WEAR CHECK
Condition Monitoring Specialists

TECHNICAL BULLETIN ISSUE 76

PT 2: A NEW PERSPECTIVE ON MODERN DAY MAINTENANCE

By Raymond T. Chizu

Business Developer, WearCheck Zimbabwe

INTRODUCTION

This *Technical Bulletin* follows on from *Technical Bulletin 75* – A new perspective on modern day maintenance, by the same author.

In the previous ***Technical Bulletin***, I promised to discuss how to transition an organisation practicing 1st and 2nd generation maintenance principles to the 3rd generation.

In this edition, I outline what several renowned maintenance practitioners believe is the best way to transition an organisation's maintenance philosophy. Fundamentally, we do maintenance to achieve reliability, and, according to well-known author Ron Moore, 'A reliable plant is a safe plant, is a profitable plant'.

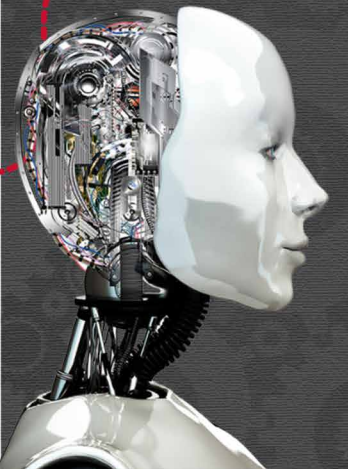
Profitability of any industrial plant is directly linked to its reliability, which in turn is determined by the quality of maintenance practiced. If we don't maintain our assets, things can go terribly wrong. Almost all industrial disasters had poor maintenance reliability practices as one of the contributing causes.

According to Erik Hupje - founder of the Road to Reliability Academy - there are four essential elements that an organisation must take to achieve maintenance reliability. They can be taken in any sequence depending on the organisational culture, but ideally the first step is **maintenance planning & scheduling** followed by **preventive maintenance, defect elimination** and **leadership & culture.**

Most organisations, by default, are already practicing preventive maintenance with varying degrees of success. What is generally lacking is the most important aspect: a robust planning & scheduling programme. Previously, I discussed the 1994 study by Winston Ledet for Du Pont Chemical Company, which highlighted the importance of planning & scheduling, preventive maintenance and defect elimination in improving reliability. Erik Hupje added one more essential element: supportive management and culture change.

Before we delve deeper into the best way to transition an organisation, I will highlight what some leading figures in the maintenance profession recommend as the correct view of maintenance. Maintenance should be viewed just like any other investment by a business - when we invest in maintenance, we are looking at reliability insurance as the return. When maintenance is viewed as an investment, it follows that the monthly maintenance expenditures are the monthly premiums for reliability insurance, and that all maintenance activities should be directed towards maximum returns - improved reliability.

