

# Audit of Frequent Breakdown of Metro Mass Transit Limited Buses at the Tamale Depot

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## Abstract

The study required to investigate the causes of frequent breakdown of Metro Mass Transit Limited buses at the Tamale depot in Ghana. A cross-sectional survey design with quantitative data was gathered for the study. The population of the study comprised all the twenty (20) mechanics of Metro Mass, thirty (30) randomly selected drivers of Metro mass and a stratified sampling method was used to select 200 passengers of Metro Mass from some ten selected districts in the Northern Region of Ghana making a total population of 250 for the study. Self-administered questionnaires were used to solicit information from participants. The findings of the study revealed that bad maintenance culture had contributed to the frequent breakdown of metro mass transit limited buses at the Tamale depot. The study therefore recommended that, the company should prepare a good maintenance policy for all their depots across the country Ghana.

**Keywords:** Frequent; Breakdown; Audit; Transit; Maintenance cost; Depot.

## 1. Introduction

Metro Mass Transit Limited (MMT) is a public transportation company owned by the government of Ghana. The company was formed in 2003 as part of the social intervention drive the then government was embarking on. The company was mandated to make transportation cheaper and accessible to every Ghanaian. Students and the aged initially boarded the buses free without paying but now they are been ask to pay fare.

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The mission and vision of the MMT is to set up a public transport system with integrated network of scheduled buses interlinking residential areas, business districts, bus terminals, suburbs and villages in a reliable, efficient, safe and affordable manner. The focus of MMT is presently on the short and medium distances, (intra-city transport). Transportability refers to the ease of movement of passengers, freight or information [1]. Political factors such as laws, regulations, borders and tariffs can influence transportability. When the cost of transportability is high, activities are less constrained by distance. Infact the purpose of transportation is to fulfill a demand for mobility, since transportation is only achieved if people, freight and information are moved around. This is because transportation is dominantly the outcome of a derived demand. Distance, a core attribute of transportation may be expressed in a variety of ways; ranging from a simple Euclidean distance, a straight line between two locations to logistical distance. Transportation is one of the most important human activities worldwide [2]. It is an indispensable component of the economy and plays a major role in spatial relations between locations. Transportation creates valuable links between regions and economic activities, between people and the rest of the world. Therefore transportation is a multidimensional activity whose importance is evident in all human endeavors.

- **Social.** Transport modes facilitate access to healthcare, welfare, and cultural or artistic events, thus performing a social service. They shape social interactions by favoring or inhibiting the mobility of people. Transportation thus support and may even shape social structures.
- **Political.** Governments play a critical role in transportation as sources of investment and as regulators. The political role of transportation is undeniable as governments often subsidize the mobility of citizens. Transportation thus has an impact on nation building and national unity, but it is also a political tool in Ghana. This is because politicians based the improvement of the economy on how the masses have access to reliable, affordable, efficient and available transportation system in the country [2].
- **Economic.** The evolution of transportation has always been linked to economic development [2]. The transport sector is also an economic factor in the production of goods and services. It contributes to the value-addition of economic activities, facilitates economies of scale, influences land (real estate) value and the geographic specialization of regions [2].

MMT established two main departments to oversee the day today activities of the company; the Technical department ensures that, the company buses are well maintained and road worthy. It also advises management on Technical issue concerning the company. On the other hand, the administrative department ensures that administrative issues of the company including finance and human resource as well as spare parts are well managed for effective functioning of the company. MMT established depots in all the ten Regions of Ghana. The Tamale depot is one of the major depots with greater number of buses. Currently, the depot operates with about forty (40) buses out of the total fleet of ninety (90) buses. Tamale depot has many routes, because of the large geographical area of the Northern Region. Furthermore, most commercial vehicles do not ply on most of the routes because of the bad nature of the roads. Bad roads increase vehicle maintenance cost, upon this fact that most private transport operators are hesitant to ply on these roads. Moreover, Motorists and transporters face a lot of inconvenience due to bad roads [3]. The poor road conditions have increased the vehicle maintenance costs of city transporters. Bad roads are damaging the suspension, steering box and shock absorbers of many buses [3]. Most of the roads in the Northern Region (Tamale to Gushegu, Tamale to Saboba,

Tamale to Bimbila, Bimbila to Kpandai) are in very deplorable state such that if a passenger (traveler) misses a scheduled transport on these routes, he/she has to return the next day to be able to travel to his or her destination. This shows the crucial role of MMT in the Northern Region of Ghana. An audit of this nature is intended to reveal the circumstances causing MMT buses to break down frequently. To date, however, there has not been any research to investigate the causes of the frequent breakdown of the MMT Buses at the Tamale depot. Therefore it is essential to conduct an empirical study to investigate the causes of the frequent breakdown of the MMT Buses at the Tamale depot.

