

# A SIMPLE, EFFECTIVE TRACTOR MAINTENANCE SYSTEM

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## Abstract

Prior to 1971, an ineffective system was used to service and maintain a fleet of 234 tractors. The problems encountered and an action plan to improve the fleet operating costs are described. The method includes the following features:

- Planned preventative maintenance
- Decentralisation of tractor servicing
- Improvement of Estate workshops
- Training of workshop staff
- Managers' accountability for tractor operating costs.

An example of the revised system in operation is presented together with observations concerning effectiveness.

## Introduction

In 1971, Tongaat Sugar Company operated a fleet of 234 tractors on 12 000 hectares and allocated to 12 Estates and 2 Departments. Tractor service and repairs were carried out at a central garage which was 4 km from the closest estate and 20 km from the furthest. The period between each service was based upon tractor hours worked, which resulted in fluctuations in service workload at the central garage. As many as 60 tractors could require servicing, or as few as one. Often tractor hour meters were faulty, which led to under-servicing.

Daily servicing of the tractors was carried out by untrained drivers at poorly equipped estate workshops, which increased the downtime of the fleet. Implements and trailers were not serviced but repaired when broken. The maintenance problems can be summarised as follows:

- No standardised maintenance system for tractors or machinery.
- No planning to ensure that each tractor was serviced at the correct time.
- Tractor operators were responsible for machine output and not for the running condition of their machines, hence the poor standard of daily maintenance.
- Estate Managers were not responsible for tractor and implement operating costs.
- Implements and trailers were repaired when broken and received no preventative maintenance.

As a result of these problems, the financial implications were:

- A percentage Tractor downtime was 18%, which meant that 42 tractors per day were non-operative. Compared with a realistic figure of 10%, it appeared that there was an excess of about 19 tractors, drivers and houses.
- Excessive fuel was used because of the distance to and from the central garage.
- High central garage overheads due to the large fluctuations in the workload.

An effective tractor and implement preventative maintenance system was therefore necessary to reduce operating costs; to make the Estate Manager accountable for these costs and to reduce the fleet by about 8% (18 tractors).

## Method

### *Planned Maintenance*

With a large fleet of tractors and implements, it is very important to be able to plan the maintenance so that the machinery receives the attention that the manufacturer intended. Thus the prescribed service schedules from all the major tractor and implement manufacturers were obtained and combined into a common schedule. To be able to pre-plan periodic servicing, a method of converting the prescribed schedules from hours into days had to be established. This was accomplished by studying tractor utilisation figures from the various tractor manufacturers which established that the minimum service interval was 2 weeks ( $\equiv$  150 hours.) A complete annual service and preventative maintenance schedule was then designed according to the recommendations of the manufacturers. A sample of a 2-weekly service and preventative maintenance schedule is presented as Figure 1.

The service schedule has an inbuilt accountability for the serviceman, whereby he has to note the positive action taken upon the service sheet compared with a "✓" off procedure. To be able to keep some sort of technical control on the output of estate service staff, the service schedule includes a garage check every 3 months. This check requires that the tractor goes to the central garage for an appraisal. Faults found at the garage are reported to the Estate Manager for action. Daily servicing is carried out by the serviceman and not the tractor drivers. An example of the daily service sheet is shown as Figure 2. To accommodate implements and trailers, a wallchart was designed incorporating the major service points for implements and trailers.

### *Decentralisation*

To reduce the time taken and the excessive fuel used travelling to and from the central garage, the servicing and repair facilities on each estate were improved so that minor repairs and servicing could be carried out. This was achieved by redesigning estate workshops, improving their tools and equipment, and training the servicemen.

An example of a typical renovated estate workshop is shown in Figure 3. The simple workshop caters for rapid daily service and effective periodic preventative maintenance. The facilities include a drive through service bay, two repair bays, a separate room each for tools, spares, oil and tyres and a work area with essential equipment.

Drivers were no longer responsible for the daily servicing of their tractors, but they had to wash, refuel and report operating problems to the servicemen on duty. Once this scheme was operational, it became evident that a ratio of 5 tractors to 1 serviceman was a reasonable ratio on which to base manpower resources. The central garage then only undertook complicated tractor repairs and dynamometer testing, and all other repairs and servicing were undertaken by the estates.