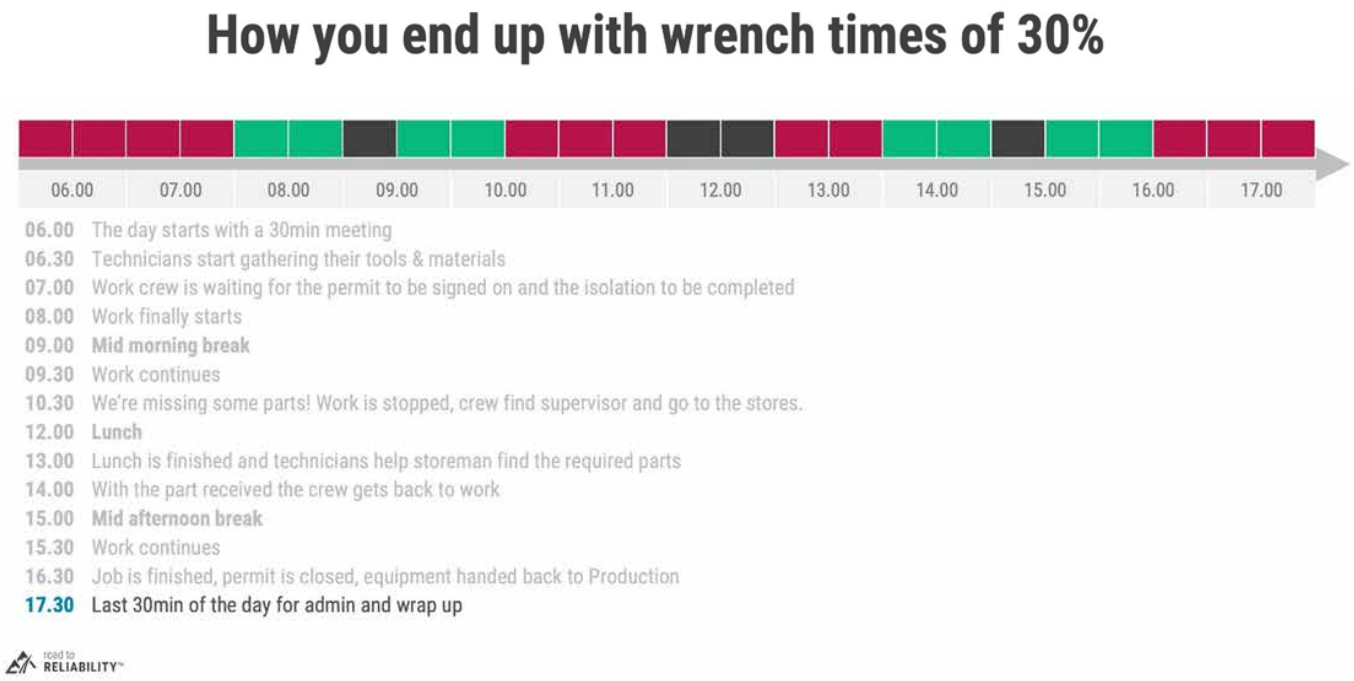
Presently during maintenance execution, the emphasis is on returning the machine to service as soon as possible without any consideration for reliability improvement while the opportunity is presented.



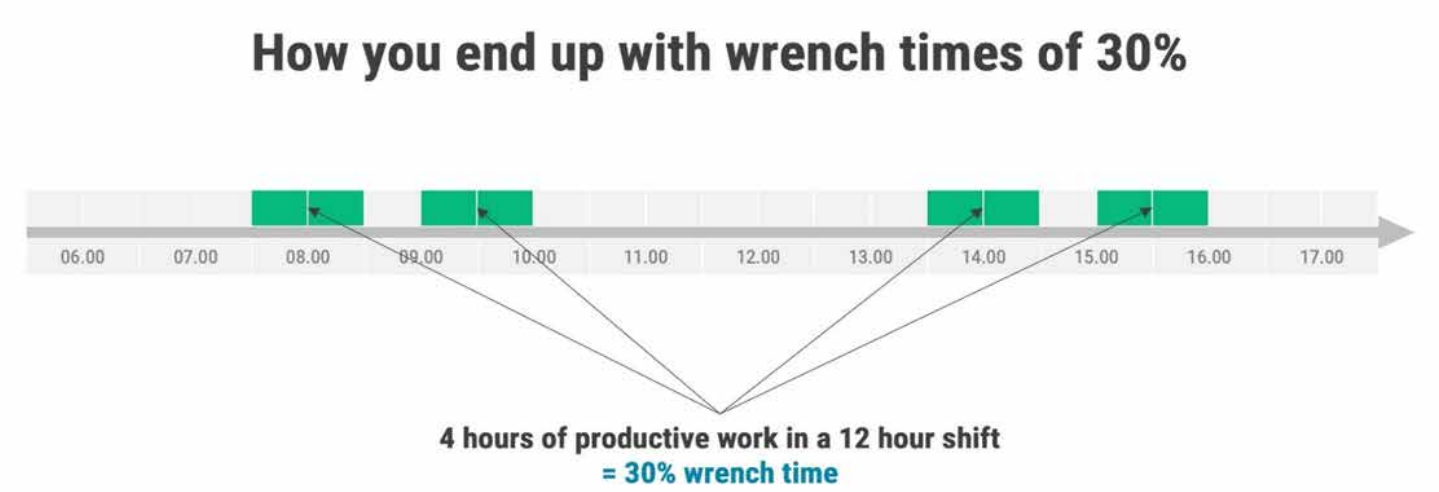
Now let's talk about maintenance productivity, aka 'wrench time', which is an expression of how much productivity is generated during a shift by the maintenance personnel. A 2007 study carried out by Richard Doc Palmer (author of the ***Maintenance Planning and Scheduling*** handbook) revealed that the general belief by senior management in most industrial organisations is that their wrench time is +-80%, but once these companies thoroughly investigated the matter, the reality is that the average wrench time of plants that practice reactive maintenance is 25-35%. After this study, several benchmarking exercises were carried out and they all agreed to an industrial average of 30%.

