

# Preliminary Study on Current Process of Bus Component Inspection Among Public Bus Transport in Malaysia

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## Abstract

Public transport bus services are generally based on regular operation of transit buses, along a route calling at agreed bus stops according to a published public transport timetable. Types of bus services are urban transport, long distance transport, flexible bus services and specialist services. Buses services are sometimes delayed due to breakdown of the bus components. Therefore, continuous inspection of buses is needed to make sure they are in good condition to avoid any breakdown. The process of bus inspection in Malaysia is mostly carried out either by the bus company itself or sending the buses back to the bus manufacturers. A bus will be inspected daily, weekly or monthly based on the usage of the bus or mileage. A preliminary study was conducted to find out the preliminary screening process of a bus before it is used for a trip. A set of questionnaire with open and closed questions were presented to some of the bus companies through the workshop manager. The survey was conducted on five companies that run regular bus inspections in the country. The results showed that each company has its own process in the course of an inspection. Though there are companies that still use checklist form, there are companies that use special software and conduct online checks. In addition, there are also companies which inspect buses depending on the bus mileage. Mileage for bus inspections should be based on the type of bus service for either a short or long distance. Therefore, a strategic and futuristic plan has to be developed for systematic examination for proper management, safety, high reliability and reduce cut maintenance cost.

*Keywords:* Public transport, bus inspection, bus components, inspection process

## 1. INTRODUCTION

Bus service management is defined as managing bus parts for safety. A bus should be inspected either daily, weekly or monthly, since a breakdown is never expected. Most bus companies are required to use Original Equipment Manufacturer (OEM) specifications or interval suggested for maintenance servicing to avoid breakdown [1]. Many agencies use OEM service

manuals as the base to set up their own work rules and time standards [2]. There are also other agencies for maintenance service based on OEM and historical repairs. OEM includes the manual book of maintenance and management information about bus or transit that comes from the bus manufacturer.

Prior consideration of vehicle safety can prevent accidents and cut risks to the driver, passengers, or

other vehicles on the road [3]. Maintenance practices are regularly addressed to make sure that there is no unsafe vehicle on the road. Bus breakdown will increase the bus maintenance cost as mechanic needs to go to the site to find the cause of the breakdown and to fix it on the site if possible. In most cases, the bus towed back to the workshop depot, which is time consuming and costly. Proper bus service can decrease service interruptions during the service. A lot of studies have been conducted to look into how to reduce service interruptions based on historical data and time estimation of maintenance. It was found that most of the standards used in transit facilities are based on estimations from historical information from an information system containing preliminary work standards for division performed maintenance [4]. This is main reason that bus service schedule is implemented from historical maintenance and guided from the OEM.

The maintenance needed reference to the bus maintenance service schedule, but in most bus common operations, it does not have a fixed schedule; which is one of the problems for undertaking bus maintenance service in Malaysia. Therefore, this research was conducted to review the current process of managing bus components and also routine services to avoid bus breakdown and to reduce the cost of the maintenance. Maintenance service is very important to ensure safety, reliability and vehicle life cycle running smoothly. Systematic service maintenance can reduce service interruptions during vehicle operation. Minimizing the service interruption can cut the cost involved during maintenance. Maintenance cost is the second highest cost for vehicle system. Prior to purchase, a fixed schedule of components service maintenance is provided to make sure the bus companies to have systematic service schedule.

## **2. BUS MAINTENANCE INSPECTION AND OPERATION SERVICES**

Before starting any trip, each bus must undergo a routine or regular service of maintenance. Any part of the bus nearing a deadline will be replaced or repaired in advance to make sure safe travel and to minimize the next maintenance cost.

Public transport is delineated as exaltation that delivers immense capacity to take passengers at the time of his orchard, in contrast to each vehicle with smaller capacity [5]. The safety, reliability and bus vehicle life depend on the maintenance system employed by the bus agencies or manufacturer workshop. As previously mentioned, maintenance cost is the second highest expense group after vehicle operations. In public transit maintenance, the repair and inspection service seek minimization in costs and maximization of fleet use, and these fact shows that maintenance is vital in a bus transit system to cut the cost and to support funds to improve the services [7].

