Maintenance Tactics

Are you doing the right maintenance??

Excellence in Maintenance truly requires that you have good control over your maintenance activities. As with just about any process, it is crucial to firstly understand what needs to be done. Hence, one of the key control elements in maintenance is having the RIGHT maintenance tactics. i.e.: making sure you are doing the right maintenance!

I remember back to my early days as a young engineer, fresh from college and full of bright ideas on new maintenance and engineering techniques …. Passionate about moving my company from the backward reactive maintenance, where the maintenance "hero's" were those mechanics and technicians who were the quickest to respond to breakdowns, often working through the night to get the plant operational and when the plant was back on line the manager would arrive and slap everyone on the back and tell them what a great job they had all done. Well to me as a young engineer, there was always one nagging thought in the back of my mind …. Why did the plant breakdown in the first place …. Wouldn't it have been much better if we could have prevented the breakdown from occurring in the first place!

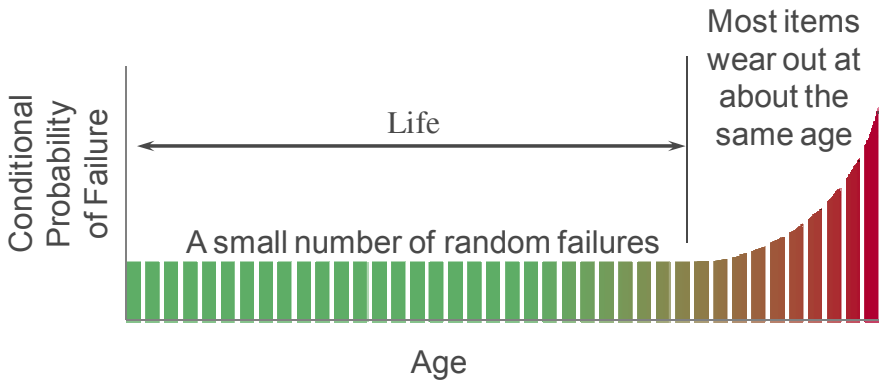
After a time I decided to question some of the older, more senior technicians to try and get the answer to my nagging questions … and surprisingly the response was "well son, if it ain't broke then don't fix it!!"

This just didn't make sense and contradicted just about everything I had learned in college …. So determined that I was right and they old guys were wrong … continued on my march to implement Preventive Maintenance programs wherever I could. But after some time …. I realized that the results we were achieving were often only marginally better than the old ways of breakdown maintenance.

It was then, during my frustrations that I happened to stumble on a book by John Moubray called RCM II, after studied this for sometime …suddenly it became apparent that perhaps in some cases my older colleagues were right …. They knew intuitively and based on their experience that some machinery failure were very likely to happen **after** maintenance work is done on that machine.

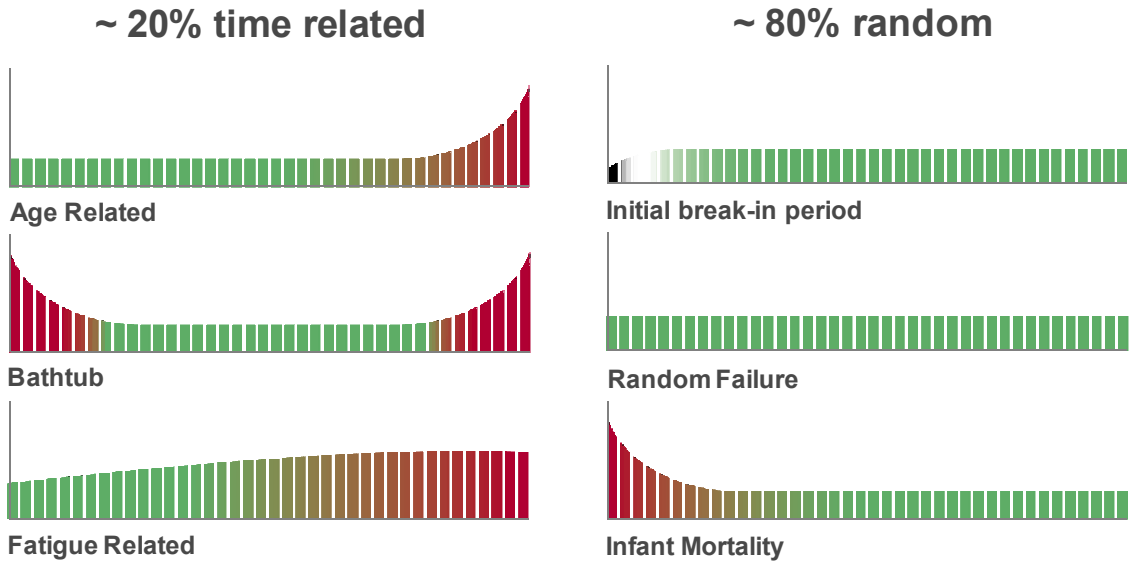
It became clear to me that the right approach to determining maintenance tactics (or also known as Asset Maintenance Strategy which also include Planned Maintenance programs) was to better understand exactly how equipment failed … then based on these understanding of failure modes we could determine what the effects and consequences of the failure would be and hence determine the most appropriate maintenance tactics to manage those failure consequences.