### *Operational system*

The driver checks his tractor and implement or trailer daily for repairs undertaken during the daily service together

TONGAAT-HULETT SUGAR LIMITED

Service and Preventative Maintenance Procedure for Tractors and Cranes

PHASE 1  
FORTNIGHTLY

TGL 2270  
TGL 83-90-139

ESTATE	MAKE:	REG. No.:	SERV. MECH./MAN:	DATE:	INSPECT. & PASSED BY:
<b>SERVICE POINT:</b>		<b>OBSERV.</b>	<b>ACTION TAKEN:</b>	<b>SERVICE POINT:</b>	<b>OBSERV.</b> <b>ACTION TAKEN:</b>
<b>COOLING SYSTEM :</b>	Radiator Cap & Core Water Level Hoses Fan Belt			<b>FRONT WHEELS :</b>	Bearings Seals King Pins Alignment Wheel Nuts Tyre Condition Tyre Pressure
<b>ENGINE :</b>	Oil Filter Cap Oil (Check) Breathers Oil Filter Leaks Mountings Noises Exhaust			<b>REAR WHEELS :</b>	Wheel & Rim Nuts Water Ballast Brakes Tyre Condition Tyre Pressure Tyre Tread Depth
<b>AIR FILTRATION :</b>	Pre-Cleaner Ducting Outer Element Housing Restr. Gauge Mountings			<b>DRAWBAR :</b>	Hooks Bolts Cracks
<b>FUEL SYSTEM :</b>	Filters Water Trap Pipe Brackets Tap Leaks Fuel Inject. Pump Lift Pump Smoke Emission			<b>STEERING :</b>	Play Ball Joints & Idler Arms & Bolts Operation Steering Box Oil Power Steering Oil Oil Filter
<b>ELECTRICAL :</b>	Wiring Connections Instruments Switches Lights Starter Charging Systems BATTERY Electrolyte " Caps " Terminals " Box " Clamp			<b>PEDALS :</b>	Clutch Free Travel Brake Free Travel Bushes Locking Device
<b>GEAR BOX</b>	Noise Gear Shift			<b>HYDRAULICS :</b>	Operation Hose Couplings Leaks Three Point Linkages Pins & Bushes Levelling Boxes Top Link Trailer Brake Pressure
<b>BODY :</b>	Front Grill Mountings Bonnet Mountings & Latches Mud Guards Seat & Roll Bars			<b>AXLES :</b>	Centre Pivot Cracks & Cross Member
				<b>COUNTY 754 :</b>	Pivot Bearings Flanges Universal Joints Shaft Seals End Float Check Cables
				<b>IMPLEMENTS :</b>	Service & Check as per Guide All Grease Points
				<b>CRANE</b>	Check Acc. Cable & Action Check Gearbox Mountings Check Turn Table Check Ropes, Cables, Pulleys & Hooks

**SYMBOLS** P - Perfect condition or no attention required.  
W - Wear - signs of wear noted but safe to carry on.  
A - Attention required - or action to be taken.  
S - Spares required - or to be ordered.  
X - Circumstances prevented completion of job.

FIGURE 1 Two-weekly service and preventative maintenance schedule.

**TONGAAT-HULETT SUGAR LIMITED - AGRICULTURE**  
**Daily Maintenance Check List for Tractors**

ESTATE: .....  
 NJ. No.: .....

SEQUENCE	SERVICE POINT:	DATE			
DRIVER	Wash				
	Fuel & Report:				
SERVICEMAN 1	Engine Oil				
	Power Steering				
	Radiator Water – leaks				
	Fuel Leaks				
	Steering Ball Joints				
	L.F. King Pin & Centre Pivot Pin (grease)				
2	L.F. Wheel : Abnormal wear				
	: Wheel Nuts				
	: Pressure and Ballast				
3	Radiator Hoses				
	Air Filter Hoses & Pre-cleaner Bowl (L.H. inst.)				
	Radiator Core				
4	R.F. Wheel : Abnormal wear				
	: Wheel Nuts				
	: Pressure and Ballast				
5	Steering Ball Joints				
	R.F. King Pin (grease)				
	Fan Belt				
	Air Filter Hoses & Pre-cleaner Bowl (R.H. inst.)				
6	Brake Pedals				
	Pedal Locking Device				
	Tread Plate Bolts				
	Steering Wheel Operations				
	Diff. Oil Level				
7	R.R. Wheel : Abnormal wear				
	: Nuts				
	: Pressure & Ballast				
8	Three Point Linkage				
	Draw Bar and Attachment				
9	L.R. Wheel : Abnormal wear				
	: Nuts				
	: Pressure and Ballast				
10	Clutch Free Travel				
	Tread Plate Bolts				
	Gear Box Oil Level				
	Water Trap				
	Service and Check Implement				

SYMBOLS : P – Perfect condition or no attention required.  
 W – Wear – signs of wear noted but safe to carry on.  
 X – Circumstances prevented completion of job.  
 S – Spares required -- spares to be ordered.  
 A – Attention required -- action to be taken.

