WEAR CHECK
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WHY MAINTENANCE PLANNING & SCHEDULING MAY FAIL - PART 2

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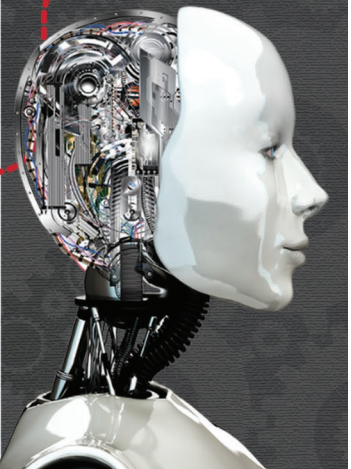
ABSTRACT

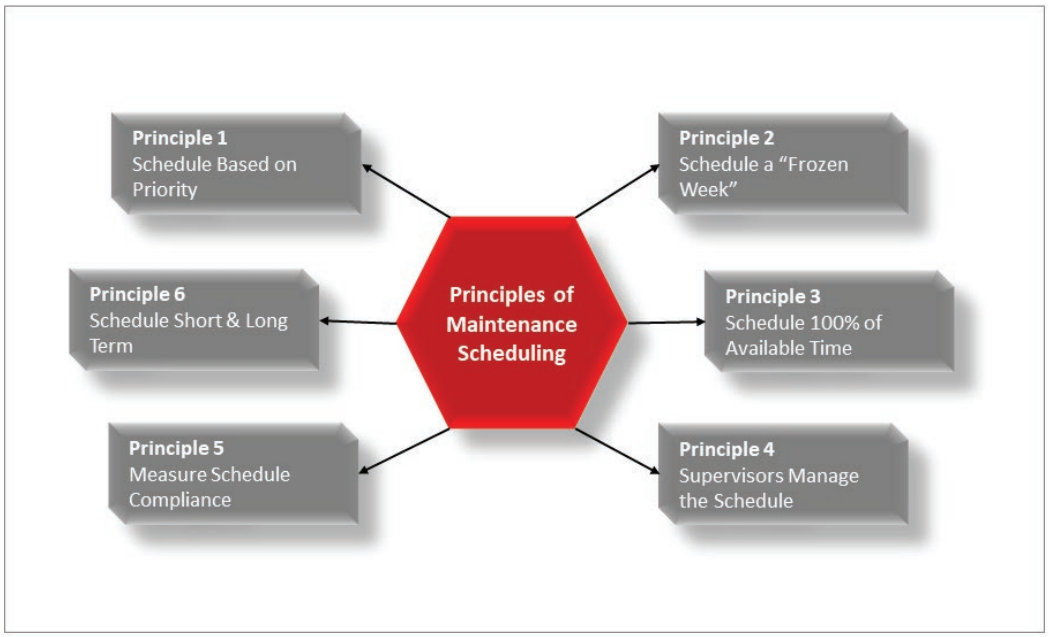
In this article, we discuss the six principles of maintenance scheduling and their importance to the maintenance function. Scheduling is sort of a direct response to Parkin's Law (1955), which states that the amount of work assigned expands to fill the amount of time available.

Visualise waking up without a to-do list on your day off from work - you might be able to do one or two tasks that day, but when you wake up with a list of five tasks, you might accomplish three or four of them. You might not be able to accomplish all five tasks on your list, but being able to complete three or four of them is far more of an achievement than just waking up without a plan and seeing how the day proceeds.

Scheduling is all about goal setting, which involves giving enough work to craft crews to fill up a forecast of crew-work hours available - whether for a day or a week.



Below are the six principles of maintenance scheduling, which will be discussed in detail.



PRINCIPLE 1 – SCHEDULE WORK BASED ON ITS PRIORITY

From the perspective of the originator, their jobs are the most urgent and have to be attended to 'by yesterday'. The scheduler's dilemma that unfolds from this situation is: 'which jobs have precedence over the others?'