In the past it was generally believed that most equipment behaved in a time-based predictable pattern – that the probablity of failure was relatively low and constant until a so called wear-out zone was reached. In other word, it was generally believed that the likelihood of failures increases as equipment gets older.



Traditional View of Equipment Failures

However from a research study conducted by the airline industry which started in the 1960's, the reality was that a very small percentage of equipment actually failed that way. In fact, as the diagram below clearly shows, there are many failure patterns of machinery behaviour, and only about 20% of the failures in a typical industrial plant has a time-based predictable "wear-out" zone.



Note the phenomenon of infant mortality, depicted above by the initial high probability of failure upon commissioning an asset into service. About 68% of failures in the airline industry is attributable to this failure pattern. While, only 11% has a time-based predictable wear-out pattern. In general industry, the more advance the plant / equipment is, the more it resembles the airline industry. Hence, it seems that my older colleagues were on the right track … and I was the one who was wrong …. By pushing a predominately time-based Preventive Maintenance approach, I was only addressing a small percentage of the equipment and even more frightening I was potentially introducing infant mortality on a high percentage of our assets. So all more good intentions and the knowledge I had been taught in college was in fact doing more harm than good!!

Now I am not saying that we shouldn't do anything until our equipment fails, but rather, while most of our the failures do not have time-based pattern, most of these failures give warning or an indication that failure is about to happen or in the process of happening. Hence failures can be predictable using predictive maintenance technologies or also known as condition based monitoring techniques. Eliminating the unnecessary Preventive Maintenance and introducing Predictive Maintenance policies enhances our ability to proactively manage our assets to be more reliable, and reduce the cost of maintenance at the same time! The challenge is knowing the right tool to use at the right time.

So what are the maintenance tactics currently available or used?

Failure management techniques are divided into two categories:

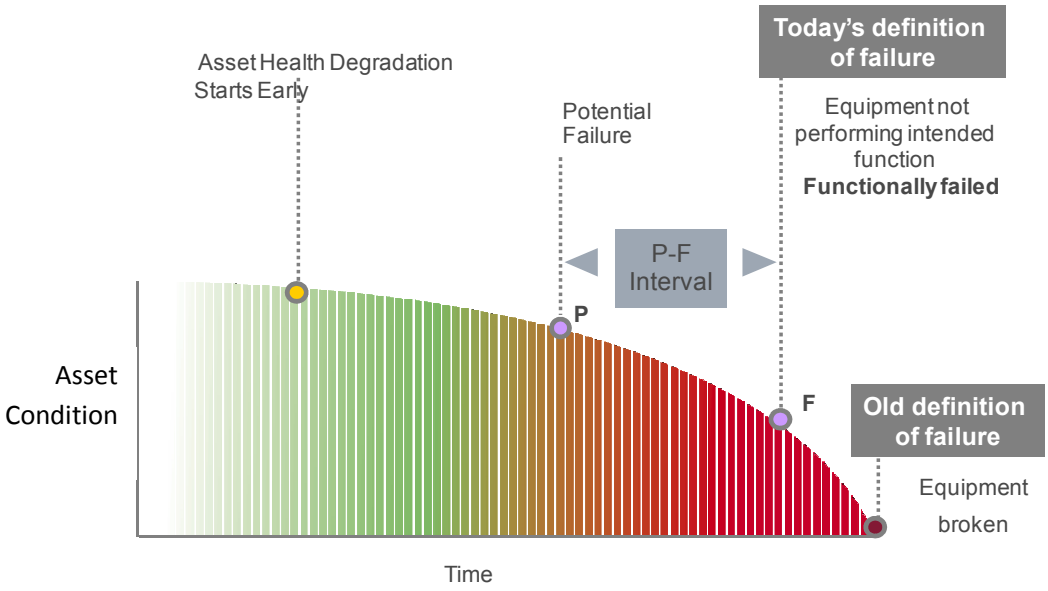
Proactive tasks: these are tasks undertaken before a failure occurs, in order to prevent the item from getting into a failed state. They embrace what is traditionally known as 'predictive' and 'preventive' maintenance. Sometimes these are also refered to as scheduled restoration, scheduled discard and on-condition maintenance. Scheduled restoration entails remanufacturing a component or overhaul