In most companies, routine inspection and maintenance services are performed according to the interval mileage and part lifetime. Maintenance managers and supervisors are able to prognosticate and perhaps use schedule inspections due dates or using preventive maintenance for planned engine or transmission repairs based on mileage intervals, hours operated or fuel used. The bus components have a routine maintenance for the technician to detect any part failure. Most bus drivers send their bus to the workshop after the buses have unexpected breakdowns, rather than routine inspection.

Bus maintenance inspection depends on their working services. The types of bus operation services are designed according to local needs such as bus rapid transit (BRT), express bus service, shuttle bus service, internal and private bus service, tour bus service and school bus service [9]. Bus operation service type depends on the mileage, either long or short distance. Some of the examples of bus operation services are:

- Urban transport services
- Long distance transport services
- Specialist bus services

### **2.1 Urban transport service**

Urban transport service is the transport operation service used for the short distance trip. There are several types of urban transport such as bus rapid transit (BRT), shuttle bus service, and tour bus service. BRT is an innovative bus transit system with advanced, high-speed and frequency that is

widely used in urban areas to connect passenger with other types of public transit such as trains [10]. Shuttle bus tour is for public mobility, for shorter trips along busy corridors. Tour bus service is catered for for tourist' sightseeing tours. In this bus service, the maintenance inspection is either by sending the bust to the bus manufacturer for the major services or conducting the repair itself for the minor services. In Malaysia, urban transport service such as BRT is run by RapidKL bus company and shuttle bus is run by City Liner or Metrobus bus company.

## **2.2 Long distance transport services**

Long distance transport services for long journey trip is such as express bus services. Express bus is the service intended to run faster and have limited stop trip to reach destination [11]. In Malaysia, express buses conducted by private bus companies are such as Transnasional Express, Mutiara Express, Sani Express, KKKL Express and so on. These express buses can fulfill one trip within 12 hours depending on the destination.

## **2.3 Specialist bus services**

Specialist bus services are used by organization for their own need, such as private bus service or school bus service. Private bus service depends on the agencies' need, such as the UTM bus run by University of Technology Malaysia management for transporting students to the campus or residential area.

## **3. METHODOLOGY**

The study aims to outline the process of bus inspection before it is permitted for a trip. Five bus companies voluntarily participated in this study. Data collection was done using a set of questionnaire with open and closed questions distributed to the respective bus companies through the workshop manager.

The questionnaire consists of survey questions regarding bus inspection process about:

- Demographic profile
- Bus maintenance services

- Bus management system
- Bus detail inspection

### **3.1 Demographic Profile Survey**

The outline of demographic profile required the bus companies profiles participating in this study. The profile included participant name, company name, participant place and company operation services. The demographic information were important to acknowledge the companies participating in the study.

### **3.2 Bus Maintenance Services Survey**

This survey was conducted to know the process of bus maintenance services in Malaysia, which included inspection type, part service interval, information of components with frequent breakdown or easily broken and the highest estimated cost of part repairing. These information are the main course of this study, as they would be used to estimate the mileage interval for maintenance inspection servicing and for a futuristic plan of part service.

### **3.3 Bus Management System Survey**

This survey was conducted to gather information on maintenance process management in Malaysia, especially on the type of maintenance management used by most bus companies in Malaysia. This process is usually done by either using checklist form or computerized applications for every maintenance servicing.

### **3.4 Bus Detail Inspection Survey**

This survey was conducted to gather information about the type of bus used by most companies in Malaysia. It was also done to know the best and also the most preferred bus model for bus operation servicing between bus companies in Malaysia.

## **4. RESULTS AND ANALYSIS**

Questionnaires were sent to ten (10) selected bus companies but only five (5) bus companies responded to the questionnaire. Table 1 summarizes the demographic profile of the bus companies, which consists of three (3) express buses, one (1) shuttle bus and one (1) private bus services.