- Objective: schedule the work with the highest priority first, thus Preventive Maintenance (PM) always comes before routine Corrective Maintenance (CM) work. The plant has to define what type of work is considered urgent/critical as opposed to routine work.
- Reasons for prioritisation: schedulers are faced with two categories of maintenance work to schedule, and the biggest dilemma is which of the two categories takes precedence over the other: 1) Preventive Maintenance (PM) and 2) Corrective Maintenance (CM)
- Prioritisation methodology: in Technical Bulletin 82, we discussed prioritisation of corrective work requests, and that the Ranking Index for Maintenance Expenditures (RIME) and Risk Assessment Matrix (RAM) are the preferred tools. These two methods are not effective for prioritising PM work that sits in your computerised maintenance management system (CMMS), and most typically you would have applied some kind of categorisation when uploading your PM into your CMMS. Using that categorisation, you can then create what is called Schedule Load Sequence (Erik Hupjé of The Road to Reliability), which is nothing more than an agreed sequence in which you put work into your frozen weekly schedule. A simple example of schedule load sequence is:

  o Priority 1
    1. All Safety Critical and Legislative PM
    2. All Safety Critical and Legislative CM
  o Priority 2
    1. Production Critical PM
    2. . Production Critical CM
  o Priority 3
    1. Other PM
    2. Other CM

- Advantages of scheduling based on priority: when applying the RAM, RIME, and Schedule Load Sequence to create a draft schedule, there's little chance of that draft schedule being taken apart and restarted during the schedule review meeting, because as an organisation, you have shared priorities.

- Take note:
  - o No system is perfect and foolproof - despite application of these methodologies, common sense overrides everything. At times you've got to deviate from your agreed sequence and that should be an exception, not a regular occurrence.
  - o When loading your schedule, job size matters. The big jobs should be loaded first into the schedule. This is best explained by Stephen Kobe's 'Jar of Life' analogy to time management, which explains how we make space in our busy lives for the most important things by doing them first.

PRINCIPLE 2 – SCHEDULE A 'FROZEN WEEK'

The term 'frozen week' shows two important facts about principle two, which are: firstly, that the schedule is frozen - meaning it's locked and not easily broken unless there's prior approval from a senior authority, and secondly, the work schedule is for a week, not only for a single day and not for a month.

- Objective: the one-week period strikes a balance between being a long enough and a short enough period. The one-week period cancels out the time estimate inaccuracies of the individual job plans. An individual job plan has an estimated accuracy of ±100%, whereas a week's worth of work has an estimated accuracy in the ±10% range. Those jobs whose time has been underestimated are cancelled out by those jobs whose time has been overestimated, and a one-week schedule is the ideal period.
- The process of preparing the one-week schedule:
  1. The plant has to agree to what constitutes a working week and stick to it. Typically, the week starts from Monday to Sunday for a seven-day working week, or Monday to Friday for a five-day working week. In some plants that run a back-to-back shifts system, they align their weekly schedule to the crew schedule, so that it runs, for example: from Wednesday to Tuesday.
  2. Develop and agree upon a load sequence for the weekly schedule. At the same time, develop a rolling schedule, where the first week becomes the frozen week once the schedule is approved. As part of the process, the scheduler also builds a draft schedule for week two, and eventually weeks three and four. Those draft weeks will be less complete and accurate. What is important is to start having a discussion of weeks three and four, so that when the time comes to build those weeks out to a frozen week, there are no real surprises.
  3. Set up a specific day of the week when you hold the schedule review meeting to lock the schedule. For a seven-day working week, it'll be typically on a Thursday. In this meeting, maintenance, operations and planning sections should be represented, and - in most cases - the scheduler chairs the meeting. This is the day the weekly schedule is frozen.
  4. For a seven-day working week, on Sunday night before the frozen weekly schedule starts, take a snapshot of the data in your CMMS and then take another snapshot on Monday or Tuesday morning of the following week, to see what work was completed and what's still outstanding.
- Advantages of scheduling for one week: supervisors can generally protect a week by asking if a new job could wait until the next week, or even asking if it could wait for a couple of weeks. The one-week period is also short enough to allow supervisors more certainty in knowing which of their crew members will be available for work.

PRINCIPLE 3 - SCHEDULE 100% OF THE AVAILABLE TIME

Build your frozen weekly schedule on 100% of your available hours, not on 80%, and not on 120%, but using exactly 100% of the available hours. To determine the available hours, you first need to break your overall crew into their relevant trades or work centres in the CMMS, and then use that information to load your schedule.

