

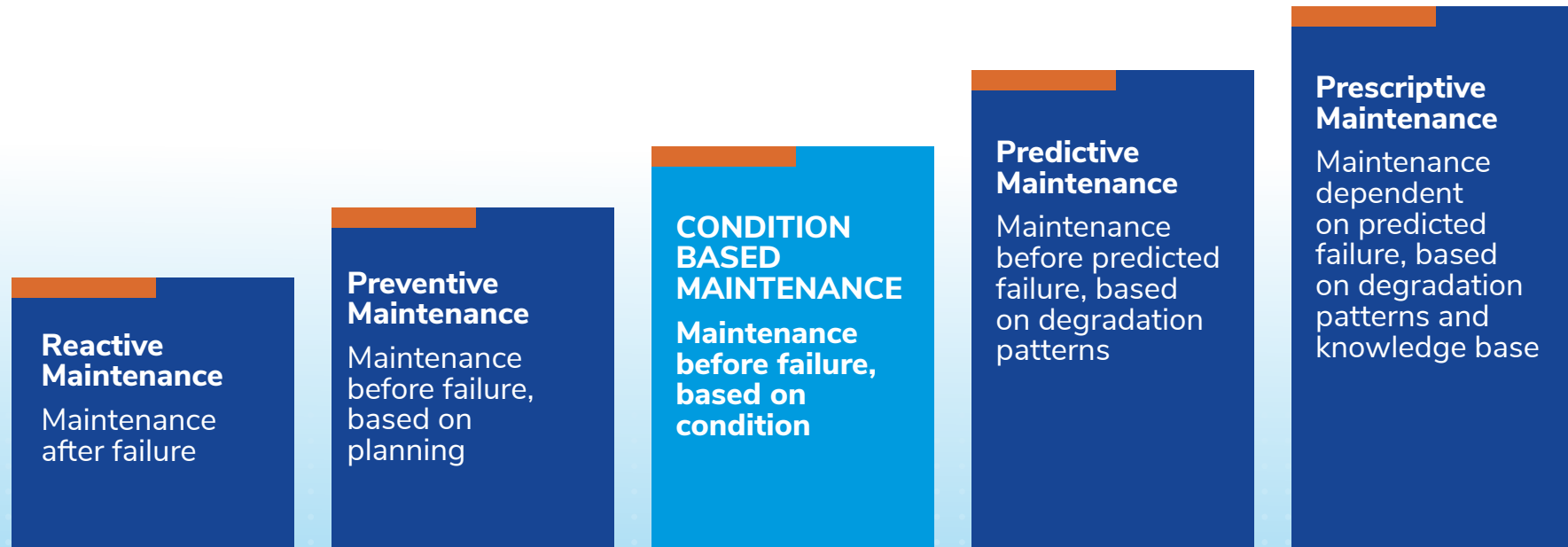


# CONDITION BASED MAINTENANCE



# WHAT IS CONDITION BASED MAINTENANCE?

Condition Based Maintenance (CBM) is a strategy for performing maintenance based on the **actual condition** of an asset, in order to focus resources on undertaking maintenance work when it is needed, rather than to a regular schedule.

