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IS THE CURRENT SYSTEM OF MAINTENANCE OF WHEELED
VEHICLES WITHIN THE BATTLE GROUP ADEQUATE?

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PREFACE

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Much of the information contained in this monograph is based on the operation of the preventive maintenance system as I observed it in Korea during the period 1954-55.

I would like to express my sincere appreciation to the maintenance personnel of the 1st Battle Group, 15th Infantry, 3rd Infantry Division, and Captain Charles R. Moffett, Ground Mobility Department, The Infantry School, Fort Benning, Georgia, for giving so freely of their time in assisting me in gathering information and material used to support this study. I would also like to thank the members of the Infantry School Library for the cooperation and patience they rendered, which greatly aided in obtaining research material necessary for the preparation of this monograph.

The point of view expressed in this paper is that of the author, not necessarily that of the United States Army Infantry School or the United States Army.


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INTRODUCTION

The history of military transportation goes back many hundreds of years and developed from all types of land transportation. Centuries ago armies transported equipment and soldiers on animals--horses, elephants, and camels. Sometimes they fought on the animals that transported them, sometimes they dismounted to fight. In many countries of the world this is still true today. Even then the ability of an army to move overland was a decisive factor in achieving victory. When the wheel was invented, the chariot and wheeled vehicle came into use. The flexibility and use of land transportation was greatly increased, allowing greater mobility of armies, but centuries elapsed before the development of the motor vehicle. It was not until after World War II that vehicular transportation became more common in the United States Army.

Never before in the history of our nation has speed and mobility been more important. This day and age in which we live is characterized by incredible speed--speed in everything we do, but especially in our means of transportation. This is true everywhere in the world around us, but its impact assumes far greater importance to us in the military. It is generally recognized that any war of the future will be one in which mobility assumes tremendous importance and even perhaps a deciding factor in ultimate victory. So convinced of this are we that many new ideas and changes have already been incorporated into the military defense of this country. New weapons and new means of transportation have caused new concepts as to how future war will be fought. The dependence on highly mobile forces operating independently over widely dispersed areas appears to be the only feasible method in which an army the size of ours can hope to compete with that of the communist world.

At the present time all nations of the world are reorganizing their armies to meet the needs of this age of speed we now live in. The future of the Infantry lies in its ability to incorporate this speed within its capability. Herein lies the importance of an adequate and effective preventive maintenance system. For an army is only as mobile as its transportation, and its transportation is only as effective as its maintenance, or lack thereof.

To consider the adequacy of the preventive maintenance system on wheel vehicles within the battle group we must first examine the system that is presently being used. And second, we must establish what constitutes an adequate system. Therefore, the purpose and scope of this monograph will be to discuss the present system of preventive maintenance of wheel vehicles within the battle group, in light of the factors the author feels is necessary for an adequate and effective preventive maintenance program.

DISCUSSION

In an attempt to solve the problem of proper maintenance manufacturers of automotive vehicles, after years of research, have established the mileages at which certain vehicle parts should be inspected, adjusted or replaced. Out of this constant checking and study of motor vehicle operation has come a "repair-before-failure" servicing idea founded on the axiom that "an ounce of prevention is worth a pound of cure." It has been found that by preventing the need for repairs through periodic inspections and servicing much after damage shop work is eliminated and greater road dependability is insured. (3:159) This in essence is what our military preventive maintenance system is based on. Generally, the Army preventive maintenance system provides for the systematic inspections and services accomplished by operators, company, battery or battle group maintenance personnel under the supervision of the commanders and leaders. Its successful operation also depends on an effective supply system. (6:2)

Let us examine then the present preventive maintenance system for wheel vehicles as applicable to the battle group. We find the battle group is responsible for first and second echelon maintenance. This is referred to as Organizational Maintenance. Included as a part of Organizational Maintenance is a system of periodic inspections and services, performed at regular intervals by the driver or crew of the vehicle, and the organizational mechanics. These services are classified as "A" service, "B" service, "C" service and "D" service. First echelon maintenance consists of the "A" and "B" services which is performed by the driver or crew, while second echelon maintenance consists of the "C" and "D" services which is performed by the battle group mechanics. (1:8)

