

National Manual of Assets and Facilities Management

Volume 6, Chapter 4

Development of Maintenance Plan Procedure

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1.0 PURPOSE

Maintenance Plans are designed to deliver all types of maintenance in a variety of contractual arrangements. Maintenance Plans are part of Maintenance Management and Work Control processes and are subject to various influences that impede and redirect maintenance work, with direct and indirect consequences. Continuous review and improvement of Maintenance Plans is therefore crucial to the success of the maintenance contract.

The purpose of this document is to:

- Provide guidance and a methodology to understand how well the Maintenance Plan is performing
- How to correct, adjust or improve adoption of plans so as to establish a way to deliver Maintenance Plans which are compliant, consistent, and effective

By applying the advice and procedure provided within this document, the Entity and their Maintenance Contractor shall be able to address aspects of Planning and Scheduling which classified as priority within National Committee for Legislation and Standardization of Operation and Maintenance (NCLOM 1/1435) report, Planning and Scheduling have a significant impact on the performance of Facilities Management.

2.0 SCOPE

The scope of this document is to:

- Provide guidance on when development is beneficial and necessary
- Help the Entity to identify areas of improvement within maintenance activities
- Support the Entity in refining its approach to Maintenance Plans and manage the associated Maintenance Plan development activities
- Guide the Entity on how to deliver the changes effectively

The guidance presented herein resides within the context of a number of related documents within National Manual of Assets and Facilities Management (NMA & FM) Volume 7 – Work Control, most notably Chapter 2; Performing Work and Work Closeout. The guidance presented also identifies the connections and dependencies of Asset Management (AM), operations management, financial and performance management, supply chain management, business reputation and health & safety.

Benefits of implementing this procedure may not be realized immediately. Simple failings can be fixed, and improvements are immediately noticeable, however, more complex issues can take longer to address. Furthermore, observation of the results may be dependent on reporting cycles (e.g., monthly or quarterly indices).

The examples contained within this document are applicable to all strategies and delivery models of maintenance. Although, guidance is intended for application within a hard services Facilities Management (FM) environment, the principles can also be applied to the soft services environment.

Implementing fit-for-purpose and business-specific Maintenance Plan Development Procedures offer the Entity with the following benefits:

- Consistency in approach
- Ability to demonstrate compliance
- Reduced human error
- Reduced reliance on memory and competence level of individual technicians
- Robust auditing, root cause analysis, and reporting
- Ability to pinpoint errors and capture lessons learned within the continuous improvement process



3.0 DEFINITIONS

Term	Definition
Client Representative	See Site Custodian. Interchangeable with Facilities Manager, Building Manager, or similar representative of the building or contract owner
Development	Development is the activity that responds to a need for change. It is applied to an existing procedure
Development Matrix	A matrix of categories with specific entries used to structure and convey the development plan. It is a type of action plan
Job Plan	A list of pre-designed tasks that are recommended to be performed at certain frequencies on plant. Different frequencies will have different Job Plan details (e.g., tasks). Sometimes referred to as 'Task List'
Stakeholder	Person within the maintenance contract or external that has an input or may experience an impact from an activity or action
Work Management Center (WMC)	Consists of help desk and CMMS administrators and operators, scheduling and planning staff
Work Order (WO)	Formal uniquely identifiable documented instruction to work
Abbreviations	
AM	Asset Management
PRB	Procedure Review Board
CIM	Continuous Improvement Model
CMMS	Computerized Maintenance Management System
FM	Facilities Management
NCLOM	National Committee for Legislation and Standardization of Operation and Maintenance
NMA&FM	National Manual of Assets and Facilities Management
PAT	Portable Appliance Testing
PCN	Procedure Change Notice
PDCA	Plan-Do-Check-Act
PMT	Post Maintenance Testing
PRB	Procedure Review Board
WMC	Work Management Center
WO	Work Order