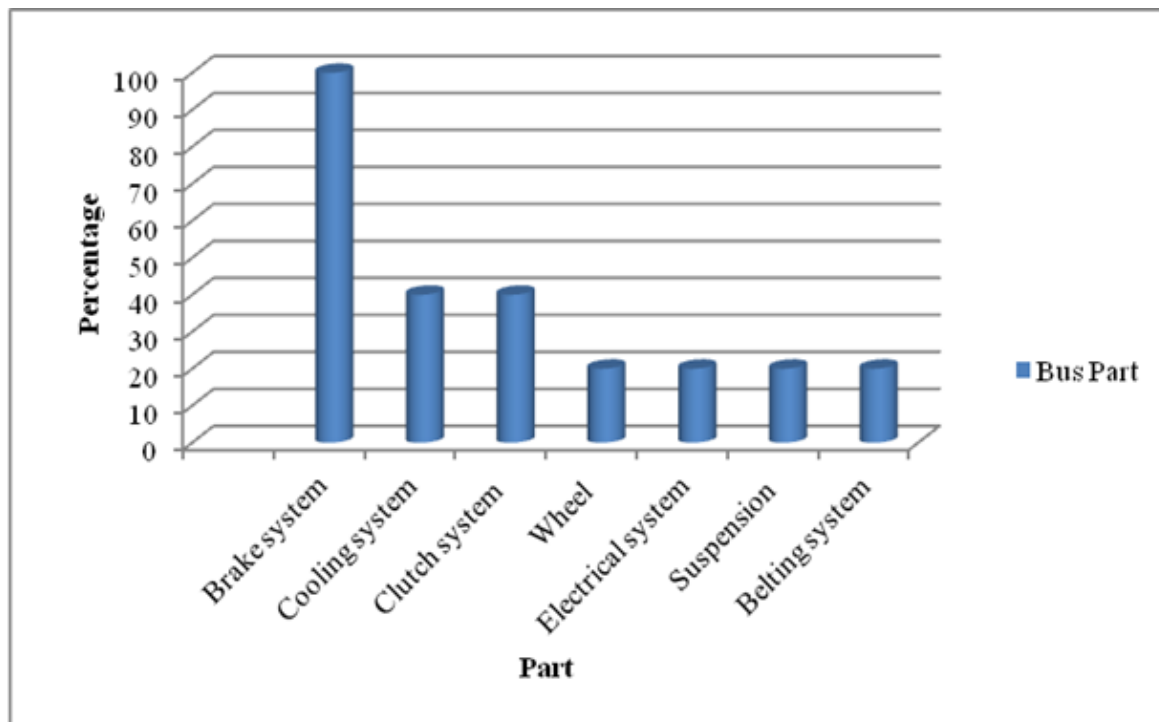
**Table 1: Demographic profile**

No	Bus company name	Type of company	Type of operation services
1.	Scania (Malaysia) Sdn. Bhd	Bus manufacturer	Express and private bus service
2.	Consortium E-Mutiara Berhad	Private agencies for commercial use	Express service
3.	Badan Bas Sdn Bhd	Private agencies for commercial use	Express service
4.	Syarikat Kenderaan Melayu Kelantan Bhd	Private agencies for public mobility	Shuttle bus service
5.	Universiti Teknologi Malaysia Kuala Lumpur	Private agencies for internal use	Private bus service

The maintenance interval on repairing of bus components was divided into three sections as below:

i. Long distance transport services

- Major inspection for mileage of 75000 km for services operated by private company and 240000 km operated by bus manufacturer.
  - Minor inspection for mileage of 10000 km for services operated by private company and 600000 km operated by bus manufacturer.
  - The mileage of routine inspection operated by bus manufacture is 25000 – 30000 km.
- ii. Urban transport services
- Major and minor inspection for shuttle bus services with mileage of 10000 km for every service operated by bus manufacturer only. Shuttle bus operators do not conduct maintenance themselves. They always send their buses to manufacturers for routine services.
  - The routine inspection operated by bus manufacture for every interval of 10000 km/mileage.