- Objective: scheduling 100% of the available hours means that your frozen weekly schedule will be loaded with just enough work to complete based on your actual resources available.
- Common misconception: at times, maintenance personnel mix up loading the schedule to 100% of the available manhours and achieving 100% schedule compliance.
- Correct relationship with schedule compliance: you

load your schedule to 100% of the available manhours, which drives the best efficiency and then aim for a schedule compliance of, say 80 - 85% for starters, and gradually aim to drive higher. You never aim for 100% schedule compliance, and, should you be achieving 100% compliance, it should set alarm bells ringing, which warrants an investigation of how you're loading the schedule.

- Reasons why some fail to schedule 100%:
  - In some plants, an allowance is reserved for emergency work or other high priority work that may occur,
  - Violation of any of the six planning principles results in little fully planned work orders, which results in less jobs to put in the schedule.
- Consequences of not scheduling to 100%: those PM jobs that are left undone might have been work that was being herded off while dealing with emergencies, which will bog down the plant into reactive maintenance - the very environment we're trying to break out of by implementing maintenance planning and scheduling.

PRINCIPLE 4 – SUPERVISOR MANAGES THE SCHEDULE

Once the schedule has been approved and frozen, it's now handed over to the crew supervisor.

- Objective: supervisor develops a daily schedule in advance using the current job progress, the one-week schedule and new high-priority jobs as a guide, considering personnel skills and work order requirements.
- Advantages of supervisor managing the schedule: some jobs will run over, and some will run under, their planned work hours. Since the supervisor is closer to the field situation, he's constantly monitoring the job progress, and can assign particular jobs to individuals based on their experience, or even the need to learn. For those jobs that run over their time estimates, the supervisor delays assigning another job, whereas for those jobs that run under their estimated times, the supervisor will assign additional work to start earlier than expected.
- Dealing with emergency jobs: ordinarily, when an urgent job arises, the supervisor and the planners assesses the jobs, and the supervisor assigns them as soon as qualified technicians complete current jobs in progress. Emergency jobs do not receive planning attention, they are handled entirely as jobs in progress from a planning standpoint. Emergency work interrupts jobs already in progress for the current day, while the supervisor schedules urgent jobs for the next day as appropriate.
- Reasons why planners and schedulers should not handle daily planning of work:
  - The daily process is so dynamic such that the only one who knows what's going on, is the supervisor, who should be out in the field. The supervisor is best positioned to make the next daily schedule.
  - Supervisors understand the specific abilities of their various technicians. There might be various personalities within the crew that make the supervisor favour pairing certain technicians together and keeping certain others apart. Some technicians work better alone, whereas others work better as a team.
  - Supervisors are best placed to know the daily personnel concerns of their departments, such as persons that call in sick, etc.
- The critical driver of maintenance productivity is the weekly schedule, according to the book *'In Search of Excellence'* written by Peters and Waterman. It identifies eight common characteristics of top-performing companies. One of the characteristics is the concept of 'Tight and Loose'. The plant should be 'tight' about creating that schedule i.e. mechanisms are put in place to ensure that the plant starts each week with each maintenance crew having a batch of work that matches its labour hours without fail. The plant is 'loose' about over-controlling the daily scheduling, by allowing the crew supervisors to manage the daily scheduling without interference from the planning and scheduling groups.

PRINCIPLE 5 – MEASURE SCHEDULE COMPLIANCE

'If you can't measure it, you can't improve it,' This quote is by Peter Drucker, who is credited with inventing modern business management. Since maintenance is repetitive by nature, measuring it gives the opportunity to improve.