Table 1: Definitions

4.0 REFERENCES

- National Committee for Legislation and Standardization of Operation and Maintenance (NCLOM 1/1435) – Project of Study of the Current Operation and Maintenance Works Status at Government Facilities, 31 January 2016
- National Manual of Assets and Facilities Management Volume 5, Chapter 3 – Procedure Development
- National Manual of Assets and Facilities Management Volume 6 – Maintenance Management
- National Manual of Assets and Facilities Management Volume 6, Chapter 2 – Conduct of Maintenance & Chapter 3 – Types of Maintenance
- National Manual of Assets and Facilities Management Volume 7, Chapter 2 – Performing Work
- National Manual of Assets and Facilities Management Volume 7 – Work Control
- National Manual of Assets and Facilities Management Volume 6, Chapter 4 – Maintenance Plan Writers Guide
- National Manual of Assets and Facilities Management Volume 6, Chapter 2 – Formality of Maintenance Performance
- National Manual of Assets and Facilities Management Volume 7, Chapter 2 – Work Closeout Procedure



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5.0 RESPONSIBILITIES

Key personnel involved in the development of a Maintenance Plan are stated in the table below:

Role	Description
Development Lead	Responsible for analyzing development need, proposing, and implementing the improvement plan. Operationally a central member of staff, they may be the line manager of the Work Management Center (WMC) and technical teams
Work Management Center (WMC) Team	Source of key information for decision making and development activities. The team will have key responsibilities for implementation of any changes
Technician	Responsible for the contract compliant delivery of maintenance within the published Plans and Procedures
Maintenance Plan Writer	Suitably skilled person responsible for writing the Maintenance Plans
Quality/Compliance Manager	Responsible for managing the auditing of compliance with contract requirements, including Maintenance Procedure

Table 2: Responsibilities

6.0 PROCESS

6.1 Maintenance Plans

A Maintenance Plan is a document that addresses the requirements for the delivery of maintenance to an entire system, group, or type of assets. It describes the specification, characteristic and factors affecting the selection and delivery of maintenance. Maintenance Plans are concise and complete documents including technical and non-technical standards that shall be applied in the maintenance of the particular assets. A Maintenance Plan consists of many aspects, including the use of Job Plans as part of Work Orders (WOs) to deliver the intended maintenance approach.

The advice presented herein lies within the context of several related documents within NMA & FM Volume 6 – Maintenance Management. In particular, references shall be made to chapters of NMA & FM Volume 6 titled “Conduct of Maintenance” and “Types of Maintenance”.

Maintenance Plans are essential to the writing and execution of Maintenance Procedures, Work Performance, and Work Closeout. Refer to Volume 7 – Work Control, for more guidance.