Default actions: these deal with the failed state, and are chosen when it is not possible to identify an effective proactive task. Default actions include failure-finding, redesign and run-to-failure.

Now lets examine the proactive tasks in a little more detail:

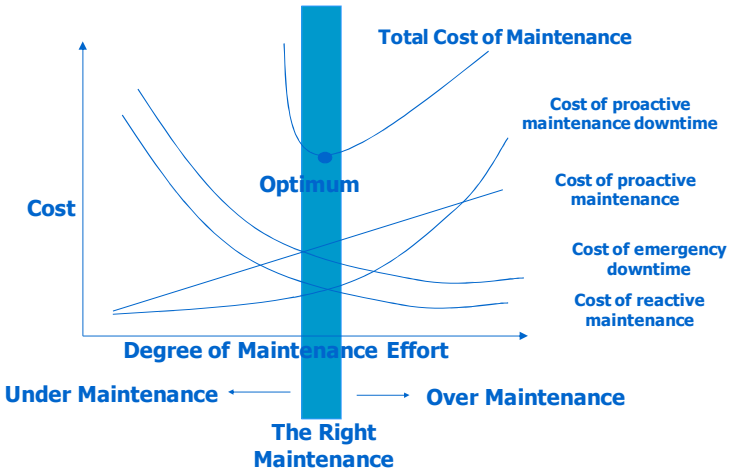
Schedule restoration and scheduled discard tasks , generally these are known as Preventive Maintenance tasks. They are the most widely used form of proactive maintenance, however for the reasons discussed above they are less widely used than twenty years ago. They are technically feasible, only if we know that the failures we are meant to prevent has a time related pattern and we know the point to which there is an increase of the conditional probability of failure.

On-condition tasks, given the continuing need to prevent certain types of failures, and the growing inability of classical techinques to do so, are behind the growth of new types of failure management. The majority of these techniques rely on the fact that most failures give some warning of the fact that they are about to occur. These warnings are know as **potential failures**, how often have we experienced a small noise, perhaps some unusual vibration or in extreme cases excessive heat from a bearing that is about to fail. The new techniques are used to detect potential failure so that action can be taken to avoid the consequences which could occur if they degenerate into functional failures. They are called on-condition tasks because items are left in service on the condition that they continue to meet the desired performance standards. On-condition maintenance includes predictive maintenance, condition-based maintenance and condition monitoring.



Used appropriately, on-condition tasks are a very good way of managing failures, but they can also be an expensive waste of time.

From the diagram below, you can see there is an optimum range in which we are optimally maintaining our equipment. That is we are not overmaintaining, i.e too heavy investment in Preventive Maintenance, and Predictive maintenance and at the same time not undermaintaining, i.e. too much reactive "breakdown" maintenance.



That brings me to the next stage, having determined the equipment failure mode, the final challenge in order to ensure we have the optimum in terms of maintenance results (asset reliability and availability) and maintenance costs, we need to answer two questions:

Is it technically feasible?

Whether or not a proactive tasks is technically feasible is governed by the technical characteristics of the task and of the failure which it is meant to prevent. Depending on the maintenance task type, there is a set of criteria that needs to be satisfied

Is it worth doing?

Whether a maintenance task is worth doing is governed by how well it deals with the consequences of the failure, and that the cost of doing the task is less than that cost of the consequences of the failure for failures which have operational or non operational consequences. Or for tasks addressing failures which have safety / environmental consequences, these tasks under consideration must reduce the risk of failures to a tolerable level.

This approach means that proactive tasks are only specified for failures which really need them, which in turn leads to substantial reductions in routine workloads. Less routine work also means that the remaining tasks are more likely to be done properly.

Need more info?

If you or your team would like to learn more about how to determine the most appropriate maintenance tactics please contact us at relogica@relogica.com or consider attending our RCM II training workshops.