

# Developing a Master Asset Protection Plan: a road-MAPP for success

Are you utilising best practices? As stewards and trustees of multi-million dollar portfolios, we need to focus on adopting a long term asset management philosophy to help create a more organised and effective lifecycle team (i.e. planning, engineering, design, construction, O&M). An organised approach will lead to significant financial benefits. For the past eight years, the author's efforts have been focused on identifying and implementing best asset management practices. Currently and as a former utility manager (or practitioner), he is involved with local, national and international research and collaboration with various public and private industries. As a result, he has collected and tested tools and techniques in order to define a total enterprise asset management model called the 'Master Asset Protection Plan', or a road-MAPP for success.

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**One interesting facet: whether we manage physical assets in utilities, academia, healthcare, or manufacturing, our roles are 90% the same and only 10% different. The difference is in the product delivered and the customers we serve. A successful Master Asset Protection Plan demands involvement from key business units: planning, finance, engineering, information technology, construction, operations and maintenance. Employing change management principles will ensure that your organisation adopts and integrates asset management best practices and reaps the associated long-term benefits. This article outlines fourteen core MAPP principles, along with explanations of each element based on first hand experience.**

*1) Asset Register – a master register/inventory of building, plant and infrastructure assets maintained in the asset register. Each asset receives a criticality value and a unique identifier to use with supporting programmes/technology.* The asset register should include all assets. A preventive maintenance programme should be assigned to each, whether it is an inspection, preventive or predictive task. Many organisations only capture equipment assets and

forget about buried piping and the building envelope. If an inventory is needed, consider a cost-effective approach similar to one utilised at a large utility. Since a team of engineers were already slated to inventory each facility, they also tagged (with a unique identifier or 'smart number') and performed equipment condition assessments. Prior to embarking on this effort, an automated process was developed with off-the-shelf software technology which supported sequential, non-duplicated tagging and collection of condition data for timely use in the capital improvement planning (CIP) process as well as equipment data input into their computerised maintenance management system (CMMS). A future effort developed a criticality scheme that would be used in prioritising equipment for a maintenance optimisation programme, and would also be used in helping to prioritise projects against these assets.

*2) Condition Assessment/Monitoring – a programme that collects and monitors the condition and/or performance of all assets. Because data collection is expensive, a criticality/prioritisation process determines depth and frequency so that critical assets are monitored more frequently.* Many organisations confuse condition assessment and condition monitoring terms. Traditionally 'condition

assessments' are completed well into an asset's life and used to develop scope as part of a capital renewal project. This is a reactive and costly approach. The maintenance strategy should include regular condition assessment/monitoring tasks for all asset types. The approach will vary quite a bit depending on the asset and its importance in meeting the organisation's mission. At a water treatment plant for example, continuous condition monitoring (on-line vibration) is used for high-speed critical equipment and a manual 'walk-around' programme is used for second tier, lower speed equipment. In addition to the five human senses, other condition monitoring techniques include oil sampling and infra-red scanning.

Building envelope assets (roofing, siding and windows) can be monitored through visual condition assessment/inspection tasks. And since these decay at a lower rate than mechanical assets, the frequency could be extended to every 2-5 years, depending on where they are in their decay curve.

*3) Design and Construction Standards – a new projects programme includes O&M Readiness practices such as tagging/smart number coordination, maintainability reviews, maintenance plan development and appropriate technology purchases. These items are coordinated with the facility*

management team leading to a smoother and cost-effective transition from the design/construct phase into the O&M phase.

Design and construction standards need to keep the facility managers interest in mind. All too often the drivers for new facilities are cost and schedule, where management teams tend to focus on 'first costs' and not lifecycle costs. At one facility, detailed standards and procedures were developed with the facility management team that accounted for safe and easy access for serviceability, asset naming matched existing CMMS naming standards, vibration tolerances for high-speed equipment were detailed and a 'vibration signature' created at turnover as a baseline for decay monitoring.

The design process should also require a full facility lifecycle cost analysis. As part of this effort, team members should develop a maintenance plan that includes a list of active and static assets, appropriate maintenance plans, and a 10-year budget projection, including a staffing plan, to meet the PM programme's needs. While this is the correct (and often tedious) approach to fully fund the operation-specific facility, some owners, executives, and managers choose to ignore this and mandate a zero-budget increase.

**4) Maintenance Strategy – a mix of maintenance policies (determined through a criticality review) help monitor and maintain asset health. Policies must include preventive (PM), predictive (PdM) and condition assessment/monitoring practices managed through a Computerised Maintenance Management System (CMMS) and performance metrics.**

The time-based PM should be employed only when an adequate predictive technology to identify machine faults is not available. Studies have shown that approximately 10% of machine failures occur due to time or operations-cycle based wear. The other 90% of equipment failure modes have no equipment age to failure rate relationship, and therefore are said to be random in nature. This means that for most equipment failure modes, time-based PM inspections are inadequate for mitigating the occurrence of failure. In addition, inappropriate use of invasive PM procedures may introduce faults, or instability, in an otherwise healthy machine – exactly the opposite of the desired impact!