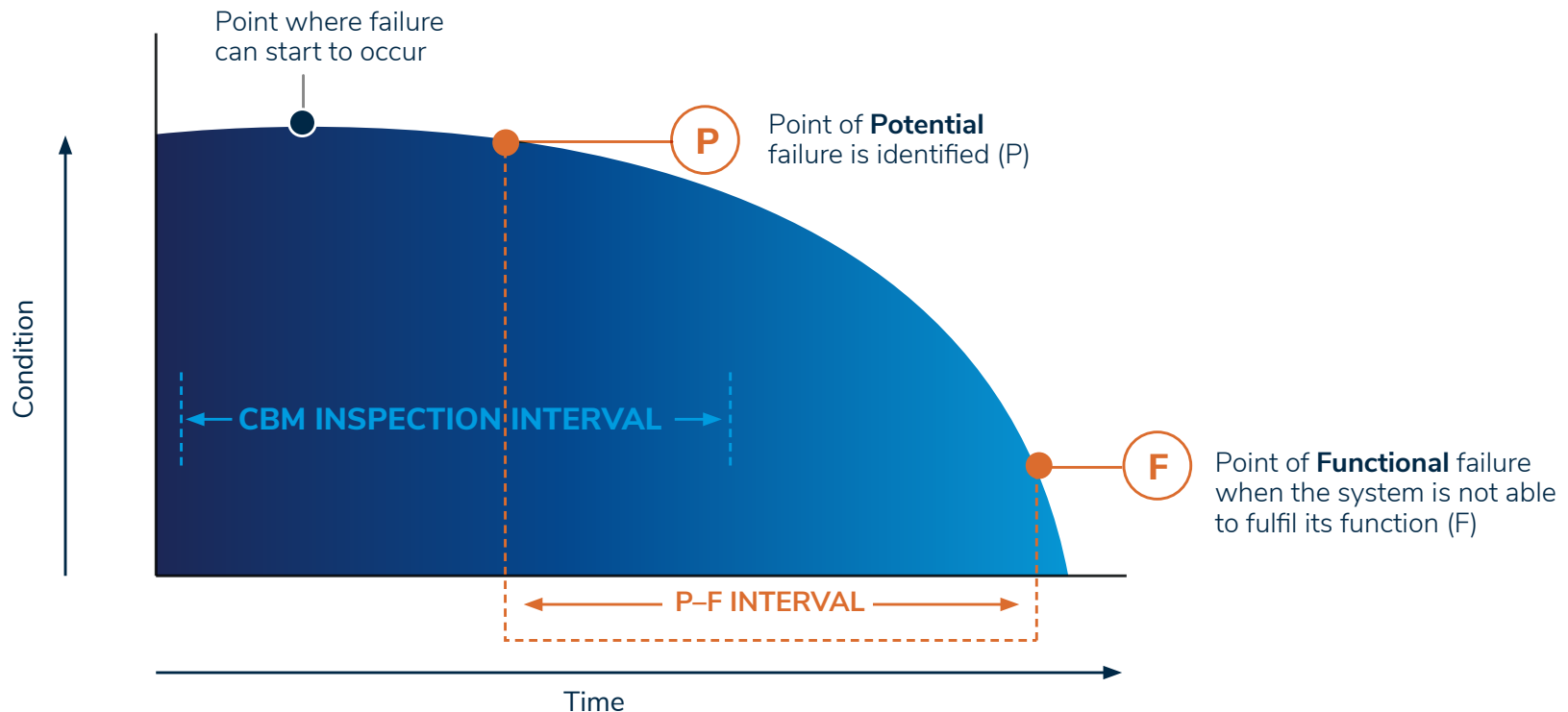


# CBM AND THE P-F CURVE

For all physical assets, functional failure is inevitable. But CBM can be used to extend the useful life of an asset within the P-F curve.

The P-F curve represents the status of assets over a period of time. It can be used to identify the interval between potential failure and final functional failure.