Despite the numerous benefits that would be derived from this research, the researchers anticipate real challenges that would attempt to bedevil this study. The following are some of the anticipated limitations that are likely to slow down the progress of this study.

- Getting access to passengers who are scattered all over the Northern Region in Ghana.
- Willingness of Metro Mass Transit Limited staff to volunteer information.
- The findings of this study should not be generalized to all MMT depots across the country as the respondents involved were workers of MMT at the Tamale depot only.

### ***1.1 Research Question***

To what extent do bad maintenance culture leads to frequent breakdown of MMT buses at the Tamale depot?

## **2. Literature**

The study adapted Maintenance Theory of Reliability (MTR) as the theoretical framework to investigate the causes of frequent breakdown of MMT buses at the Tamale depot [4]. Reliability is the science of maintenance; it uses statistics and failure theory to measure and improve the performance of equipment and vehicles. Reliability theory guides engineers as they design and test new equipment. Similarly, after equipment has been in service, reliability data tells the engineer how to improve its performance and possibly its life span [4].

As the Gulf Wars demonstrated, MTR has produced outstanding results in the USA defence [4]. Regrettably, little of this knowledge has found its way into industry. Most maintenance operations still operate on the principle of "if it is not broken, don't fix it". This breakdown theory of maintenance generates several undesirable effects:

For example, when a (\$38) roller bearing on a plastics extruder fails, the resulting misalignment of the shaft destroys the gears and the pinion shaft, three other bearings and an oil seal leading to sudden stoppage which causes plastic to freeze in the barrels. As a result, the total cost is about (\$13,000) plus three days of lost production [4]. A routine inspection using vibration analysis or even the touch and hearing of an experienced mechanic could have prevented almost all of this loss [4].

Frequent breakdown is one of the reasons for excessive inventory buffers [4]. Such inventory allows other production to proceed while breakdown is fixed but this inventory is expensive. Moreover, there are other

associated costs such as space, tracking and insurance. At least 75% of quality problems have a maintenance component. This causes customer dissatisfaction, scrap and further bloats inventory [4]. Therefore maintenance is one of the most important tools in the transportation industry if vehicle break down is to be reduced or eliminated.

## ***2.1 Maintenance***

Maintenance may be defined as 'Engineering Actions' necessary for retaining or restoring a piece of equipment, machine, or system to the specified operable condition to achieve its maximum useful life [5].

Maintenance has also been defined as 'work that is carried out to preserve an asset to ensure continued use and function, above a minimum acceptable level of performance [6].

## ***2.2 Types of maintenance***

### ***2.2.1 Corrective maintenance (cm)***

Conscious decision is made to neglect an asset until it fails or until some type of problem emerges. This maintenance strategy is therefore also referred to as "Run to Failure" (RTF) or "Fit and Forget" (F&F). No routine maintenance tasks are performed and the only "planned" maintenance on the asset is corrective maintenance; that is after a problem necessitates some action [6].

Corrective maintenance, the owners anticipate the consequences of their planned inaction, they are ready for these consequences and they are therefore still in control [7]. The advantages of corrective maintenance are; lower short term costs and requires less staff since less work is being done. It also has its own disadvantages such as; increase long term costs due to unplanned equipment downtime and possible secondary equipment or process damage [6].

### ***2.2.2 Preventive maintenance***

In this strategy, assets are subjected to regular schedule of maintenance tasks, such as inspections, cleaning, lubrication, adjustments and calibration. The tasks are performed on routine basis regardless of the status of the asset in terms of functionality. The frequency of the maintenance is generally constant [6].

Maintenance is carried out at predefined intervals in an attempt to reduce equipment failure and to ensure consistent appearance and output of the asset. As the assets age, the frequency and number of checkpoints may need to be re-evaluated. These tasks are usually done frequently and require a relatively constant amount of labor and materials.