There are tools out there to help automate the maintenance process. Depending on the size and extent of your asset base, a computerised system should be employed.

**5) Renewal/Replacement Planning – Capital improvement planning driven by accurate condition assessment/monitoring and maintenance information with projects prioritised by a criticality framework. New CIP projects include O&M Readiness practices and a complete maintenance programme analysis to ensure proper staff and resource budgeting.**

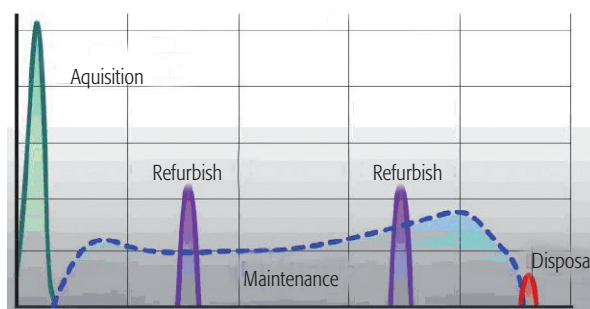
If a comprehensive maintenance strategy is in place, our assets will live well beyond their expected lives. There also needs to be a connection point between the maintenance department and the planning and finance groups to ensure timely renewal of aging and problematic assets. At one organisation for example, a Project Identification and Prioritisation (PI&P) process was created to link the maintenance supervisor's needs to the capital budgeting/planning process. Sizeable maintenance projects were then identified and captured during the normal budgeting process ensuring renewal/replacement prior to catastrophic failure and cost impacts from secondary damage.

**6) Sustainable Financial Plans – short and long-term budgeting and funding strategies match asset management principles and programme requirements. Goals include proper funding levels to avoid deferred maintenance.**

As we know, each asset has a unique deterioration/failure pattern (See Figure 1). If the maintenance strategy accounts for this and there is a feedback loop to the budgeting process, then long term financial forecasts will be more accurate. At the same organisation noted above, the PI&P process connected the 'voice of maintenance' to the annual budgeting process. So the financial plan not only included budgeting for master planning and growth, but for cyclical rebuilt projects (i.e. large compressors) and renewal projects (i.e. VFDs that had a 10-year particular life). Once the financial plans are well understood, then rate/fee structures can be more appropriately set allowing for adequate funding. Sustainable financial plans now take into account renewal/replacement requirements helping to control deferred maintenance.

**7) Organisational Framework – departmental silos are minimised, MAPP programmes are designed, implemented and monitored at a corporate level, and MAPP principles are daily policy.**

With any large scale initiative, it is strongly recommended that a steering or guiding coalition be created with key department managers. This group should initially meet on a regular basis to ensure the MAPP is aligned with the organisation's business plan and that



**Figure 1**  
Asset Life-Cycle Profile

everyone agrees on which practices will be included in the programme. In one case, a large utility re-organised completely to meet new goals set in their re-aligned business plan. And in another case, strategic asset management positions were created along with inter-departmental task teams to help facilitate the adoption of new practices. In both cases, a corporate spokesperson/champion was assigned, linking the effort to the executive team agenda.

**8) Documented Policies/Procedures – asset management processes including planning/design/construction, maintenance, renewal/replacement, and associated MAPP policies are documented and reviewed annually.**

As change is made, new policies and procedures need to be developed and should be captured in a 'standards manual' managed by the asset or facility management department. Training on these new procedures is critical to timely adoption and change sustainability.

**9) Document Control – a programme where new asset documents (vendor cut-sheets, as-builts, and O&M manuals) and engineering programmes (CAD and standard specifications) are fully maintained and coordinated with facility management programmes.**

For this to be effective, the design and construction specifications need to include appropriate language and be coordinated with in-house facility management and information technology (IT) data standards. At one facility, a specification section was created for new construction projects that required electronic O&M manuals and a new 'smart number' naming scheme for as-built drawings and technology data standardisation (i.e. SCADA, CMMS and GIS). In addition, this facility created a formal technical information center (TIC) to help develop and control the lifecycle of these documents as well as manage the 'smart numbering' system.

**10) Technology and Data Management – a programme with the most appropriate technologies (CMMS, SCADA, GIS,**

*EMS, financial) in place (and integrated, as appropriate) to support all MAPP principles. The programme must include appropriate staffing/budgeting levels to keep the technologies up to date and control data input for accurate reporting.*

The IT department needs to be part of the asset management organisational initiative and not out on their own. It is important that processes are documented on paper first prior to trying to automate them with technology. And once selected and implemented, there needs to be data entry control points. If not, the data quickly becomes contaminated and reporting less accurate. At one organisation, the maintenance team knew about the poor data quality, did not trust the reports and stopped using the programme, negating the return on investment opportunity. At another facility, IT staffing was cut and software upgrades/patches went unmanaged which led to an outdated and problematic system.