- Objective: we're not targeting one big improvement, but we do want regular small improvements, which, over time, add up to become massive improvements in the process.
- The three types of scheduling metrics:
  - o Schedule compliance
  - – Schedule compliancy measures how much work that was included in a frozen week weekly schedule was actually completed within the week.
  - – This metric is so important, because it is a reflection of how stable your environment is.
  - – There are two methods to measure schedule compliance:
  1. Calculate on the basis of actual jobs completed:
     - This is the total number of jobs in a frozen weekly schedule completed within the week and divided by the total number of jobs in the frozen weekly schedule, multiplied by 100.
     - The downside of this approach is that you don't consider whether the job was a major task that maybe took 20 hours, versus a small job that only took three hours. Instead, you're treating both of these jobs the same, and this tends to distort figures somewhat.
  2. Calculate on the basis of actual hours liquidated:
     - You divide the total number of hours for all jobs in a frozen weekly schedule that were completed, by the total number of hours for all the jobs in a weekly schedule, and multiply by 100.
     - Don't start mixing planned hours with actual hours, it's strongly recommended to use the planned hours for both the numerator and denominator. If you use actual hours for the numerator and planned hours for the denominator, you're then measuring planning accuracies, which is not what we want at the moment.
     - Initially, aim for a compliance of 70% and gradually improve it to >90%, which is considered world class.
  - o Emergency maintenance
  - – Emergency maintenance is that work which was identified during the frozen week, that was so urgent that it was not able to wait for a week. This work was allowed to break into the frozen weekly schedule and done as a priority.
  - – Emergency maintenance can also be calculated using both:
  1. Number of jobs
     - Total number of jobs completed during the frozen week that did not exist before the frozen week, divided by the total number of jobs in the frozen weekly schedule, multiply that by 100.
  2. The number of hours.
     - Total number of hours spent on emergency work that broke into the frozen weekly schedule, divided by the total number of hours of all the jobs in the frozen weekly schedule, multiplied by 100.
  - – Initially aim for <10% and gradually improve it to <2%, which is considered world class.
  - – Emergency work values of around 20% is indicative of a very reactive environment, which, when implementing a robust maintenance planning and scheduling system, is meant to methodically steer you away from such a repressive, reactive working environment.
  - o Fill-in work
  - – Fill-in work is made up of a ready backlog of jobs that are already planned in the CMMS but did not make it in the weekly frozen schedule because they were deemed as not urgent.
  - – Fill-in work is calculated by total hours of all planned work in the CMMS, but not included in the weekly schedule because it was deemed as not urgent, divided by the total number of hours of all planned jobs in the weekly schedule, multiplied by 100.
  - – Initially aim for <15%, and gradually improve it to <5%.
  - – Reasons for increase in the amount of fill-in work:
  1. Technicians not taking the schedule seriously,
  2. When the supervisor has the tendency to not issue enough jobs equivalent to the length of the shift duration, with the instruction that when the technicians finish the job, they have to come and get additional work orders.

- Key points:
  1. Take a snapshot of all the work scheduled for the following week (if you run a five-day working week, it's on Friday; and if it's a seven-day working week it's on Sunday) as a baseline for calculating the metrics. On the next Monday (end of day) after the frozen week, take another snapshot and determine how many jobs in the schedule where completed. These two figures are what we use when calculating the metrics.
  2. Don't focus too much attention on the actual values of the performance metrics. The most important factor is the longer-term trend and understanding the story behind each metric. Understand the reasons behind poor schedule compliance - was it due to a high amount of emergency work or a high amount of fill-in work?
  3. Achieving a schedule compliance of 100% is very suspect to say the least, it's a symptom of several factors, chief amongst them being:
  - o Violation of scheduling principle three – not scheduling to 100% of the available man hours, or
  - o You might have too many technicians in your employment for the amount of work available.
  - o The technicians might have developed the habit of managing the KPIs instead of doing the actual work. They are now in the habit of a tick-and-flick culture - just ticking the completion boxes, but not actually doing the work.
  4. Using all three metrics simultaneously will give you the current state of your scheduling process, which opens up opportunities for small improvements each and every time.

PRINCIPLE 6 – SCHEDULE SHORT TERM AND LONG TERM

Short-term scheduling revolves around creation of a weekly schedule by looking at work (both Preventive Maintenance and Corrective Maintenance) that is coming up in the next few weeks, whereas long-term scheduling is most concerned about Preventive Maintenance (PM) and some major corrective campaigns that you can identify way ahead.

- Objective: long-term and short-term scheduling allows you to use scheduling as a way to drive down your downtime by reducing waste between jobs, improving coordination between trades, between maintenance and operations, and it enables the staging of materials, parts and tools.

