	Lorries	others
1	7.2	6.1	6.3	2.1	6.0
2	6.5	6.2	6.3	0	0
3	0.0	6.5	0	0	0
4	6.9	5.7	5.9	2.2	5.0
5	0	6.2	6.5	0	0
6	0	0	0	0	0
7	6.8	5.7	0	0	0
8	6.9	6.2	6.5	2.0	5.2
9	6.2	0	5.9	5.8	0
10	6.7	5.7	5.9	2.5	5.7
11	6.3	5.7	5.6	2.1	5.3
12	7.0	5.8	5.9	5.0	5.6
13	6.5	5.7	5.7	2.7	5.7
14	6.5	5.7	5.9	0	5.0
15	7.0	6.2	6.5	0	6.0
16	0	0	0	0	0
17	0	5.9	0	0	0
18	6.1	5.7	5.8	0	0
19	6.7	5.1	5.5	2.0	0
20	7.8	6.0	5.1	2.1	5.2