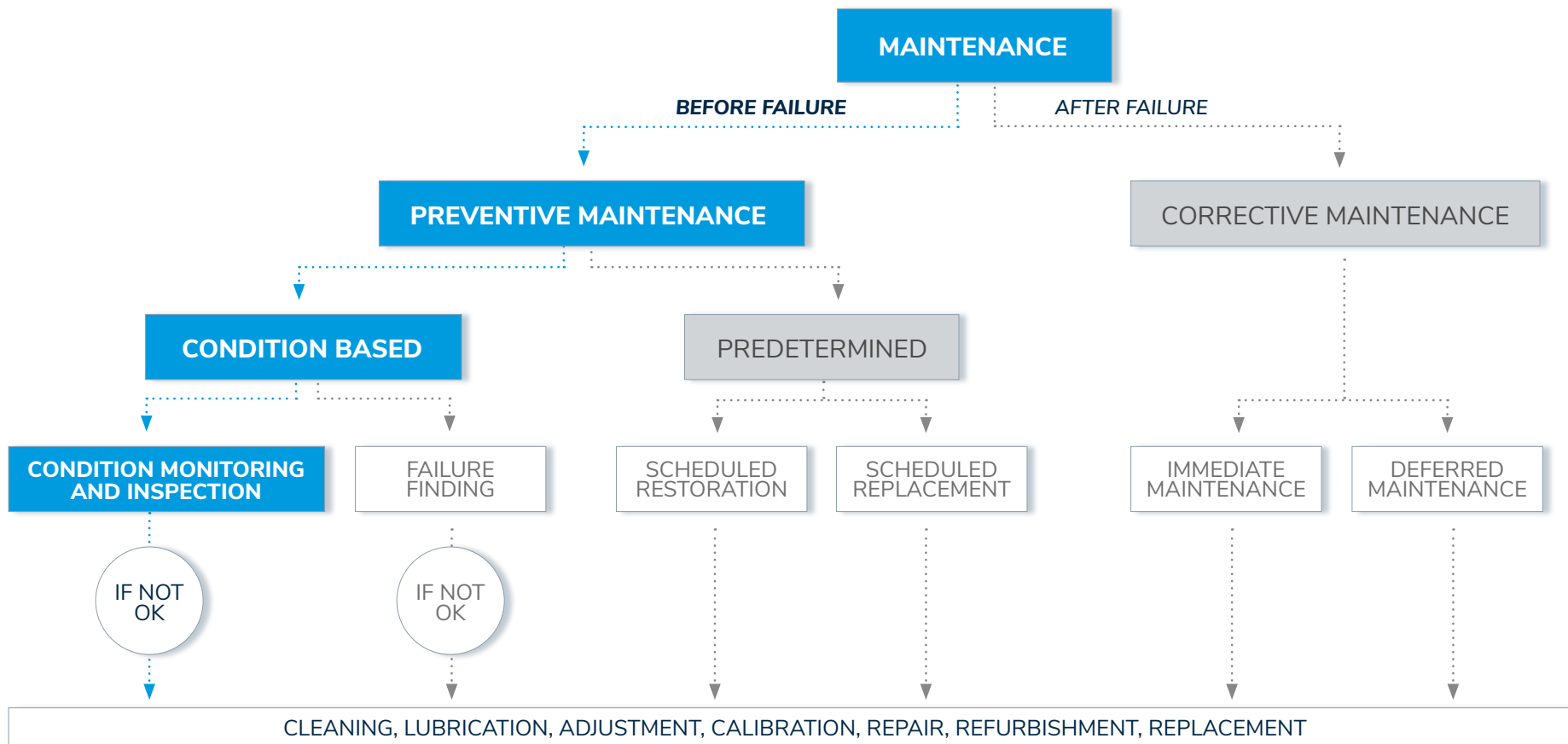
CBM can help organisations manage the P-F interval by allowing maintenance teams to monitor asset deterioration and plan the appropriate responses.



# MAINTENANCE POLICIES

CBM is one of several failure maintenance policies. These are highlighted in blue on diagram below.

It is not about scheduling preventative measures at predetermined intervals. Nor is it a replacement for an entire maintenance plan. **It is about using real-time measurements to conduct maintenance at the precise moment it is required.**



## DEFINE A STRATEGY AND BUSINESS CASE

When applying CBM, you should always start with an overarching **strategy** – a specific reason you are implementing CBM that will remain your guiding focus throughout the process from development towards evaluation.

For example, the strategy could be one, or a combination, of:

- Cost-driven
- Performance-driven
- Risk-driven
- Solutions-driven

You should also prepare a **business case** that clearly establishes:

- How your organisation will benefit – for example, specific details about how CBM will actually reduce costs
- Any risks that are involved in implementing a CBM approach
- The assets and processes that need to change
- Technology and resource requirements
- Evidence of comparable CBM initiatives that have achieved similar goals within the rail industry



# DEVELOP A CBM FRAMEWORK

Ricardo has produced a framework that itemises the key components of a successful CBM implementation.