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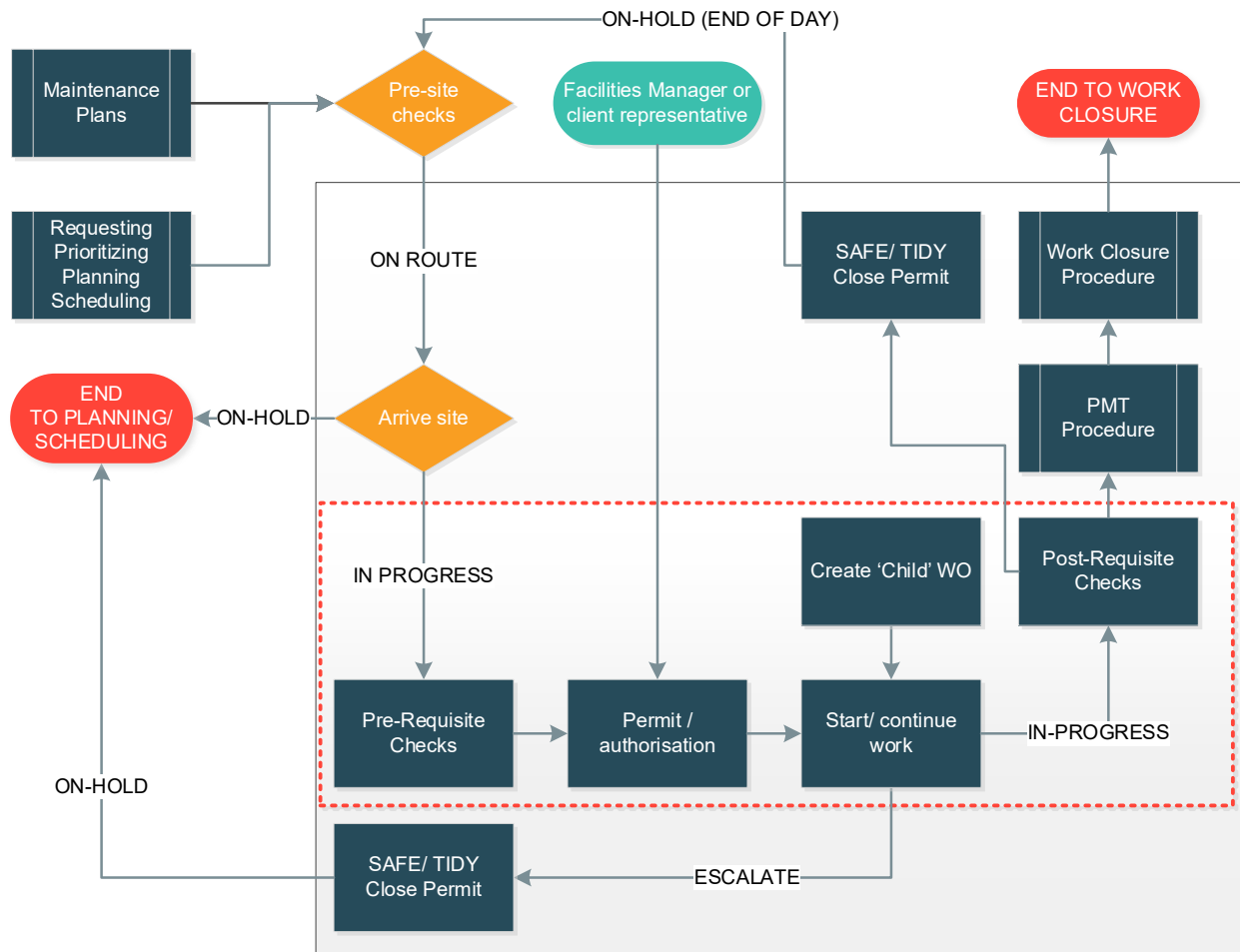


Figure 1: Maintenance Management and Work Control

Figure (1) above shows the position of Maintenance Procedure (red rectangle) within the wider Performing Work activity (large square). The area outside of the large grey rectangle represents the Work Control Process and supporting activities. This high-level flowchart confirms the interdependency of Procedures on each other for their mutual success. Maintenance Plans provide most of the information required to create and deliver maintenance according to the relevant procedures.

Following list provides a summarized detail of the content of Maintenance Plans according to NMA & FM Volume 6 Chapter 4 – Maintenance Plan Writers Guide. This Development of Maintenance Plans Guide shall be delivered in respect of the full requirements mentioned in the Maintenance Plan Writers Guide.

6.1.1 Maintenance Types

- Maintenance type selection requirements
- Maintenance requirements
- Planned maintenance requirements
- Unplanned maintenance requirements

6.1.2 Technical Standards

- Technical Requirements

6.1.3 Engineering Delivery

- Engineering requirements



- Job Plan/Task List requirements

6.1.4 Work Management Center (WMC)

- Computerized Maintenance Management System (CMMS) requirements
- Planning requirements
- Materials resources requirements
- Operational requirements

6.1.5 Risk Management

- Support and mitigation requirements
- Mobilization requirements

6.1.6 Health and Safety

- Health and safety requirements

6.1.7 Quality

- Writing standards
- Document requirements

6.2 Recognizing the Need for Change

Development of Maintenance Plans adopts a Continuous Improvement Model (CIM), which provides an effective approach to recognize the need for and implementing changes. Refer to NMA & FM Volume 5, Chapter 3 – Procedure Development, for further guidance regarding development of Procedures. The “need” for change is a constant pressure on any operating business in order to respond to a changing environment and continuing to meet the contract obligations. Noticing where change is needed most or most urgently requires all staff, and senior staff in particular, to observe the business operations, and respond when evidence prompts a concern or opportunity to improve and strengthen the Procedures.

Need can be categorized into one of the following three categories:

- Planned periodic (internal and external)
- Urgent
- Unplanned investigative

It is preferable and beneficial to carry out periodic internal and external reviews of performance and compliance, as compared to reacting to the actions highlighted from investigations.