Preventive Maintenance (PM) has several advantages such as; reduced asset failure, low maintenance cost, increased component lifecycle and many more over that of Corrective Maintenance (CM) programme. Preventive maintenance activities (such as lubrication, filter change, etc) ensure that equipment run more

efficiently with extended lifespan of the equipment translating into money savings. However Preventive Maintenance will not prevent catastrophic failures, it only decreases the rate of failures [6].

### ***2.2.3 Predictive maintenance***

This maintenance strategy is based on monitoring and measuring the conditions of an asset to determine failure during some future period and then taking appropriate actions to avoid the consequences of failure [8].

Monitoring involves looking out for unhealthy trends of changes over time.

This philosophy consists of scheduling maintenance activities only if and when conditions warrant. When the condition gets to a predetermined unacceptable level, the equipment is shutdown to repair or replace damaged components so as to prevent a more costly failure [8].

A variety of technologies are used to help monitor the conditions of assets. The process begins with the sampling of physical data such as vibrations or particulate matter in oil over time [8]. Measurements detect the onset of degradation thereby allowing causal stressors to be eliminated or controlled prior to significant deterioration. Analysis is then performed on the collected data to develop an appropriate maintenance schedule that is tailored to the asset and its condition. Predictive Maintenance (PdM) differs from Preventive Maintenance (PM) in that it bases maintenance needs on the actual condition of the asset rather than on some preset schedule. This approach offers cost savings over time-based preventive maintenance because tasks are performed only when warranted [8].

### ***2.4 Effects of Lack of Maintenance on Vehicle***

Vehicles are maintained in order to keep them in good operating conditions and to prolong their life span. As a vehicle works the components and moving parts rub against each other leading to wear which reduces efficiency of the vehicle. These components need to be maintained in order for them to function well as a unit. The brakes, hubs, tyres, engine and many other components of the vehicle needed to be maintained constantly in order for these components not to fail. Lack of maintenance or poor maintenance could render the entire vehicle road unworthy which also becomes a threat to other road users [9]. People on tight budgets are often tempted to skip some routine car maintenance services, or at least to delay an appointment with the auto shop. However, poorly maintained vehicles cause thousands of wrecks each year [10].

## **3. Methodology**

This section provides detailed description of the methodology that was used in the study. This included the population and setting of the study, sample and sampling procedures, research design, research instrument, data collection procedure and the method of data analysis.

### ***3.1 Population and Setting***

The population of the study comprised of twenty (20) Mechanics, thirty (30) Drivers and two hundred (200) Passengers of MMT at the Tamale depot. The depot at Tamale was chosen for this study because the researchers did their attachment with the company at the Tamale depot for one and half years and has familiarizes himself with the working environment of the company at the Tamale depot. Mechanics, Drivers and Passengers of MMT were used in this study because they deal directly as well as interface with the buses.

### ***3.2 Sample and Sampling Technique***

Accidental sampling technique was used to select two hundred (200) Passengers but all the twenty (20) Mechanics from the Tamale depot were considered. Simple random sampling was used to select the thirty (30) Drivers, making the total population of two hundred and fifty (250). Accidental sampling technique was used in this study because most of the passengers from the Tamale depot were resided in all over the 26 Districts of the Northern Region. Therefore to be able to get equal representative of the passengers from all the Districts in the Region is difficult.

### ***3.3 Research Design***

The study used survey research design with quantitative approach. Surveys are procedures in quantitative research in which investigators deal with a sample or the entire population to describe the attitudes, opinions, behaviours, or characteristics of the population [13]. Survey uses standard set of questions to get broad overview of group's opinions, attitudes, self-reported behaviours, demographic and background information [14]. There are four (4) main types of research designs of which cross-sectional research design was used. This research design entails the collection of data on more than one case at a single point in time in order to have quantifiable or quantitative data on two or more variables [15]. These quantifiable data are then examined to detect patterns of association.

### ***3.4 Research Instruments***

After a careful review of appropriate literature, questionnaire was chosen as the instrument to use to elicit information for this study. Questionnaire was chosen because it took less time to administer them and also ensured the anonymity of respondents. Questionnaire enabled the researcher to collect potential information about the frequent breakdown of MMT buses at the Tamale depot in the Northern Region. The questionnaires consisted of both close and open ended items. The open-ended questions enabled the researchers to probe a little deeper and explore the main causes of the frequent breakdown of MMT buses at the Tamale depot from the participants.