In the performance of the daily "A" preventive maintenance service the

driver or crew bear the brunt of the responsibility for accomplishing this service. Technical Manual 9-2810 states: "Each tactical vehicle will be inspected by its assigned operator and crew each day that it is operated." The "A" service is divided into four parts. First we have the before-operation service. This is merely a brief check to ascertain that the vehicle is ready for operation and that no irregularities exist. Next is the during-operation service. This service consists primarily of detecting unsatisfactory performance of the vehicle during operation. The driver should be constantly alert for any malfunction of any part of the vehicle. Then there is the at-halt service. This service consists of investigating any deficiencies noted during operation and repeating part of the before-operation service. Finally the after-operation service. This is the basic daily service for all tactical vehicles. It requires that all deficiencies are corrected insofar as possible and that the vehicle is ready to go for the next day's operation. (7:6)

The biweekly "B" preventive maintenance service supplements the daily "A" service. Generally it provides for cleaning the vehicle more thoroughly and for servicing certain items that do not require daily attention. It is accomplished on wheel vehicles once every two weeks by the crew or driver under the supervision of the squad, section or platoon leader. When necessary the driver will be assisted by the battle group mechanics. This service normally requires about four hours to complete. (7:6)

The "C" preventive maintenance service is performed on wheel vehicles once every one thousand miles. It is accomplished by the organizational mechanics aided by the driver and crew under the supervision of the motor officer. The "C" service generally includes the correction or adjustment of the mechanical and electrical components of the vehicle, minor replacements, and the lubrication of the moving parts to a degree that gives reasonable assurance of trouble-free operation until the next preventive maintenance service is performed. (7:12) This service normally requires approximately five to nine man hours to complete, depending on the type and condition of the vehicle. The time factor is based on the use of two

mechanics plus the driver. (5:70)

The semiannual "D" service is a comprehensive scheduled service performed on the wheel vehicles once every six months or at six thousand miles, whichever occurs first. This service includes all items covered in the "C" service plus additional items--some twenty-eight in all. It is accomplished by the organizational mechanics aided by the driver and crew. (7:12)

Based upon studies and estimates by the Automotive Department of the Infantry School, it has been calculated that it requires approximately twelve to twenty-four man hours, depending on the type and condition of the vehicle, to perform the "D" service. This is computed using three mechanics in addition to the driver and crew. (5:70)

Since the success or failure of the system seems to depend in great measure on the performance of these services, let us consider briefly the manner in which they are accomplished from the stand point of scheduling. Technical Manual 9-2810 states, "The Preventive Maintenance Roster DA Form 460 is used for scheduling and recording "B", "C", and "D" preventive maintenance service on tactical motor vehicles continuously throughout the month." (7:15) This form is designed to permit scheduling one month in advance. It is possible that the schedule may not be always followed to the letter due to the tactical operations in which case Technical Manual 9-2810 states, "The mileage that a vehicle travels is the principal criteria for the frequency of the preventive maintenance services. Operation under adverse conditions such as extreme temperatures, dust or mud, may require preventive maintenance services to be performed more frequently." (7:13) The need for systematically controlling the flow of work, we see, has been provided for, and with some degree of flexibility included.

Having now looked at the present preventive maintenance system we are ready to analyze the adequacy and effectiveness of the system. To do this we must necessarily consider the elements that go into making up the system. Doubtless there are many. The logical point to begin however, is with the most critical aspect of the system--that factor upon which the success or failure hinges, driver maintenance.

The driver is the critical factor in maintaining the vehicle in fighting condition. The importance of the driver to unit combat efficiency is not fully appreciated. The best designed and constructed vehicle plus the best mechanics in the Army cannot compensate for bad driving and/or lack of driver maintenance. Any unit in which driving and maintenance is below satisfactory standards eventually fails in its mission because of lack of mobility, despite other measures taken to prevent it. Inadequate mobility is often assumed to result from faulty vehicles, unskilled labor, difficult terrain, and excessive operational demands, when usually it is due to improper driving and lack of first echelon maintenance. Bad driving is usually not recognized as the source of trouble because its effects build up over a period of time rather than immediately, except in the case of an accident, and officers and non-commissioned officers fail to detect bad driving practices. In spite of this the durability of the vehicle and the work of the mechanics keep the vehicle running for a time. But bad driving practices can and do reduce the normal life expectancy of a vehicle considerably, and increases the maintenance requirements. The commander who neglects driver maintenance may get by in periods of quiet operations, but in the supreme test of sustained combat, his unit will gradually lose its combat effectiveness due to an excessive number of vehicle failures. (1:127)