Below is a timeline from the Road to Reliability Academy, which breaks down the technician's day hour-by-hour. Different colours indicate these items: green for productive time, red for non-productive time and black for official breaks

This wastage is not a deliberate act by maintenance teams but is caused by the way the company has allowed the work to be done - it is due to defective work processes. Over time, organisational cultures have unconsciously tolerated introduction of waste into their work processes.



*The wrench time calculator used above is a free download on the Road to Reliability Academy.



These diagrams show a typical day for a maintenance technician. For a small organisation employing 20 maintenance technicians (without a planner and scheduler), working 10 hourly shifts five days a week, this gives 1000 hours per week (20 technicians X 10 hours X five days).

Since this is a reactive environment, the productivity is 30%, which means the technicians are liquidating 300 productive hours per week (1000 hrs X 30%).

We can express this maintenance productivity in dollars. Assuming the total cost to the company per technician is $100/hour (this is normally 60 – 70% more than the technician's hourly rate). The company is investing $100,000.00 in maintenance per month (1000 hrs X $100/hr) and the return per month is $30,000.00 (300 hrs X $100/hr). Annually the organisation is investing $1,200,000.00 into maintenance and realising a return on investment of $360,000.00.

Now that we have identified the problem ('Low maintenance productivity aka wrench time'), we need to proffer a solution. This solution need not be complicated, expensive computer software that even some who are eager to improve their maintenance productivity end up abandoning midway due to its complexity or the use of exorbitantly-priced consultancies.

Revisiting Winston Ledet's Manufacturing Game and Erik Hupje's Road to Reliability eBook, we find that implementing a robust planning and scheduling programme is the only affordable way to transition from a reactive environment to a planned preventive maintenance practice. The beauty of this route is the use of available human resources. It only involves role changes for some employees to take up the new roles created - planner and scheduler. The other positive aspect of this route is that in most industrial plants the planning function is already in place.

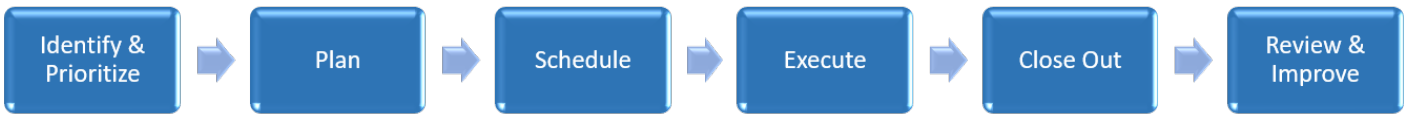
Implementing a robust planning and scheduling programme will increase wrench time to a more reasonable 45%.

Now let's look at why most of the present planning setups in many industries are not effective. One of the fundamental reasons is that planning and scheduling are misconceived in their application. Many times, people talk about planning whereas they are putting Gantt charts together, which is really much more about scheduling.

Maintenance planning involves defining what needs to be done and how it's done. Through maintenance planning, we eliminate waste and improve efficiency by ensuring everything we need to do a job is in place before we start the job, this in turn increases our overall crew efficiency and our maintenance productivity or wrench time goes up.

Planning often entails Murphy's Law, which states: 'anything that can go wrong will go wrong' if you don't fully plan. Scheduling, on the other hand, addresses who does the job and when it is done. Scheduling deals with Parkinson's Law, which states: 'the amount of work will expand to the time available'- this is a reflection of human nature. Scheduling increases efficiency by goal setting (agreeing on the amount of work to be done during the week) and by grouping work efficiently which reduces travel time and frequent machine isolations. Planning and scheduling, or work management as it is sometimes described, is all about getting the right work done, by the right people with the right resources at the right time. It's all about prioritisation and efficiency, it's all about deploying your scarce resources on those issues that matter the most.