Need is almost always highlighted by statistics, which usually takes the form of trends or thresholds. For example, if an asset repeatedly fails even though planned preventative maintenance is being performed on it, might be due to the application of incorrect maintenance on that asset.

‘Why there is a need for change’ takes various forms. The need for change in the broadest sense may be for a number of reasons, including:

- Efficiencies
- Productivity
- Cost
- Audit performance
- Human error

Other reasons include technology limitations, legislation changes, organizational policies, and environmental compliance.



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Being aware of the need and opportunities for continuous improvement is the responsibility of the entire staff. Taking appropriate action to improve and facilitating a smooth transition to the new requirement is the responsibility of management, specifically the Development Lead.

Periodic audits of completion of the WOs and CMMS records is a common requirement of maintenance contract operating under best practice. Internal audits are typically required by an organization, including maintenance contracts, as part of their quality assurance management. External periodic audits are designed to allow the client to check the quality and compliance of the maintenance contract. An external periodic audit may focus on the maintenance regime applied to a particular building, or the application of a particular task across an Entity. These audits would typically cross-reference these tasks with the asset register as applicable.

An urgent review may be initiated following an incident elsewhere in the country that has raised awareness of specific requirements for a particular maintenance task, such as electrical Portable Appliance Testing (PAT). The maintenance contractor may decide to review the detail of their electrical PAT maintenance tasks in order to reassure their client that the assets have been tested in accordance to the current regulations.

An investigation into an incident may create the need for a wider review of the Maintenance Plans affecting the building or the type of asset. For example, if a final fire exit door is discovered to not open correctly, the Entity, client, or stakeholder may have concerns that the maintenance task is inadequate, or it is not applied to all fire doors. The Development Lead, with the assistance of the WMC, would then carry out an urgent check on the details of all fire door Maintenance Plans against the fire door asset register.

6.3 Development of Maintenance Plans – Approach

This development activity will normally take place while the existing plans are being used; normally, it is not possible to stop the business operation while a review and re-plan is being carried out. The well-established Plan-Do-Check-Act (PDCA) cycle is the recommended approach for the development activity. More details about these four steps is provided below:

Plan

- Understand Failings
- Improvement Opportunities

Do

- Identify Required Changes
- Draft Changes

Check

- Test the Change
- Check Consequences

Act

- Approve (Procedure Review Board)
- Launch

This PDCA cycle for Development of Maintenance Plans is an activity initiated from within the larger Work Control process.

The “check” step of the Work Control development cycle identifies the need for development of the Maintenance Plans. The “act” step of the Work Control development cycle is the current Development of Maintenance Plans Procedure.



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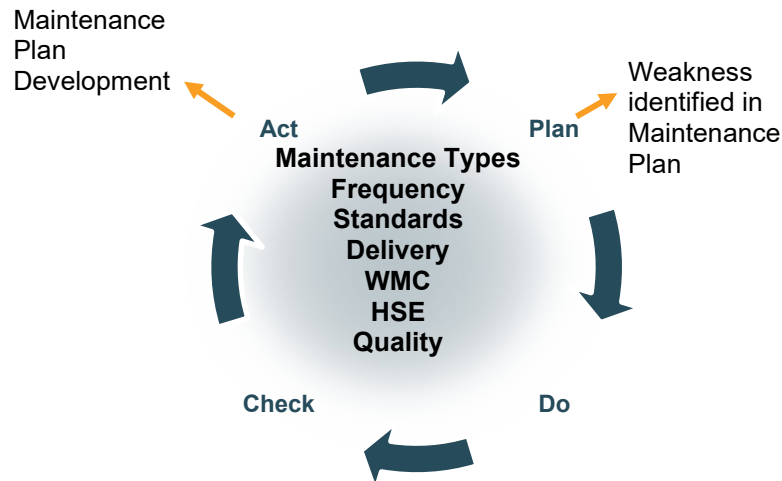


Figure 2: Procedure Development

It is recommended that the development activity is formally managed through a Procedure Review Board (PRB) or something similar. This is to ensure that all stakeholders can review the issues, acknowledge the contribution and propose solutions, and understand the motivation and authorization in place for change. Submission of the findings and proposals to the PRB by the Development Lead can be recorded in a matrix format, which is referred as the Development Matrix in this document. A Development Matrix can take the form of a spread sheet and form the basis of an Action Plan or continuous improvement tracker.