### ***3.5 Data Collection***

To achieve the main objectives of the study, the research team contacted and had approval of the Manager of MMT at the Tamale depot and told him about the intended study. With the consent of the Depot Manager, questionnaire was administered to the respondents by the researchers. This was done to ensure that, there is improvement in the collection and response rate. The questionnaire was collected as soon as responses were

completed which enabled the research team to obtained 98% response rate.

### 3.6 Data Analysis

The responses were coded and analyzed through the use of Statistical Package for Social Science (SPSS) software version 16.0. The SPSS software was used for the data analysis because it was user friendly and did most of the analysis of the quantitative data for the research team. The data entries were done by the research team in order to check the accuracy of the data. Data were cleaned before running any analysis. Cleaning the data helped the research team to get rid of errors that could have resulted from coding, recording, missing information, influential cases or outliers. Descriptive statistics such as percentage scores were calculated for participants' responses to the reasons for the frequent breakdown of MMT buses at the Tamale Depot.

## 4. Presentation of Results

This chapter focuses on the presentation of results and the analyses of the data on the frequent breakdown of MMT buses at the Tamale depot. The data was organized and presented using descriptive statistics including frequency tables and figures.

### 4.1 The Maintenance Culture of MMT at the Tamale Depot

Maintenance is very important in the life of every equipment, if the equipment is required to operate to its optimal capacity. The types of culture of maintenance that will be employed by maintenance team will have greater influence on the performance of that equipment. The maintenance culture employed by mechanics of MMT was examined. The Mechanics were asked to respond to questions in relation to the type of maintenance carryout on the buses including how often maintenance plans were reviewed. Mechanics were also asked whether there were strict adherences to the maintenance schedule in the workshop. The details of their responses are presented in Tables below.

**Table 1:** Responses on Type of Maintenance Employed

Responses	Frequency	Percentage
Preventive maintenance (2500km/h)	20	100%
Break down maintenance(2500km/h)	0	0%
Predictive maintenance (2500km/h)	0	0%
<b>Total</b>	<b>20</b>	<b>100%</b>

Source: Field Data, 2014

As shown in Table 1, the entire 20 Mechanics representing 100% reported that, they conduct preventive maintenance at every Two Thousand, five hundred kilometers per hour (2500km/h) on the buses. This suggests that, all the mechanics were consistent and were aware that the company maintenance policy is to conduct preventive maintenance on the buses. It then stands to reason that, breakdown maintenance and predictive maintenance were not part of MMT maintenance policy.

**Table 2:** Responses on Review of Maintenance Plan and Maintenance Schedule

Responses	Yes	No	Total
Do you have maintenance Schedule?	14	6	20
Has the maintenance Policy been reviewed?	2	18	20

**Source:** Field Data, 2014

Table 2 shows that, when mechanics were asked whether they have maintenance schedule to guide their maintenance activities, 14 Mechanics representing 70% reported that, MMT at the Tamale Depot have maintenance schedule to guide mechanics to maintain the buses. The remaining six (6) Mechanics representing 30% disagreed and reported that, they do not have maintenance schedule in the technical workshop of MMT at the Tamale depot. Mechanics were further asked if the company maintenance policy has ever been reviewed since the inception of the company, 18 mechanics representing 90% reported that the company's maintenance policy has not been reviewed since the inception of the company.

**Table 3:** Responses of Components of the Buses that Frequently Breaks Down

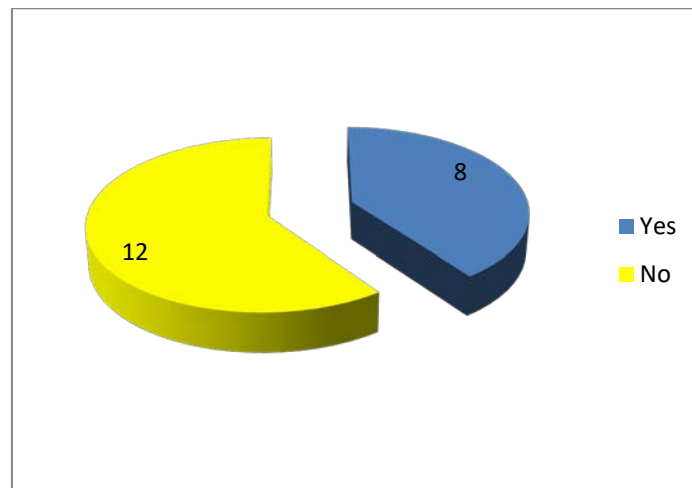
Components	Level of Agreement				Total	percentage
	S. agree	Agree	Disagree	S. disagree		
Hub	20	0	0	0	20	100
Leaf spring	16	3	1	0	20	100
Center bearing	0	6	9	5	20	100
Clutch	0	0	2	18	20	100
Tyre	16	0	0	4	20	100
Brake pad	20	0	0	0	20	100
Engine	0	8	11	1	20	100
Radiator	20	0	0	0	20	100
Fuel tank	20	0	0	0	20	100