Over five distinct stages it sets out the sequence of actions you may need to take during the course of your programme. These actions could be taken separately or at the same time as other actions.

Each organisation should produce a tailored version of this framework that is specific to the strategy and business case.

STAGES	ELEMENTS	PRODUCTS + APPROACH
1 Strategy selection	Business policymaking	PREPARATION PLAN
	Business case development	
	Risk management	
	Use cases and user stories definition	
2 Preparation	Product purchasing/tendering	DEVELOPMENT PLAN
	Certification/CSM	
	Design and modification	
	Installation	
3 Development	BI & data handling	IMPLEMENTATION PLAN
	Digital resilience	
	Design tooling	
	Maintenance management	
	Process development (business, maintenance, logistics)	
	Training and support	
4 Implementation	Change management (processes, training)	EVALUATION PLAN
	Human factors	
	Process integration	
	Verification	
5 Evaluation	Validation	
	Business case evaluation	
	Continuous improvement/PDCA	

# PHASE IN THE IMPLEMENTATION

## Phased implementation

Like any major change project, implementation requires a mix of both pragmatism and patience. We recommend starting small – select one system, one shift team, or just a few specific maintenance tasks – and plan an initial phased implementation.

## Priorities

Prioritise early efforts on your most critical systems or on assets and components with high repair or revision costs – this is where the benefits of CBM will be most visible and offer the fastest return on investment. Be sure to also address some practical issues in order to raise commitment at an operational level.

## Stage plans

As you work through your framework ensure documented plans are prepared before moving onto each separate stage. Each stage plan should set out clear actions, responsibilities and milestones, with direct links back to the original objectives and commitments made in the business case.

Align CBM with a culture of continual improvement across the organisation, embedding it as a cornerstone of a longer-term asset management strategy.



## ENGAGE WITH COLLEAGUES

CBM can not be implemented by one individual working isolation, or even by one department. To be successful, **all levels of the organisation** need to be engaged from the earliest stages.

Securing the **support of colleagues** in operations, data analytics, senior management and financial controls can help you avoid administrative delays and add alternative viewpoints to include in your Business Case and Stage Plans.

Ensure you have people in your project who can interpret the data correctly, have a good understanding of vehicle system architectures and present it in formats that will readily meet the needs of different teams across the organisation.

Provide **regular communications** on progress, achievements and experiences – draw attention to early successes by circulating Case Studies and dashboards/infographics showing progress against targets.





## OUR ADVICE

### SET EXPECTATIONS

CBM is a failure maintenance policy, not a replacement for an entire maintenance plan.

### DETERMINE YOUR STRATEGY

Have an agreed strategy from the outset and ensure it remains central throughout the implementation process. Set out a business case that is coherent and true to your strategic aim.

### USE A FRAMEWORK

Define a framework that covers all necessary elements and choose specific aspects to focus upon. We have produced a framework that could serve as a generic starting point.

### ENCOURAGE FEEDBACK

Involve colleagues from all levels of the organisation and from the earliest stages.

### CONTINUOUS IMPROVEMENT

Keep improving on both a tactical and operational level. This will help secure benefits for the long term.



## HOW RICARDO CAN HELP YOU

Whether for fleet management or network infrastructure, we can provide expert support during every stage of your transition to CBM.

**Strategy:** Our experts will help you define your reasons for implementing CBM, including a business case setting out the benefits, timescales, investments and resourcing requirements.

**Framework:** Using Ricardo's proprietary CBM framework, we will help you map your implementation, from defining responsibilities through to change management and training.

**Evaluation:** We will assist you in analysing feedback from across the organisation and then introducing improvements at both tactical and operational levels.

**Proportionate:** Above all, we'll ensure your teams never lose sight of your original objectives and focus on delivering a proportionate and appropriate CBM approach for your organisation.





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