PREVENTIVE MAINTENANCE : A METHOD FOR EFFICIENT FLEET OPERATIONS

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ABSTRACT

The paper introduces a method for implementing preventive maintenance for efficient fleet operations in an automobile workshop of a renowned transport company. This workshop handles the overhauling and maintenance works of the entire fleet of vehicles of the transport company. The recurrent problems in the workshop are intermittent repairs of engine, gear box, differential, radiators etc. The reason for frequent break downs of the vehicles is imperfect maintenance procedures being followed in the workshop. The main objective of this paper is to introduce a maintenance method which cuts down the maintenance cost thereby yielding benefits to the company. This is achieved by implementing preventive maintenance Viz. scheduling and supervising the work to be completed. By doing so, better quality of work, reduction in breakdowns, improved life of the vehicle parts and better delivery performance of the vehicles can be achieved.

Keywords – maintenance, preventive maintenance , fleet , Reactive maintenance , overhauling.

I. INTRODUCTION

Maintenance is defined as actions necessary for retaining or restoring a piece of equipment, machine, or system to the specified operable condition to achieve its maximum useful life. It is "the work of keeping something in proper condition; upkeep." This would imply that maintenance should be actions taken to prevent a device or component from failing or to repair normal equipment degradation experienced with the operation of the device to keep it in proper working order[1]. Unfortunately, data obtained in many studies over the past decade indicates that most maintenance facilities do not expend the necessary resources to maintain equipment in proper working order. Rather, they wait for equipment failure to occur and then take whatever actions are necessary to repair or replace the equipment. Nothing lasts forever and all equipment has associated with it some predefined life expectancy or operational life. For example, equipment may be designed to operate at full design load for 5,000 hours and may be designed to go through 15,000 start and stop cycles. Hence preventive maintenance is required. Preventive maintenance can be defined as follows: Actions performed on a time- or vehicle -run-based schedule that detect, preclude, or mitigate degradation of a component or system with the aim of sustaining or extending its useful life through controlling degradation to an acceptable level [2].

This paper is the result of our study on the problems prevailing in an automobile workshop of a renowned and leading road transport company in Southern part of India. The transport company has a fleet of 500 vehicles. This fleet of vehicles are to be repaired and maintained in their well equipped automobile workshop. The workshop can facilitate up to 20 vehicles at a time for repair. Workshop has strength of 8 skilled mechanics and 30 supporting staff working at the repair yard. The workshop is always flooded by the vehicles to be repaired and the rate of repair was slow[3]. Reactive maintenance is basically the "run it till it breaks" maintenance mode. No actions or efforts are taken to maintain the vehicle as the designer originally intended to ensure design life is reached[4]. Process of restoring and maintaining an equipment, machine, or system in a serviceable condition. Overhaul involves partial or complete disassembly of the item, inspection to detect damaged, defective, or worn parts, repair or replacement of such parts, and reassembly, testing, and trial-run prior to returning the item to its full operating level[5].

So to overcome this problem, we have proposed a solution. Our solution to this problem is to apply the concepts of preventive maintenance. Studies indicate that savings can amount to as much as 12% to 18% on the average. Depending on the facilities current maintenance practices, present equipment reliability, and facility downtime, there is little doubt that many facilities purely reliant on reactive maintenance could save much more than 18% by instituting a proper preventive maintenance program.. In this automobile workshop, preventive maintenance schedule is designed using the data like meter readings, periodical check on parts.

II. EXISTING METHODOLOGY

When the problem is identified in a vehicle, the driver of the vehicle brings it to the notice of the person in charge of the vehicle maintenance section of the transport company. The person in turn opens a job card which consists of all the different repair and maintenance works that are to be carried out for that vehicle. The vehicle which is to be repaired, along with its job card enters the workshop. Now it is the duty of the Foreman to refer to the job card and facilitate a mechanic to complete the repair work as per the job card. The mechanic blindly follows the standard repair procedure for that specific part. for example in repairing a gear box, they dismantle the gear box and check for the errors in the gear box. If they find any defect, they change the specific gear wheel or replace it with a existing one .The same is being done with the other parts like engine, radiator and wheel hubs. This might solve the problem temporarily but it is the beginning of a major problem to occur in the future.