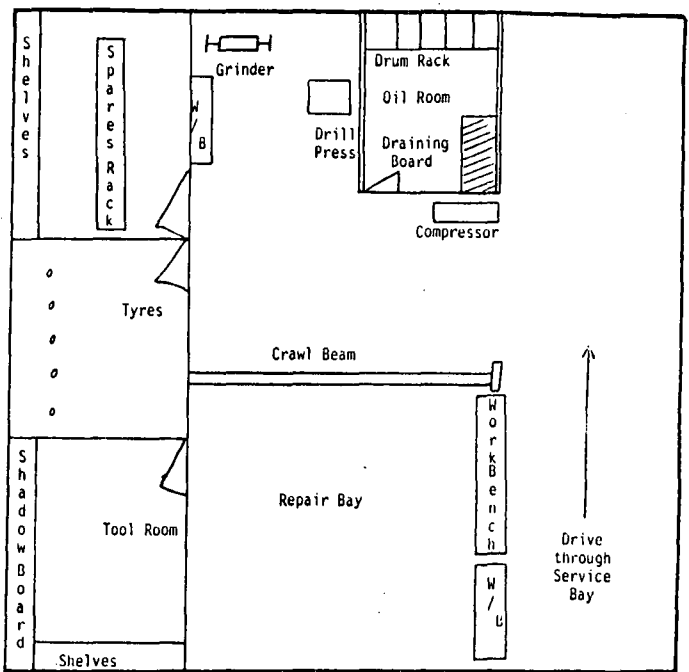
TGL 83-32-405

SERVICED BY: .....

**FIGURE 2** Daily service schedule

with checks for general safety and traffic regulations. There are a few selected spanners available for implement adjustment and tightening which is necessary during the days work. Breakdowns during the day are attended to by the estate workshop staff.

When the daily task has been completed, the machine returns to the estate workshops, it is washed, refuelled and parked for daily service. The serviceman completes the daily service and preventative maintenance checklist on both the tractor and implement or trailer. The servicemen also undertakes minor repairs and parks the tractor ready for the following days work. Should a major repair be necessary, the serviceman notes the defect on the service sheet and parks the tractor ready for the repair to be done the following day.



**FIGURE 3** Layout of a typical estate workshop

During each day, the service mechanic undertakes the periodic service to the machine or machines that are indicated on the service plan. Any problems that occur beyond the scope of the service are noted on the service schedule and done when spares have been purchased. In the case of tractors requiring a "Garage" check or dynamometer test, these machines are sent to the garage and returned with an action list which must be seen to before the tractor re-enters the field. Any repairs that are beyond the scope of the service mechanic are undertaken by the garage on request.

Throughout the year, all servicemen visit the Maintenance Training School (MTS) for 8 days, and service mechanics visit the MTS for 18 days to progress with their training and to revise any weak areas. The Maintenance Instructor also visits each estate workshop three times a year to assess the progress of his students. Reports on his visits are presented to the Estate Manager.

On a weekly basis, Workshop Supervisors or Estate Management check the 2 weekly service sheets for those tractors serviced during that week and note any specific problems that require attention. All Estate Management personnel are given pocket cards which assist them in checking any machine for defects or sloppy servicing.

Each month, each Estate Manager receives a cost report on every tractor in his fleet together with a downtime report which enables him to pinpoint problem areas and take effective action.

**Observations**

This system has now been operating successfully for 14 years, and it has lowered downtime from 18 to 5%, being a saving in real terms on a fleet of 234 tractors of 30 tractors per day. Running costs have been contained to an average annual escalation of 10% and tractor life has been extended from 4 to 7 years. The system has been extended to include loaders, cranes, light delivery vehicles, motor cycles and heavy machines where applicable. In the case of heavy machines, the hourly basis for service has been retained due to

fluctuating workloads, as these machines have very specific maintenance requirements based upon hourly usage. However, because there are only a few of these machines, scheduled servicing is not a problem. As the majority of repairs and maintenance are undertaken by the estate, the Manager is now fully responsible, and accountable for his tractor fleet operating costs.

The average Grower with between 5 and 10 tractors could also utilise this system and effect the same percentage savings that were possible on the larger estates, by using the S.A.S.A. Experiment Station's Training department for training their service staff.

### **Conclusion**

The planned preventative maintenance system described meets the objectives of reduced downtime and operating costs and makes the Manager accountable for his fleet.

### **Acknowledgements**

The detail of the above system was investigated and compiled by Mr J. A. Singh, Maintenance Instructor for Tongaat-Hulett Sugar (Agriculture) who must be complimented on his efforts in setting up the system and for his conscientious work in maintaining it.