Stakeholders in this procedure are all those with responsibilities declared in **Section 5** of this document, in addition to the below mentioned groups:

- Maintenance team
- Asset management team
- Performance, compliance, and budget managers
- Client side/site representatives

6.3.1 Plan

6.3.1.1 Understand Failings

The need for development may arise from planned periodic, urgent, or unplanned investigative development inputs.

Development opportunities including but not limited to:

- Documentary
 - Incomplete entries
 - Too much information
- Operational
 - Technically poor or inappropriate
 - Not site specific, too generic
 - Incorporation into the CMMS
 - Incomplete/interrupted mobilization
 - Inadequate Work Resources, for example tools.
- Work practices
 - Ineffective feedback
 - Ineffective auditing
 - Ignored by staff
 - Lack of monitoring



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For any or all of the reasons mentioned below, continuous improvement is needed to correct the maintenance plans for commercial or compliance reasons:

- It is possible for a periodic audit to confirm that one or more teams are simply not following the published plans and procedures
- It is possible that the Maintenance Plans were originally poorly drafted or that several and significant changes to the working environment or contract has happened and the Plan or Procedures were not updated
- It is possible that there is ineffective auditing and compliance enforcement by the management and the technical workforce are “doing their own thing”

6.3.1.2 Development Opportunities

Development opportunities describe failings that are predictable or have limited negative impact on the maintenance operation. Failing may be something that the maintenance contractor has not fully appreciated as the root cause of their performance limitations.

- **Incomplete or too much information** – The Expro Maintenance Plan Writers Guide has many requirements. If these are not addressed properly, the maintenance contract will not be furnished with the required information that facilitates best practice maintenance. This guide is designed to ensure that all stakeholders’ requirements and contributions are addressed
- **Incorporation into CMMS** – It is not uncommon for the available and required information to not be fully inputted into the CMMS. This usually happens at the mobilization phase of a contract, when the contractor management are focused on operations mobilization and are not suitably resourced to complete their site surveys, complete the building, and populate the CMMS
- **Ineffective feedback** – Feedback to the personnel responsible for updating the Maintenance Plans shall be structured as well as responsive. When an error is found, whether this is on-site or within the CMMS, the details need to be recorded and the change needs to be managed in an auditable manner. Feedback shall be continuous, and it is important for the contract in its several months or years of existence. The staff may become demotivated if they note that the corrections, they have reported, are not altered in future communications, such as WO details

6.3.2 Do

6.3.2.1 Identify Required Change

During the delivery of maintenance, many problems will appear and manifest themselves. The root cause is likely to be elsewhere, further back up the work process or external to the WMC and technical teams. Understanding the failings is the first crucial step in identifying the root cause, and in turn, the solution.

The identification of the information and the need to complete, correct, or change it, is everyone’s responsibility. From the delivery technical teams and sub-contractors to the WMC and above, the process of continuous checking and updating the Maintenance Plan information is an activity that will probably never cease to find opportunities to increase compliance. Indeed, as the building, facility, or the site evolves, there will be changes to quantities, models, and maintenance requirements of the assets under the maintenance contract.

A common failing of continuous improvement cycles is that the information identified as incorrect is reported unofficially and not followed through. A common mistake is when someone passes on the observation of an error by telephone call or a conversation to a person who does not have authority to make the necessary changes. In a busy office, the request for a correction can easily be forgotten. A system of continuously reporting observations of mistakes in the Maintenance Plans shall be established and disseminated to the workforce.

Below are examples of errors in Maintenance Plans:

- The asset details are incorrect. This can be as simple as the number of air conditioning condensers installed to an incorrect identification of the areas that a fire alarm system protects



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- WO have no task details. This is caused when the information on that particular asset model was not available at the time of writing the Maintenance Plans, or the task of inputting the information into the CMMS was interrupted
- Maintenance is applied inconsistently. On sites with multiple buildings, there is a risk that maintenance of a particular type of system is arranged differently to that of a similar system in other buildings. This can occur without any technical reason and can occur because the populating of the CMMS was interrupted, and the solution approach was changed inadvertently. This can lead to duplication or gaps in both assets; affected assets might receive some maintenance twice as often as they require, and some tasks may not be applied to the applicable asset in a consistent manner
- Maintenance tasks are not followed. Unused or lightly used maintenance tasks can point to inconsistent application of maintenance. On sites having multiple buildings, similar tasks can be used as the maintenance solution to the same requirement, leading to the Technicians doing what they believe is right rather than what is instructed

Once failures in the Maintenance Plans have been identified, the next step is to understand the desired outcome. The difference between the actual and desired conditions has to be identified and quantified, so a plan can be drafted that will lead to improvements. The proposed and agreed change shall be recorded in the Development Matrix.