Maintenance planning and scheduling is a six-step process: 1. identify and prioritise, 2. plan, 3. schedule, 4. execute, 5. close out and 6. review and improve. (Diagram courtesy of the Road to Reliability Academy.)



Below, we elaborate on each step:

1. **Identify & prioritise** (planner, supervisor, maintenance manager, operations) – in a reactive maintenance environment you're forever getting loads of new work requests. Unless you prioritise these incoming requests, you'll never break out of that reactive maintenance cycle. Prioritising work using a simple High, Medium, Low or 1, 2, 3, 4 & 5 scale simply doesn't work- you need proven systematic metrics like the RAM (Risk Assessment Matrix) and the RIME (Ranking Index for Maintenance Expenditure) methods developed by the Road to Reliability Academy.

2. **Plan** (executed by the planner) – this involves clearly defining the machine to be worked on, work scope, method, materials (tools, spares and consumables), manpower (trades and skills level) and the money (budget to get the job done). Planning ensures everything required to do the job is ready before the job is marked as 'ready to be executed'.

3. **Schedule** (executed by the scheduler) – is goal setting by agreeing on the amount of work to be executed for the week and measuring success in terms of schedule compliance. Scheduling enables coordination between maintenance and operations so that there's an agreement upfront about what and when equipment will be taken offline. The outcome of the scheduling process is the production of a frozen weekly schedule.

4. **Execute** (supervisor & technicians) – the heart of the planning and scheduling process is execution of the job with the focus being on work completed on time, with a high degree of safety adhered to and the job executed to the right standard of quality.

5. **Close Out** (supervisor & technicians) – once the work is physically completed it must be closed out in the computerised maintenance management system (CMMS). The technicians record the technical history, quality of the job plan, etc. back to the planner via the supervisor. This gives the supervisor the opportunity to flag some jobs for an RCA (Root Cause Analysis) on frequent failures.

6. **Review & Improve** (planner, supervisor, maintenance manager, operations) – in this process we improve both the machine condition as well as the planning and scheduling process by using a standardised set of performance metrics which helps to track if your performance is trending in the right direction. We're looking at small improvements to make sure the work is done just a little bit faster, safer, cheaper next time around. These small improvements really add up over time.

Planning and scheduling are a process, not just a collection of six random tasks that you just happen to do. Planning and scheduling are made up of a series of steps that need to be done in the right sequence, in the right way and failure to do that prevents you from achieving the efficiency for which you are aiming.

Planning and scheduling should be treated as a process for the following reasons:

- Maintenance is repetitive: we are forever going to plan, schedule and execute again and again, we should have a process in place to manage this continuous cycle so that we go through the right steps in the right sequence every time.

- Unless we treat planning and scheduling as a process that we formally document and communicate to our staff, we'll struggle to embed it into our organisation and make sure it lasts. This is one of the main reasons why sometimes efforts to implement condition monitoring on some clients' maintenance programmes fail.

The other reason why some organisations fail to implement planning and scheduling is the way they go about it- they tend to take shortcuts and then focus on certain parts of the process they prefer rather than sticking to the whole process. In reality, the workflow is not as simple as shown in the diagram above, there are some intermediate steps in between.