We have understood that there are lots of problems that have to be solved which occur by this method.
The main drawbacks are :
i. The vehicle is not being repaired completely because the mechanic insists only on the repair stated in the job card.
ii. The future problems that might be fatal cannot not be prevented.
iii. Since the transport company has large number of vehicles there is a pressure on the mechanics to release the vehicles quickly. Hence due to oversight of the mechanics minor repairs are neglected which might turn out to be a major one in the near future.

III. APPLICATION OF PREVENTIVE MAINTENANCE

Preventative maintenance can be thought of as a proactive strategy. It is a strategy that involves making sure that equipment and facilities are always kept in good order thereby minimising the chances of defects occurring, whilst finding ways to improve vehicle efficiency beyond merely ensuring that basic roadworthiness is attained . The actual implementation of preventive maintenance varies greatly. Some programs are extremely limited and consist of only lubrication and minor adjustments. Comprehensive preventive maintenance programs schedule repairs, lubrication, adjustments. The common denominator for all of these preventive maintenance programs is the scheduling. While preventive maintenance is the optimum maintenance program , it does have several advantagesover that of a purely breakdown program. By performing the preventive maintenance as the equipment designer envisioned, we will extend the life of the equipment closer to design. This translates into rupee savings. Preventive maintenance (lubrication, filter change, etc.) will generally run the equipment more efficiently resulting in rupee savings. While we will not prevent equipment catastrophic failures, we will decrease the number of failures.

Minimizing failures translate into maintenance and capital cost savings .Advantages of preventive maintenance includes Cost effective in many capital-intensive processes, Flexibility allows for the adjustment of maintenance periodicity, Increased component life cycle.Energy savings, Reduced equipment or process failure, Estimated 12% to 18% cost savings over reactive maintenance program.All preventive maintenance management programs assume that machines will degrade within a time frame typical of their particular classification.

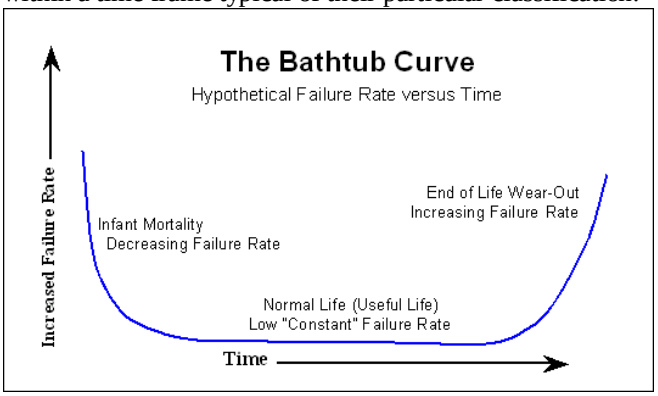

FIGURE NO:1

'Failure, for most parts of an operation, is a function of time' (Slack, 2001). In many cases, plotting the failure rate against a continuous time scale, the results will constitute the so-called 'bath-tub' curve (see **Figure 1**). From its shape, the curve can be divided into three distinct zones or periods quite readily. These zones differ from each other in failure rate and in causation pattern as follows: infant mortality, useful life, and wear-out. Programme plan to reduce the initial-failure rate, exten d the useful life, limit the random failure rate and take necessary action before wear-out period.

The typical theory of 'bathtub curve'has been widely accepted as an engineering tool.The bathtub shape is 'characteristicof the failure rate curve of many well designed products and components including the human body'(Oakland, 1992). The classic bathtub curve against time has three different periods: Decreasing failure rate for infant mortality; Constant failure rate for useful life; and increasing failure rate (without bound) for wear-out. Ebeling (1997) expresses this notion of bathtub curve as a composite of several failure distributions, and formulises it as 'a function of piecewise linear and constant failure rates'
Preventive maintenance is an investment. Like anything in which we invest money and resources, we expect to receive benefits from preventive maintenance that are greater than our investment. The following financial overview is intended to provide enough knowledge to know what method is best and what the financial experts will need to know to provide assistance .Making preventive investment trade-offs requires consideration of the time-value ofmoney. Whether the organization is profit-driven, not-for-profit, private, public, or government, all resources cost money. The three dimensions of payback analysis are
(1) the money involved in the flow, (2) the period over which the flow occurs, and (3)the appropriate cost of money expected over that period.