The consequences of the proposed changes might lead to improvement but not towards perfect maintenance, and this may be considered acceptable. The Development Lead must be wary of starting too many corrections that either they or the WMC have the resources to meet the demands of their day-to-day obligations.

The key procedure in Work Control for recording errors and suggested corrections to the WMC is the Work Closeout Procedure.

6.3.2.2 Draft changes

Development of Maintenance Plans shall be a continuous activity and, therefore, shall have an active recording and progression management. Identifications and solutions can be summarized in the Development Matrix and considered by the stakeholders of the PRB. The proposal can include tentative support from stakeholders, whose contribution and possible changes to their working procedures have been identified and discussed.

Bridging the gap between how the Plans are performing or being complied with and how the Development Lead needs it to operate, will depend on the details of any problem or problems and where the maintenance contractor needs the Plans to be.

6.3.3 Check

6.3.3.1 Test the Change

Consulting with the appropriate stakeholders and Subject Matter Experts (SMEs) is key to testing any change to a Plan. These people will help the Development Lead to think through the effectiveness and consequences of the proposed change. If several changes are being proposed, affecting various aspects of the maintenance delivery, there may be interlinking impacts that the Development Lead has not recognized:

- If changes to the CMMS are required, are the required resources available, moreover is the required skillset available?
- The availability of the CMMS Planner is particularly important to understand if the changes to the Plans is extensive, such as harmonizing the maintenance regime of a particular asset type
- If the recommended changes are fundamental or extensive, is it possible to build a parallel correct data model in the CMMS so that the change can be tested before going live?

6.3.3.2 Check Consequences and Cost Benefit Analysis



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The Development Lead shall be cautious when adding to the maintenance regime without checking that the maintenance is being carried out under other tasks or instructions. Similarly, when concluding that an asset is not being maintained, is the maintenance of this asset assigned to the right contractor? It is possible that, according to the contract, the daily or weekly checks are carried out by the user stakeholder. If the asset was installed under a particular capital projects budget, is the maintenance of the asset the responsibility of the maintenance contractor or the capital budget holder?

Benefits that are difficult to identify or associate with a particular action include the rationalization of the maintenance regime, where the impact is more easily measured on an annual timescale when reviewing the number of maintenance tasks performed or overtime hours attached to a particular asset, system type, or group.

A subjective benefit of making corrections to the Maintenance Plans is that the workforce will see that the senior managers are listening to their advice and observations, which is helpful for the morale of the employees.

6.3.4 Act

6.3.4.1 Approve

The design of the Development Matrix can include columns that allows it to act as an Action Plan tracker.

Once a proposed change has been approved by the necessary stakeholders, the organization will likely require compliance with their document change control procedures, utilizing a Procedure Change Notice (PCN) or something similar.

6.3.4.2 Launch

One of the widely accepted advices on how to approach introducing changes to any organization is to introduce it with enthusiasm and explanation.

Providing the explanation for the changes can take several forms and deciding which methods to use is almost as important as the proposed changes.

- Singular meeting with the entire team
- E-mail
- Notices left in plant rooms and offices
- Explain the changes to certain key individuals first
- Training sessions

Many documents and good practices recommend a review cycle as part of a continuous improvement requirement. Following the launch of a change or changes to Maintenance Plans, it is recommended that the impact of the launch is monitored more frequently than the cycle recommended for the document review. This closer monitoring of the effects of the launch of a change is a key reason why the Development Matrix shall also evolve into an Action Plan tracker.

Statements on the impact of the developments of the Maintenance Plans may be requested in other reports, such as periodic internal Managers Report or an external Client Report.