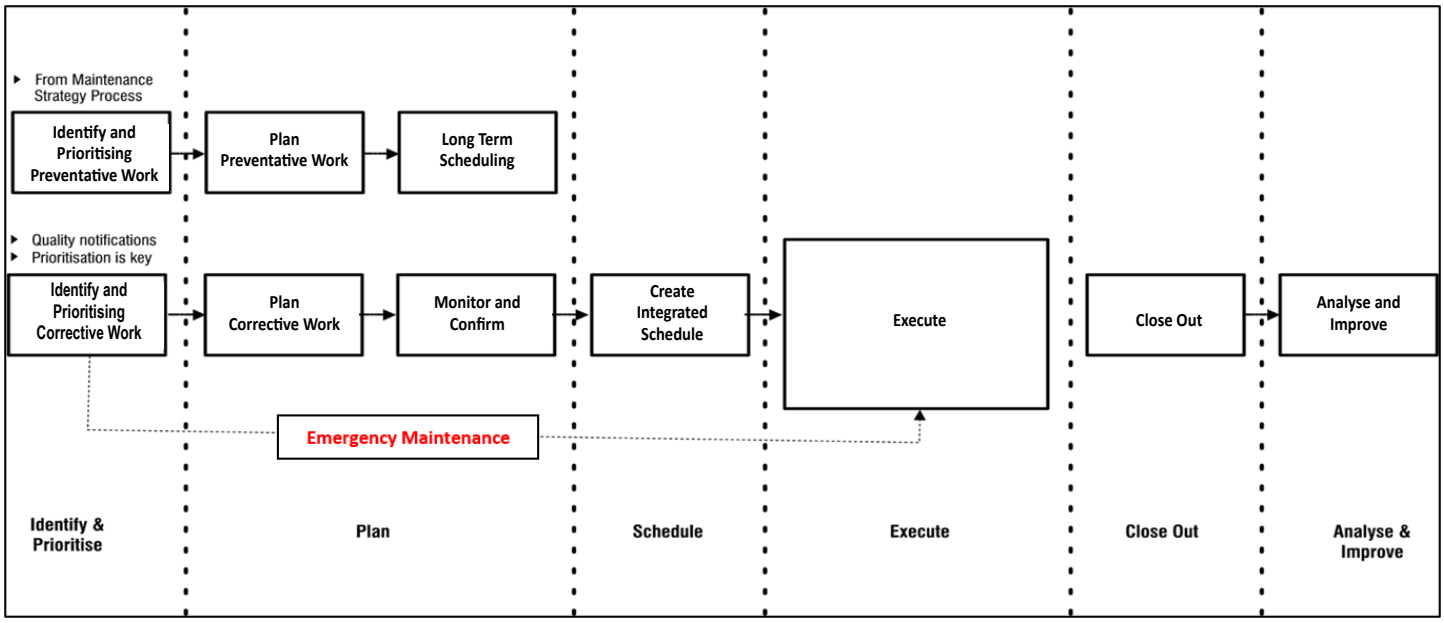
PLANNING

In planning, there are two distinct classes of work: (a) Preventive maintenance (PM) is defined as a once off effort and then it's set up in the CMMS and is repeated over and over again (every week, month and year). (b) Corrective maintenance (CM) planning is only initiated when there is a fault. A work request is raised, prioritised, planned and executed.

Application of the six elements of planning and scheduling differs in relation to the class of work being done. This difference is explained in the diagram on page 5 by the Road to Reliability Academy. The first three steps (identify & prioritise, plan and schedule)- which I'll refer to as the front end of the process- differ for PM and CM tasks. For the back end (execute, close out and analyse & improve), the implementation is the same.

Identification, prioritisation & planning of Preventive Maintenance (PM):

PM is defined as part of the maintenance strategy development, typically it has a fixed schedule to which you simply adhere, using tools such as FMEA (Failure Modes & Effects Analysis), RCM (Reliability-centred Maintenance) or RBI (Risk-based Inspections). Developing a long term schedule helps to build efficiency by avoiding multiple equipment shutdowns on the same equipment and grouping all the work that requires specialist external resources to be executed at the same time.



After this point, planning of preventive maintenance joins up with that of corrective maintenance in the process.

Identification and prioritising of Corrective Maintenance (CM)
CM is identified by operators or maintenance technicians and a work request is raised, reviewed and prioritised using the RAM (Risk Assessment Matrix) and RIME (Ranking Index for Maintenance Expenditure) methods. Mitigation of the fault is looked at thoroughly during this process. The availability of mitigation changes the criticality of the fault. CM identification and prioritisation is much more dynamic and fluid and must be managed in a different manner than PM.

Planning of Corrective Maintenance
Planning for both CM and PM has the same focus: to improve job efficiency by documenting clearly what needs to be done, how it has to done, and what resources (tools, materials and human) are required to do the job.

Monitor and confirm
This step is there to make sure that all those work orders have been planned, and are checked to make sure they are 100% ready before they are allowed to proceed to the scheduling zone. From there, all the work orders now belong to the scheduler, who produces the frozen weekly schedule.

Thereafter (from execution to analyse and improve) the process is repeated.

Emergencies
There's one more type of work that takes precedence over the whole planning and scheduling process- emergency work.

This is work that is so urgent that it must be done immediately. This is the only work that is allowed to break into the frozen weekly schedule after it has been proven that there are no mitigation actions during the prioritisation process. Studies have shown that emergency maintenance is three to five times more expensive than planned maintenance. When emergency work presents itself, it goes straight to the execution stage from the identification and prioritisation process, which can leave organisations financially and physically drained.