**Source:** Field Data, 2014

From Table 3 all the 20 Mechanics representing 100% strongly agreed that, Hub is one of the components of the buses which frequently break down. Leaf spring is another component of the buses that 16 Mechanics representing 80% reported that they strongly agreed that, it frequently breaks down. All the twenty (20) Mechanics representing 100% strongly agreed that, components such as Brake pads, Radiator tanks and Fuel tanks were the components of the buses which frequently break down. The component which actually does not frequently break down in the mechanics opinion from Table 3 was Clutch. Out of the 20 Mechanics, 18 representing 90% were of the view that clutches of the Metro Mass buses does not break down frequently.

#### 4.2 The Availability of Spare Parts in Stock at the Technical Workshop

Spare parts are major ingredient in every maintenance workshop. The study probe further to find out if there was enough spare parts in stock for maintenance work. Closed ended questionnaires were developed for mechanics to respond to issues that has to do with availability of spare parts in stock in the company's workshop store at the Tamale depot. The figure 1 below shows the responses of mechanics on issues of spare parts.



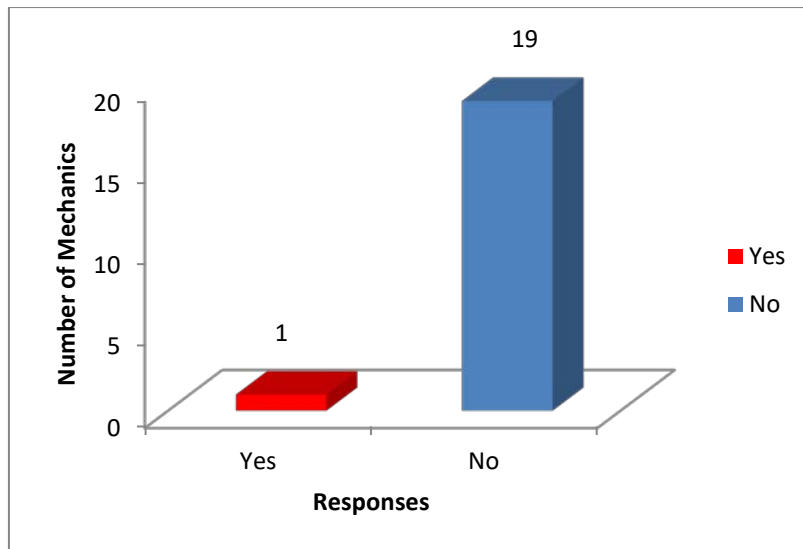
**Figure 1:** Shows a Pie Chart of Availability of spare parts

**Source:** field Data

Question was asked whether there were enough spare parts available in stock at the workshop. Figure 1 shows that, majority of the respondents 12 representing 60% of the respondents reported that, there was no enough spare parts available in stock. The remaining 8 respondents representing 40% reported that there were some spare parts in stock.

#### 4.3 Allocation of Funds for Maintenance

The study inquired further to know how timely funds are released for maintenance of the company buses by management. When respondents were asked about management attitude towards releasing of funds for the purpose of maintenance, their responses were presented in the figure 2 below.



**Figure 2:** Responses of Timely Releases of Funds by Management for Maintenance

**Source:** Field Data

Figure 2 shows that, the highest number of the respondents 19 representing 95% reported that management does not release money timely for maintenance and repair work. Only one mechanic representing 5% reported that in his/her view money was normally released timely for maintenance and repair work.

## 5. Discussion of Results

The objective of the research was to investigate the extent to which bad maintenance culture leads to the frequent breakdowns of Metro Mass Transit limited buses at the Tamale depot.

The findings revealed that, preventive maintenance is the type of maintenance that was performed on the buses at every 2500km at the Tamale depot. This is in the right direction in view of the numerous advantages that comes with preventive maintenance as indicated in the literature. The best could have been chosen the right maintenance mix by blending all the three types of maintenance. The results also revealed that, although the company has maintenance scheduled in the technical workshop but the company's maintenance policy has not been reviewed since the inception of the company.