**Figure 1.** Parts that require frequent inspection or replaced regularly

iii. Specialist bus services

- Major inspection for mileage of 20000 km for private bus services operated by private company and manufacturer (if not having main mechanics). This mileage marks bus component change of oil and filter. Other parts are only checked if they are still intact or need to be replaced.
- Minor inspection for mileage of 5000 km for private bus services operated by private company and bus manufacturer (if not having main mechanics). This mileage marks bus component change of oil and filter. Other parts are only checked if they are still intact or need to be replaced.

- Routine inspection operated by the company or bus manufacturer at every interval of 5000 km.

Figure 1 shows the parts that require frequent inspection or replaced regularly. The figure also shows that all respondents agreed that brake system is the main part prone to damage. This is followed by cooling system (40%), clutch system (40%), wheel (20%), electrical system (20%), suspension (20%) and belting system (20%). Figure 2 shows the parts with higher cost to repair, depending on the level of damage. The result shows that suspension is the most expensive part to repair with the cost of over RM 30,000, followed by engine overhaul (over RM 20,000), manual transmission (over RM 15,000), rear axle (over RM 10,000), air cooler (over RM 5,000) and clutch system (over RM 3,000).

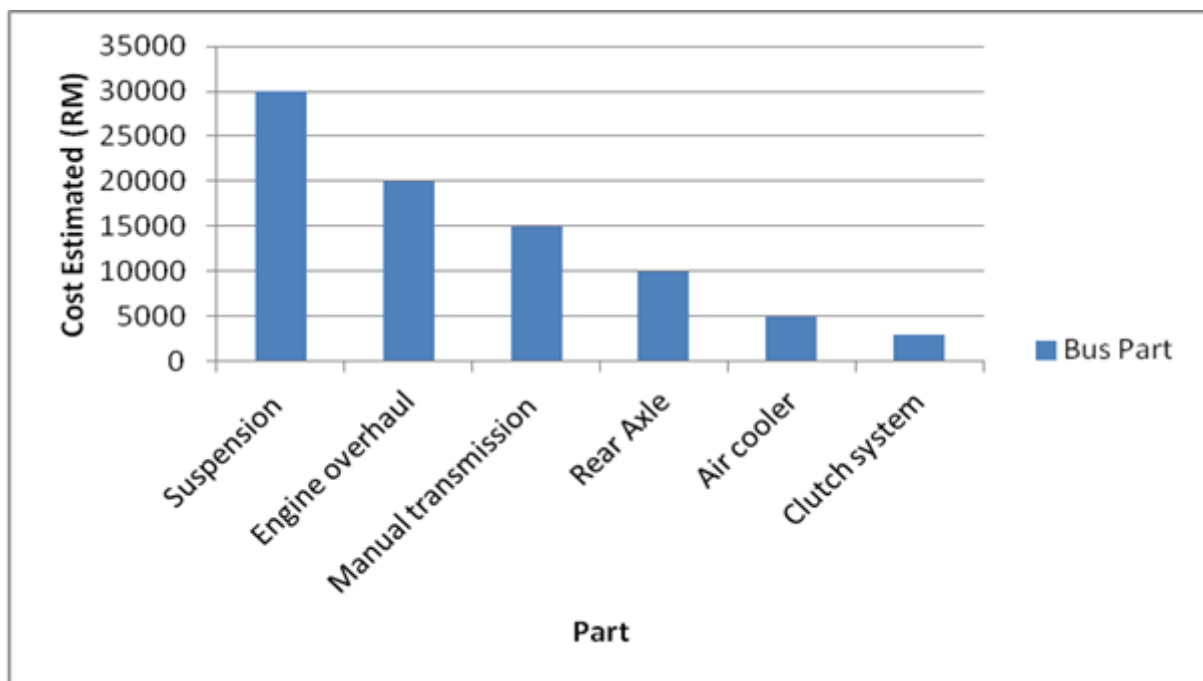


Figure 2. Parts with high cost of repairing

Table 2 shows the current method for bus inspection. There are three (3) types of bus inspection method such as using checklist form, computer system and combining both form and computer system. The computer system is used to insert and close job maintenance, including a database that has complete data of conducted bus and services. The maintenance and management of the bus are also done by online checks controlled by the main office in other country such as Sweden.