Implementing a robust planning and scheduling programme will eventually reduce emergency work to acceptable levels of <10%. This is the main reason why some of the industrial plants don't practice condition monitoring on their assets even when it has been proven that it's very helpful - they are forever engaged in a relentless firefighting exercise.

Within 6 to 12 months of implementing a robust planning and scheduling programme, wrench time can show a 45% improvement.

Let's go back to our initial example of a company employing 20 technicians: We take two technicians and make them a planner and a scheduler. This leaves us with 18 technicians. The 18 technicians should liquidate 900 hours per week (18 x 10hrs x five days). Productivity is now at 45%, which is 405 hours (900 x 45%).

18 technicians supported by a planner and scheduler are 105 hours more productive (35% increase) than 20 technicians without the support of planning and scheduling.

Traditionally, increasing productivity of 20 technicians by 35% (not supported by planning and scheduling) would require hiring seven more technicians. Converting this to dollar value the company is now getting a return of $40,500.00 per month (405hrs x $100) which is $486,000.00 (almost half a million) per annum. Take into consideration large industrial plants employing hundreds of technicians- the returns run into millions of dollars, all achieved without hiring extra people, but by changing the way we work.

There are other benefits associated with a robust planning and scheduling programme, such as improved staff morale, reduced costs, job ownership, firefighting slows down, the then prevailing situation allows you to be proactive, improved safety at the workplace, etc.

Since maintenance is repetitive, you do not end after achieving 45% productivity, because you're continuously making small improvements. Eventually, with hard work and commitment over time, you could achieve world class wrench times of >55%.

I would like to conclude with this saying: 'Explore the past to understand the present and shape the future' which is attributed to Susan Graseck, Director of the Choices Programme and a Senior Fellow at the Watson Institute for International and Public Affairs. I found this saying to be very relevant to the world of maintenance. Many industrial plants around the world approach this subject differently, but with the same objective of improved reliability, hence not many are successful at it.

About the writer...

Raymond is the Business Developer at WearCheck Zimbabwe, where he has worked for 11 years. Raymond's qualifications include a SAIT: Lubrication engineering certificate, Road to Reliability: Maintenance Planning & Scheduling certificate and he is currently studying IPMZ: diploma in Human Resources Development. Armed with a passion for excellence and piqued by a challenge from his first ever boss, who said 'You can never fix anything if you don't understand how it works', Raymond's obsession with the finer details has stood him in good stead in the condition monitoring arena.

Planet-friendly option

WearCheck no longer prints hard copies of our *Monitor* and *Technical Bulletin* publications. Should you wish to be included on our digital mailing list please scan the QR code or e-mail a subscribe request to: marketing@wearcheck.co.za.

Copies of previous *Technical Bulletins* can be accessed on WearCheck's web site: www.wearcheck.co.za

Head Office KwaZulu-Natal
No. 4 The Terrace,
Westway Office Park,
Westville, KZN, 3629
PO Box 15108,
Westmead, KZN, 3608
t +27 31 700 5460
e support@wearcheck.co.za
w www.wearcheck.co.za

Gauteng Office
30 Electron Avenue, Isando,
Gauteng, 1600
t +27 11 392 6322
e support@wearcheck.co.za

WEAR CHECK® Condition Monitoring Specialists

South African Branches

Bloemfontein	+27 51 101 0930
Eastern Cape	+27 41 360 1535
Middelburg/Witbank	+27 13 246 2966
Northern Cape	+27 66 474 8628
Rustenburg	+27 83 938 1410
Western Cape	+27 21 001 2100

International Branches

Botswana (Agent)	+267 311 6829
DRC	+260 977 622 287
Ghana (Tarkwa)	+233 54 431 6512
Ghana (Kumasi)	+233 54 229 8912
India	+91 44 4557 5039
Mozambique	+258 857 92 7933
Namibia	+264 81 129 6078
Pakistan (Agent)	+92 32 3425 7278
UAE	+971 6 740 1700
Uganda (Agent)	+256 78 529 6994
Zambia	+260 212 210 161
Zimbabwe	+263 24 244 6369