In considering whether there are adequate personnel and equipment to accomplish the preventive maintenance mission we must first determine the number of maintenance personnel and vehicles organic to the battle group. Reference Data Infantry Division Battle Group shows that there are one hundred and twenty-two wheeled vehicles organic to the battle group. There are six wheeled vehicle mechanics and seven mechanic's helpers in the supply and maintenance platoon. There is one mechanic and one mechanic's helper in the mortar battery. This gives us a total of seven mechanics and eight mechanic's helpers, or a total of fifteen altogether. The mechanic's helpers in both the supply and maintenance platoon and mortar battery have additional duties as light truck drivers. From this we could

generalize that each mechanic and mechanic's helper would be responsible for approximately 8.1 vehicles. Comparing this with the old Regiment, where we had a total of three hundred and forty-six wheeled vehicles and thirty-eight mechanics and mechanic's helpers, we find an overall responsibility of approximately 9.1 vehicles per mechanic and helper. From this standpoint then, the present maintenance organization is in favor of the battle group. (5:70)

This analysis, however, does not indicate whether the fifteen mechanics and helpers in the battle group can adequately and efficiently perform the required services as outlined previously. To do this requires a look at the time factors involved in vehicle servicing. Reference Data Infantry Division Battle Group has outlined the approximate time required for each of the four services. Disregarding the "A" service, since that is performed by the driver or crew and does not concern the mechanic, let us consider only the "B", "C", and "D" services. The "B" service requires about four hours to perform, the "C" service averages about seven hours, and the "D" service about seventeen hours. Averaging this out we find that it will require about five hours a day, five days a week for each one of the fifteen mechanics and helpers to perform the services as required by the Technical Manual 9-2810. This is based on the assumption that all vehicles would be available when the service was required and the mechanic's helpers were qualified to perform the services. Obviously this is a situation we can seldom expect to have. It is also obvious that while there appears to be a sufficient number of mechanics and helpers to accomplish the necessary services, there is very little latitude provided for unforeseeable situations that the unit has no control over. Leaves, passes, K.P., guard duty, TDY, sickness, and schools are matters that must be taken into consideration in scheduling the preventive maintenance services.

In addition to the items listed above the mission is another very important factor affecting scheduling that must be considered. During periods of extensive field maneuver or combat, the maintenance of vehicles receives its heaviest abuse. Unfortunately many commanders fail to recognize that

preventive maintenance must continue to be performed during periods away from garrison. Generally the need is even greater then since the vehicles are usually taxed to their maximum. Time must be provided for the accomplishment of the required maintenance. However, it is impractical to adhere to a rigid schedule. Certainly it must be scheduled at the most convenient time of the day so as not to interfere with the accomplishment of the mission. The important thing is that the maintenance should not be completely neglected. This frequently happens when operating under combat conditions. The result is a tremendous backlog of first and second echelon maintenance which in turn causes breakdowns and causes a backlog of third, fourth, and fifth echelon maintenance. The job of "catching up" often is difficult, if not impossible, to overcome. This may result in so-called "paper maintenance."

"Paper maintenance" or "false maintenance" as it is sometimes called, might be said to be the "downfall" of the Army Preventive Maintenance System. Any system that lends itself or permits a situation of this nature needs some looking into. The immediate question that arises is: is it a fault of the system?

Consider for a moment just a few of the requirements that must be accomplished in the "D" service of a 2½ ton truck. One of the various checks made is to pull all of the wheel bearings and inspect them for serviceability. This means that all ten of the wheels, hubs, and brake drums, plus the rear axle assembly, must be completely disassembled to get at the wheel bearings. After they have been inspected, cleaned, and repacked all units must, of course, be reassembled. To accomplish this one operation alone takes approximately four man hours using three mechanics. Another check that is required is to disassemble the steering knuckles and check for satisfactory condition. This operation also takes considerable time to complete. If the steering knuckle is tight, has grease, functions properly, etc., is it necessary to disassemble the thing to assure it is functioning properly?

Undoubtedly, there is no good substitute for a thorough inspection.