**11) Risk/Criticality Framework** – an appropriate prioritisation process developed by key stakeholders that includes likelihood/probability and consequences of failure. The framework is a foundation element that applies to all asset prioritisation, maintenance programme selection, and renewal/replacement planning.

Historically, prioritisation is usually given to those speak the loudest or who are 'connected' to decision makers. The use of a formal risk/criticality process can minimise the impact of such activities. It can be used to help prioritise capital projects and maintenance work.

At one large, complex facility, a prioritisation/criticality framework was used to prioritise which equipment assets would be included in a comprehensive Reliability Centered Maintenance (RCM) programme. RCM is a resource intensive effort which requires the most knowledgeable and experienced staff to collaborate in building a custom maintenance programme. Use of the criticality analysis helped break equipment assets into three categories that then received a different level of analysis. The outcome was a grouping of critical assets (See Table 1, above) that would undergo RCM; second tier critical assets would undergo an optimisation review and the low priority ones would remain with original equipment manufacturer (OEM) recommended maintenance tasks.

**12) Performance Metrics** – stakeholders use a variety of key performance metrics (KPIs)

**Table 1: Is RCM for all assets?**

No. It is not appropriate for all assets, and it doesn't make financial sense. So, all equipment assets were prioritised using a criticality/risk model. Then the top 1/3 of the assets were selected for review under the RCM review process.

Equipment	Maintenance Strategy
1. Critical / Problematic (e.g. main water pumps)	RCM Review
2. 2 <sup>nd</sup> Tier Systems (e.g. back-up pumps)	Optimisation Review
3. Support Systems (e.g. sump pumps)	OEM Recommendations

*to drive change and manage performance.*

The glue that holds any programme together is the use of performance measures. The old adage, 'you can't manage what you don't measure' is very true. Sometimes called service levels, measures or metrics, they are needed to help set expectations and targets to meet a desired standard of performance. There are roughly three types of metrics; regulatory (i.e., air and wastewater discharge permits), customer (i.e., odour complaints, repair response time) and internal (time to complete maintenance tasks, cost and schedule for construction projects).

Monitoring initiative performance over time is important, but with multiple initiatives it can cloud results. So overlaying other initiatives to see their impacts can be helpful. At one facility, they monitored the percentage of maintenance work orders completed over time against the target of 90%. They also documented initiation of their RCM effort. As noted above, RCM involves maintenance staff and really considers their opinions as expert. So, as shown in the PM performance monitoring chart (Figure 2), once the RCM programme started the maintenance team felt valued and took pride in meeting (and exceeding) industry benchmark targets set by management.

**13) Training and Communication** – active

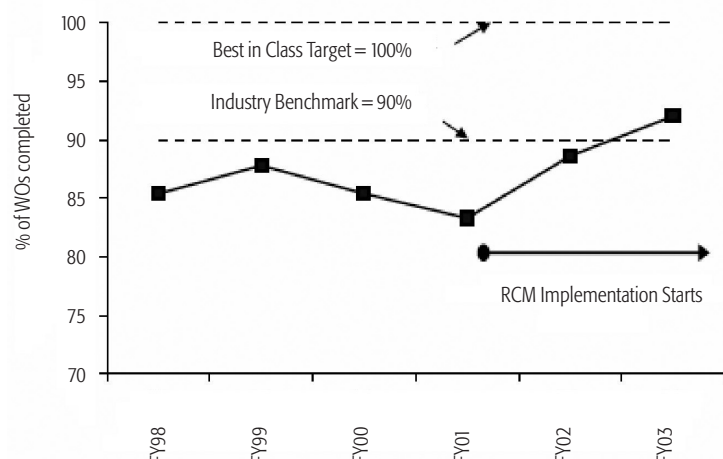
*annual training programmes ensure that staff possess current knowledge of asset management principles. A Communication Plan regularly publicises MAPP performance and effectiveness.*

It is imperative that as best practices are adopted, regular training programmes are budgeted to keep staff proficient in those areas.

The Communications Plan is another essential component to a successful optimisation campaign, allowing connectivity between workforce members and business goals. Regular communication to staff, users and regulators can be done through simple means such as presentations and newsletter articles, or as extensive as developing an intranet site. There should be a focus on the status and results/benefits of project activities and their related impacts on business objectives, and rewards provided to those involved.

**14) Leading Change Effort** – a corporate sponsor and guiding coalition/steering committee made up of key business unit leaders develop the programme's Mission and Vision including identifying and supporting internal change agents. Internal change agents should be well respected by their peers.