It is very surprising that as the buses are aging, management were not taking any steps to review the maintenance schedule for the company. This phenomenon also contributes significantly to the frequent breakdown of the Metro Mass Transit Limited buses. Possibly the buses are under maintained because aging vehicle needed to be maintained frequently to compensate the age loss. The findings further revealed that, there were particular components of the buses that frequently break down. These components were leaf springs, brake pads, hubs, radiator tanks, fuel tanks and the tires of the buses were observed to be breaking down frequently. The components that the results of the study found to be breaking down frequently suggests that, the buses were normally overloaded on rough roads. The suspensions of vehicles were designed to handle the weight of the

vehicle plus the specified maximum trailer-towing weight. Overloaded vehicle causes suspension problems. Leaf and coil springs or torsion bars are overtaxed and either break or wear out prematurely. U-bolts and shackles that hold leaf-spring-packs together break, coil springs crack or snap in two, and torsion bars break free from their securing brackets in the vehicle's frame.

The results are also in consonance with the view of [16], who concluded that, there are four primary causes of hub failures. They are lack of lubrication, overloading of the vehicle, installing the axle nut too tight, or installing the axle nut too loose. [16] further indicated that usually, hub failures are progressive and will produce some evidence of the impending failure. This confirms the results from the respondents that the buses are not properly maintained. Evidence of a failing hub can include leaking hub seals, tire tread wear anomalies, sounds, smells, smoke, and steering wheel feedback. The results also indicated that spare parts to maintain the buses were not readily available. The result indicated that management does not release money timely for maintenance and repair work for the very buses that brings the money. Mechanics normally resorted to a popular practice called 'cannibalization' meaning removing part from one bus and fixing it into another bus. It was again revealed that this has become the trend of activities in the Tamale depot. Many buses were packed in the yard of MMT as a result of this practice. They constantly take parts from the partially breakdown buses until such a time that those buses are totally down beyond repairs.

## **6. Summary of Findings, Conclusions and Recommendations**

### **6.1 Findings**

The key findings of the study are as follows:

- It was found in the study that, the major maintenance carried out on the buses was preventive maintenance. The buses were normally maintained when it travels at every 2500km.
- The study revealed that although there was a maintenance schedule at the technical workshop but the company's maintenance policy had not been reviewed since the inception of the company.
- The study further revealed that, there were particular components of the buses that frequently break down. These components were leaf springs, brake pads, hubs, radiator tanks, fuel tanks and the tires of the buses.
- It was again revealed that spare parts to maintain the buses were not readily available in stock in the company's stores.
- The study found that in most cases, the mechanics were found removing parts from the partially broken down buses to repair other ones. It was also observed that the removal of parts to repair other buses has being the trend of what happens in Metro Mass Transit limited at the Tamale depot. The Mechanics at the Tamale depot referred to this practice as cannibalization.
- It was finally found that management of MMT do not released money at the right time for maintenance work and for that matter a bus can be made to pack for almost one week because of a small part that can easily be procured.

## **6.2 Conclusions**

Based on the findings made, it can therefore be concluded that the causes of frequent break down of Metro Mass Transit Limited buses at the Tamale depot can be attributed largely to bad maintenance culture. This is evident as the buses are aging but there was no corresponding maintenance review plan to compensate the age loss of the buses. There is no doubt that good maintenance culture restores the loss efficiency of the vehicle. Removing spare parts from partially breakdown buses to repair other buses is not a good maintenance culture for a company such as MMT to adopt. It is clear that this phenomenon has also increased the number of the buses that has broken down. This phenomenon was left to continue because management does not release funds for maintenance. If this act is not stopped immediately the rate of the breakdown or packed buses would continue to increase and finally collapse the company at the Tamale depot.

## **6.3 Recommendations**

From the summary of the major findings of this study, it is recommended that:

- Management of Metro Mass Transit Limited should provide the technical workshop of Tamale depot with a comprehensive reviewed maintenance plan and schedule to aid the mechanics in maintaining the buses.
- Spare parts should be provided to facilitate repairs and maintenance of the buses. The spare parts should be ordered from the original manufacturers of the buses to prevent the purchase of substandard parts which eventually increases cost of maintenance.
- MMT should increase the quota for each depot from the current GH¢150 to a figure beyond GH¢500 to allow the depots to procure parts that are not available in the company's spare parts store in the depot.

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