On the contrary, inspections are perhaps the only satisfactory means of determining adequately the true condition of the vehicle. But on the other hand the time interval at which some of these checks are made is questionable. Also, there seems to be a good indication that we run the risk of doing more damage than good by checking certain items too frequently, namely wheel bearings. For instance, cleaning the wheel bearings in solvent might, in fact, cause grit and grime to become lodged in them and thereby reduce the life of the bearing. Another risk we run is the possibility of burring the machined surface of the axle in replacing the bearing. (Annex A) Obviously, this particular aspect must be considered an undesirable feature of the system. Why go through this comprehensive and time consuming task of performing a "D" service on a vehicle that we know has had virtually no extensive operation on anything but paved roads? From this it would seem that the frequency and extent of the "D" service is in some instances unnecessary and causes "over maintenance." (Annex A)

Looking at this problem realistically with an eye toward reducing the amount of actual work required on services and at the same time providing more time for the mechanic to accomplish work on vehicles that are in real need of repair, suggests many possibilities. Perhaps a system that incorporates the idea of "trouble shooting" would eliminate a great deal of the unnecessary and time consuming features of the present system. This concept provides for a system that would approach the problem from the standpoint of hitting where the trouble is rather than habitually plunging into the laborious tasks of seemingly unending and unnecessary assembly and disassembly of component parts of the vehicle only to discover that the part was in perfect condition to begin with. Why, for example, give a vehicle a compression test if it is not losing power? There is a belief among many in the Army today that we are "monkey wrenching" our vehicles to death. (Annex A)

The mechanic who is forced to perform a "D" service on a vehicle that has spent very little time out of the motor pool knows before he starts the service that it is a waste of time and effort on his part. Unfortunately,

this type of thing can very likely permeate his entire attitude to the point that he feels this way about all the vehicles he checks. Commanders and maintenance supervisors must constantly be alert for this attitude.

Fortunately, the present organization of the battle group is ideally suited for centralized control of vehicles and maintenance personnel. Unlike the old regimental organization where we had eight motor pools, one each in regimental headquarters and headquarters company, tank company, mortar company, medical company, service company, and one in each of the three battalions, in the battle group we have one motor pool. This factor alone goes a long way toward increasing the capability of accomplishing the maintenance much more efficiently.

Under the close supervision of the motor and maintenance officers of the battle group we insure a greater degree of control over the mechanics in the performance of their duties. Lackadaisical attitudes and sub-standard work can be checked before its effects are exemplified in the condition of the vehicles. Centralizing the maintenance at battle group level definitely provides an advantage heretofore not realized under the old organization.

Diagnosing the trouble in a vehicle is one thing, but actually accomplishing the work is another. The ability of the mechanic to correct the trouble depends not only on his technical proficiency and know how, but also on the tools he has to work with. To say that a mechanic is only as good as the equipment with which he has to work is redundant, however, the necessity for considering this aspect is of paramount importance to the effectiveness and adequacy of the preventive maintenance system in the battle group. We find that Reference Data Infantry Division Battle Group lists eleven tool sets, general mechanics, in headquarters and headquarters company, and one in mortar battery. One tool set, organizational maintenance, second echelon #1, common, also in mortar battery. One tool set, organizational maintenance, second echelon #2, common, and one tool set, organizational maintenance, second echelon, #2, supplemental, also in headquarters and headquarters company. Adding all these various tool sets up we find a

total of fifteen organic to the battle group. And, since there is a total of fifteen mechanics and helpers in the battle group we can logically assume there are sufficient numbers to accomplish the mission. As a matter of fact, the tools are only limited by the ability of the mechanic to effectively use them. Certainly they are within the capability to perform second echelon maintenance which is the limit of the battle group maintenance requirements.

(5:68)

Thus far we have taken into consideration some of the major aspects of our present system of preventive maintenance. We have seen the importance the driver played in the overall operation of the system and that the success or failure of the system was basically dependent upon how well he performed his responsibilities. We looked at the number of mechanics assigned to the battle group in an effort to determine their capability to accomplish the preventive maintenance services prescribed in Technical Manual 9-2810. We considered also the advisability and necessity for having such comprehensive services at such frequent intervals as are required under the present system. The tools and equipment were examined briefly, too. One important point that has received very little mention, however, is that of the commander and the importance of his role under the present system of preventive maintenance.

The commander's attitude toward preventive maintenance is just as important, if not more so, than the system itself. The enthusiasm and interest he shows will to a great extent determine the efficiency of his transportation. It is the commander that implements the system and the degree with which he pursues the task will be demonstrated by his subordinate leaders and men. An example that took place during the Korean War demonstrates this point of commanders interest in preventive maintenance quite well.