- Implementation:
  - o As you get better with short-term scheduling, you want to build that frozen weekly schedule out into a rolling schedule with a longer time horizon of at least four weeks. Even with this four-week rolling schedule, you're still going to freeze one week, but this gives you clarity on the priorities and focus areas for each specific week.
  - o Imagine the scheduling process as a conveyor belt and your weekly schedules as buckets sitting on the conveyor belt. The size of the bucket represents the amount of labour hours available.
  - o The bucket sitting on the extreme left side of the conveyor is the frozen week, the next bucket is next week's frozen week etc. Future PMs and CMs can be put in advance buckets, and this will then be your long-term schedule.

- Advantages of short-term and long-term scheduling:
  - o Some maintenance activities require total shut down of the plant. If you bring forward and delay some PMs and CMs so that they are all executed when the plant is on shutdown, it reduces unnecessary equipment downtime and this is necessitated by implementation of long-term scheduling.

Overview of the six scheduling principles:

1. Schedule based on priority
2. Schedule for a frozen week
3. Schedule 100% of available time
4. Supervisor manages the schedule
5. Measure schedule compliance
6. Schedule short term and long term

In this two-part article, it has been clearly laid out how maintenance planning and scheduling should be implemented to increase productivity. Both planning and scheduling are built around six principles, which are required to be executed with a high degree of consistency and discipline from every member of the plant. .

WHEN IMPLEMENTING A PROCESS IMPROVEMENT – 'GO FOR THE BASICS'

When it comes to process improvement, naturally people tend to look to the market for the latest technology available. The belief is that the market always offers the latest (though with a premium cost attached), however, the latest might not always be ideal for your operation. Regular small improvements on your processes will add up over time to become a massive improvement. This is especially true when it comes to maintenance productivity.

Erik Hupjé, founder of the Road to Reliability Academy, has this to say when asked why he focuses so much on the basics: "In 2005 I took over as head of maintenance execution for an asset in Southeast Asia, responsible for the maintenance of an onshore gas plant and an offshore platform. I inherited a team with highly capable people but operating in a highly reactive maintenance environment.

'Almost all the major systems on the platform had installed redundancy, and in pretty much every case, we needed that redundancy. Every single system was plagued with issues.

'Every week we had an 'emergency' that would throw everything up in the air.

'We had a big backlog of outstanding safety-critical maintenance and significant asset integrity issues. We had a huge backlog of maintenance in general and a massive fabric maintenance problem.

'Productivity was low, morale in the maintenance team was low. We struggled to get work done and had more work than we could get through, or so we thought.

'Having a limited background in maintenance at that time, I learned the importance of the basics the hard way – by working in an organisation where the basics were completely ineffective.

'It was in this role that I first experienced the value and importance of planning and scheduling to drive maintenance productivity. I saw first-hand how it starts to create a more stable working environment, gets more work done and improves morale.

'It was here that I learned that, unless you resolve the defects and root causes that drive your repeat failures, you'll never escape the cycle of reactive maintenance- "fix forever" and not "forever fixing".

'It was here that I saw how bad many preventive maintenance programmes really are. We wasted so much time doing PMs that added no value, and at the same time, we were missing important PMs.

'When I eventually discovered Winston Ledet's work that underpinned the manufacturing game and was later documented in his excellent book '***Don't Just Fix It, Improve It***', it was a revelation. It highlighted industry research that completely aligned with my experience. I realised that my experience was not unique and could, in fact, have been predicted!

'As I travelled more in my career across Asia, the Middle East and Australia, I kept seeing organisations in those same areas, and up to this day I still see teams struggling with the same issues I struggled with back then i.e.

- Low productivity
- Repeat failures
- Ineffective PM programmes

'This is why I focus on the basics, because they work, and they offer you the best and fastest Road to Reliability.'

REFERENCES

1. *Maintenance Planning & Scheduling Handbook – Richard Doc Palmer*

2. *Road 2 Reliability Pty Ltd – Erik Hupje*

About the writer...

Raymond is the Sales Developer at WearCheck Zimbabwe, where he has worked since 2010, and prior to that he gained 18 years' experience as a maintenance artisan. Raymond's qualifications include a National Certificate in Diesel Plant Fitting, 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.

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