Change management techniques should be adopted early and often when implementing a large scale management initiative. Models such as



**Figure 2**  
Preventive  
Maintenance

Table 2

Kotter Steps	Large Public Utility Asset Management Programme
1. Establish a Sense of Urgency	Rates increased significantly due to new plant Threat of privatisation
2. Create a Guiding Coalition	AM Programme Steering Committee created Two dedicated Positions established
3. Develop a Vision and Strategy	AM Programme mandated in Corporate Business Plan Consultant Request for Proposals (RFP) developed
4. Communicate the Change Vision	Implementation Concept Plan developed Regular Presentations made and Meetings held
5. Empowering Broad Based Action	Three Implementation Teams created Site visits/collaboration meetings held
6. Generate Short-term wins	Professional Association Award received Project published in trade magazine
7. Consolidate and Produce More Change	Created a multi-year plan Expanded to seven Task Teams for new practices
8. Anchor New Approaches in the Culture	Job Descriptions modified to include new skills Promoted staff with new skills

the 8-step process detailed by John Kotter in his *Leading Change* book is a viable option and should be considered. As detailed in Table 2, overleaf, one organisation mapped

their facility asset management programme's success to the Kotter process somewhat verifying that this model is one to be considered.

### Summary

Embarking on a comprehensive management optimisation process like asset management takes time and diligence at many levels. Some clients have documented that successful implementations have taken between 24 to 60 months. So there is a need to plan accordingly and treat the endeavour as we treat a capital construction project: with a project manager and a multi-year budget. Benefits have been reported in both live and simulated scenarios to provide an average 3-year return-on-investment, making it an endeavor to strongly consider.

A successful asset management programme includes a combination of core principles, careful planning and a commitment of resources. This is a difficult task with pressures of normal workloads and competing corporate initiatives. Executive sponsorship, designated champions in each business unit along with a road-MAPP or model and continuous communication at all organisational levels can facilitate the change required to maintain a successful and rewarding asset management programme. ●

## AM DIARY

### A listing of upcoming asset management-related events and conferences. Send event details to WAMI for inclusion.

#### CNAM Workshop – Canadian National Asset Management 13–16 May 2007 Hamilton Ontario, Canada

Over the past several years many Canadian Municipalities have made significant advancements in Right of Way (ROW) Infrastructure Asset Management practices. These advancements have created the need, in Canada, to seek a common understanding on ROW Infrastructure Asset Management Practices and to explore new ideas that will lead to sustainability. The workshop objectives are to disseminate knowledge on tools, techniques, philosophies and emerging practices; to develop consensus on asset management philosophies and future needs, and to establish an index of achievable strategic tasks which can be undertaken by municipalities within a 3-5 year period.

**Email:**  
assetmanagement@hamilton.ca  
**Website:** www.cnam.ca

#### 2nd World Congress on Engineering Asset Management and 4th International Conference on Condition Monitoring 11–14 June 2007 Harrogate, UK

Recognised as the foremost international conferences in their fields, these events will bring together world leading technology and business practitioners and prominent academics. The combined International Forum is organised by the Condition Monitoring and Diagnostic Technology (COMADIT) Committee of the British Institute of Non-Destructive Testing (BINDT) in partnership with the Centre for Integrated Engineering Asset Management (CIEAM). The interdisciplinary event will feature:

- Industrial & academic papers combining scientific, technical & management perspectives
  - Workshops & tutorials
  - World leading forums for major industrial sectors
  - Expert panel sessions
  - Extensive exhibition & vendor presentations
  - Case study presentations
- World leading academics and

technology specialists from industry and commerce will take centre stage to discuss the most important issues related to engineering asset management and condition monitoring. Delegates to the three day Forum and exhibition will be able to investigate best practice and benefit from an international breadth of knowledge on topics including:

- Engineering asset management (EAM) & condition monitoring (CM) methods, techniques, systems & applications
  - Risk & strategic asset management
  - Knowledge management, optimisation & efficiency
  - Diagnostics methods intelligent data & signal processing
  - Maintenance & performance in EAM & CM
  - Design & life cycle integrity
- The forum will be of value to Heads of Asset Management, Condition Monitoring, Infrastructure Maintenance, Engineering, IT and Technical Services; IT Professionals, Asset Managers, Chief Engineers and many more...

For further information and

to register for this event, visit  
**www.wceam-cm2007.org**

#### 2nd Leading-Edge Conference & Exhibition on Strategic Asset Management 17–19 October 2007 Lisbon, Portugal

The 2nd Leading-Edge Conference & Exhibition on Strategic Asset Management will be focused on the techniques, technologies and management approaches aiming at optimising the investment in infrastructure while achieving demanded customer service standards. The conference will provide the perfect platform to discuss the developments at the leading-edge in this field to an audience of utility personnel, regulators and consultants.

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