"On a tour of the Twenty-fourth Division front in the summer of 1950, General Church drove up to a battalion command post. He walked across to the adjacent motor pool where a radio set operating in the regimental command net was located. General Church spoke briefly with the operator, asking him about the condition and performance of his radio. Later that day the

regimental communications officer happened by and the operator told him that the general had inspected his radio. The officer reasoned that, if General Church was interested in radios, they had best spruce up a bit. He had all operators in the regiment clean their sets thoroughly, and kept a much closer watch on first echelon maintenance. He passed word of the general's interest to the division signal officer, who, in turn, tipped off the other regiments. Thus, because General Church took a few minutes to show a sincere interest in one radio set, the level of maintenance of every set in the division was raised." (2:47)

Certainly the commander's attitude and approach to the problem will not in itself guarantee an effective preventive maintenance system, but it is the basis upon which the ultimate success of the system will depend. Needless to say that he should place emphasis where the emphasis is needed. An inspection of mere "spit and shine" is not only of little value but can be detrimental as well. The driver who is rewarded for his bright and shining vehicle may have a laugh on the commander, for under the hood he may have a rattling, piston slapping engine produced by driver neglect. It should not be construed that a clean vehicle is not important, because we all know that it is. Furthermore, it's an indication that everything else is in satisfactory condition, but the important point is not the shine on the fender but rather it is the machinery that runs the vehicle.

This simple verse sums up pretty well the importance of the preventive maintenance system in its future role of the Army where mobility is of vital importance to the existence of the United States Infantry:

"For want of a nail, the shoe was lost; For want of the shoe, the horse was lost; For want of the horse the rider was lost; For want of the rider the battle was lost; For want of the battle the kingdom was lost; And all for the want of a horseshoe nail." (3:180)

CONCLUSION

The present system of preventive maintenance prescribed by Technical Manual 9-2810 is adequate. Admittedly, there are certain features that are undesirable. But, the system itself is valid in that it accomplishes what it was intended to do, to reduce major shop repair by systematically inspecting and servicing the vehicle periodically. The principal undesirable features of the system are the extensiveness and frequency of the "B", "C", and "D" services, and the danger of creating a complacent attitude on the part of the mechanics.

Strong command supervision must be exercised through the subordinate maintenance personnel and company and battery commanders to realize full benefit from the system. The commander must be aware of the inherent weaknesses of the system and implement a suitable and flexible program to overcome these deficiencies.

The success of the system is also highly dependent on the driver maintenance. The assignment of the driver, therefore, must necessarily be highly selective, and a training program initiated to insure his proficiency.

In the final analysis, we can conclude that the success or failure of preventive maintenance rests squarely with the commander.

ANNEX A - Summary of Interview with Captain Charles E. Moffett,
Ground Mobility Department, The Infantry School, Fort
Benning, Georgia

Question: Do you feel there is a need for such a comprehensive service as the "C" and "D" service?

Answer: No, I do not. The "C" and "D" services are much too detailed. The current thinking of the Army since 1951 is that we are "monkey wrenching" our vehicles to death. Why, for example, pull the bearings on a vehicle when it has hardly been out of the motor pool? Or, why give a vehicle a compression test if it's not losing power?

Question: Do you feel that the present system duplicates effort in any way?

Answer: The present system does duplicate effort in the "B", "C", and "D" services to a degree. Some of the services performed on the "C" service are repeated again on the "D" service.

Question: Do you feel that the present system has provided sufficient personnel to accomplish the maintenance requirements outlined in TM 9-2810?

Answer: Yes. Under the new reorganization we have centralized control which provides far better supervision of maintenance personnel.

Question: Do you feel the present system of preventive maintenance encourages "false maintenance" by imposing unreasonable demands on the mechanics?

Answer: Perhaps. The emphasis in the past has been on statistics rather than on operational readiness. Paper work will not move the vehicle though.

Question: Do you feel the present system of preventive maintenance should be revised, and if so, what major thoughts would you recommend?

Answer: Yes, I do feel the present system needs revision. We need a system that is based strictly on a usage factor together with super-

visory checks. We need to eliminate these time consuming and comprehensive services and replace it with a system of "trouble shooting"—hitting where the trouble is.

Question: What in your opinion is the foundation of the preventive maintenance system?

Answer: Driver maintenance is the most important aspect of the system. The maintenance program is only as effective as the driver.


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Capt

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