The result as shown in Table 3 shows that one (1) Express bus and one (1) Private bus companies use the checklist form, while two (2) Express buses and one (1) Shuttle bus companies use both form and computer system methods. None of the bus companies use the computer system as their tools to do the inspections process.

**Table 2: The current method of bus inspection**

No.	Method used	No. of Responses / Operation service
1.	Checklist Form	1 / Express 1 / Private
2.	Computer system	None
3.	Form and computer system	2 / Express 1 / Shuttle

Table 3 shows the frequent bus models used for service operation and their routine services. The survey shows that there are several bus models used as transport in Malaysia, such as HINO, ISUZU, NISSAN, MAN, SCANIA and DAEWOO.

**Table 3: Bus model used for service operation and their routine services**

No.	Model used (Manufacture)	No. of Responses / routine services
1.	HINO	1 / 5000 km (private)
2.	ISUZU	1 / 5000 km (private)
3.	NISSAN	1 / 5000 km (private) 1 / 10000 km (shuttle)
4.	MAN	1 / 25000 km (Express)
5.	SCANIA	2 / 30000 km (Express) 1 / 10000 km (Shuttle)
6.	DAEWOO	1 / 20000 km (Express) 1 / 10000 km(Shuttle)

Table 3 shows that most private bus companies in Malaysia purchase the SCANIA bus model from Sweden. This is because this model's operation service is more modern and complete with all maintenance services operated by the manufacturer itself. Thus, this model is the most economically suitable for long distance transport bus services for commercial and public safety. Table 3 also shows the routine inspection of each bus model, where they are usually inspected after every mileage of 5000 km, 10000 km, 20000 km and 30000 km. Private bus companies conduct routine inspection for every 5000km/mileage and extended services for 20000km/mileage, but only for oil and filter. Other parts are only checked if they are still intact or need to be replaced. The services are continued after every 5000 km/mileage. One of the buses checked had reached mileage deadline of 280000 km. Shuttle buses are given routine inspections or sent to the manufacturer after every 10000km/mileage. The operators do not conduct

the maintenance themselves, and all maintenance and servicing are done by the manufacturer. Express buses operated by manufacturers are given routine inspections after two interval mileage according to the type of engine oil used. The usual oil used is RX SUPER for 30000 km and SLD oil for 60000 km (minor inspection or routine services). For major or extended services, RX SUPER is used for 60000 km and SLD oil for 120000 km. The scheduled interval of servicing is S → M → S → L and it continues until the bus cannot be used anymore (reaching the mileage of 1.5 or 2 million).

- S (60000 km) → M (120000 km) → S (18000 km) → L (240000 km)
- S inspection: minimum basic inspection
- X inspection: more extensive inspection
- L inspection: includes all inspection steps

Express bus operated by the company itself – use four types of service which are A, B1, B2 and C.

- Service A - minor inspection after every 10000 km.
- Service B1 - minor inspection after every 25000 km.
- Service B2 - major inspection after every 50000 km.
- Service D - major inspection after every 75000 km.

Servicing also depends on bus model. The routine services for maintenance is usually after every 25000 km to 30000 km.

## 5. CONCLUSION

This paper has discussed the current process of inspection used and also routines inspections by bus companies in Malaysia. The current process of inspection used in Malaysia depends on the type of bus operation such as urban, long distance or private services. Computer system for bus maintenance and management is used for urban and long distance transport services. Private services only use checklist form for bus management and inspection. Online check is used by bus manufacturers because it can be controlled from international main office. In Malaysia, as stated in the standard operating procedure in bus manual, the maintenance services can be operated by the



company itself or sent to the bus manufacturer. Most bus companies in Malaysia prefer to send their buses to the bus manufacturer for maintenance. Only a few bus companies conduct the maintenance themselves to reduce the maintenance budget. Every company also has their futuristic plan for maintenance inspection by setting interval mileage for bus components.

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