Preventive maintenance analysis is usually either "Yes/No" or choosing one of several alternatives. With any financial inflation, which is the time we live in, the time-value of money means that a Rupees in your pocket today is worth more than that same Rupees a year from now. Preventive maintenance evaluations should normally use the same set of rules for consistency and to help achieve management support. Another consideration is that forecasting potential outcomes is much more accurate in the short term than it is in the long term, which may be several years away. For the application of preventive maintenance we have designed a schedule which ensures that when a vehicle enters the workshop with a repair work quoted in the jobcard, along with that repair work a simultaneous checking on the surrounding major components is to be carried out which is going to reduce the future complexity of repairing the same when it turns into a major one. The checking process includes a list consisting the part names in specified order and the condition whether it is ok or not ok. Depending on the intensity of that a necessary action is taken to prevent future damage.

IV. PROPOSED METHODOLOGY

In this method to prevent the frequent repairs we have designed a preventive maintenance chart for the various key components of the vehicle which if followed periodically increases the life of the component and also reduces the repairs.

The Sample Maintenance Chart(Tata & Ashok Leyland) is as follows:

S.no	PM DESCRIPTION	LAST MTR RDG / DATE	TO BE DONE MTR RDG / DATE
1	6 SPRINGS GREASING	01-JAN-12	24-JUN-13
2	6 WHEELS GREASING	61335	131335
3	DIESEL OIL FILTERS	136998	145998
4	ENGINE OIL/FILTERS	136998	154998
5	NOZZLES CLEANING	04-JAN-12	04-JAN-13
6	RADIATOR CLEANING	01-JAN-13	01-JUNE-13
7	T.Q OIL	136998	201998

TABLE-1

The above shown data in the table-1 is an example for scheduled preventive maintenance. It states that every aspects like diesel oil filters , engine oil filters ,engine oil, gear oil, differential oil ,hub greasing are to be changed for specific intervels as specified by the manufacturer .If they are neglected it may result in the failure of the major part. Generally, the greasing of the springs should be done every 18 months, wheel greasing should be done every 70000kms, air filters should be cleaned every 80000 kms, diesel oil filters should be changed after every 10000 kms, engine oil should be changed every 10000 kms. While performing these maintenance activities one should dedicate some amount of time in checking the parts according to the checklist like while changing gear oil, gear rod linkages, boot ends etc are to be inspected so that future damages can be prevented.

V. DATA ANALYSIS

We gathered the data from the workshop required for the cost estimation and comparison. This is done considering some major maintenance tasks. Cost incurred for the reactive maintenance for 12 tyre trucks of ASHOK LEYLAND 3116, TATA 3118

MAINTENANCE DESCRIPTION	COST (Rs)
12 TYRES WHEEL GREASING	3600
RADIATOR CLEANING	1500
AIR FILTER CHANGE	2000
DIESEL OIL FILTERS	300
NOZZLES CLEANING	2500
ALL SPRINGS GREASING	3000
ENGINE OIL FILTER CHANGE	500
GEAR OIL CHANGE	1500
ENGINE OIL CHANGE	4000

Table-2

If any of the above Table-2 maintenance is not done according to the schedule it results in the breakdown of vehicle due to major repairs in the engine ,gear box etc. If a gear box or engine oil is not inspected properly it results in the damaging of gear teeth of the gear wheels and engine systems like lubrication etc. which will range from thousands to lakhs of rupees.

VI) CONCLUSION

The paper gives an insight into the prevailing problems with the present operational method and how the proposed operational method is better compared to present operational method. The proposed operational method reduces the cost and increases the product life therby yielding benefits to the organisation. It improves quality of work and enhances the after repair performance of the vehicle by proper management of resources in the workshop.

VII. ACKNOWLEDGEMENTS

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REFERENCES

[1] Maintenance Fundamentals 2nd edition R.Keith Mobley

[2] Preventive Maintenance Louis Hathaway, Frank Buckingham , Deere & company

[3] World class Maintenance Management Industrial press 1990 Business and Economics.

[4] Fundamentals of Preventive Maintenance By John M. Gross .

[5] Reliability theory with Application to Preventive Maintenance by Ilya Gertsbakh.

[6] Ebeling, C.E. (1997) 'An Introduction to Reliability and Maintainability Engineering', International ed. Mcgraw- hill, Inc, New York.

[7] Preventive Maintenance nJoseph D. Patton Isa, 01-Apr-2004 - Business & Economics.

[8] The Complete Guide to Preventive and Predictive Maintenance By Joel Levitt

[9] The Handbook of Performability Engineering edited by Krishna B. Misra.

[10] Maintenance engineering and managementby V. Venkataraman