3. Management for Improvement

This Section provides: guidance for designing effective management systems; A risk-based approach to inform all aspects of improvement management, particularly prioritisation of workstreams; day-to-day management objectives to achieve specified standards consistently; monitoring and feedback techniques as motivators for change.

3 Management for Improvement

3.1 Principles

Sustained reliability improvement is closely associated with structured management processes. Ideally, these processes form a framework within which individual activities are shaped to achieve maximum benefit. To assure success, franchise obligations and business objectives should be used as the primary focus for developing initiatives. Best practice views management for improvement in three phases:

a) Design – to establish long-term sustained progress
b) Change – to implement design changes through projects
c) Sustain – to focus on monitoring, analysis and feedback to motivate further improvements

A) Management process design should:

i. Evaluate depot/facility capacity and capability to ensure engineering objectives can be fulfilled
ii. Evaluate short- and long-term staff and resource requirements to match commitments and plans
iii. Specify skills and competences required by staff to support current and future obligations
iv. Develop a data structure capable of measuring both process and vehicle performance
v. Specify maintenance plan controls
vi. Establish appropriate relationships internally and externally with suppliers of spares and components, ROSCOs and any other maintenance services
vii. Identify the management routines through which each element of the design will be implemented or employed to achieve maximum benefit

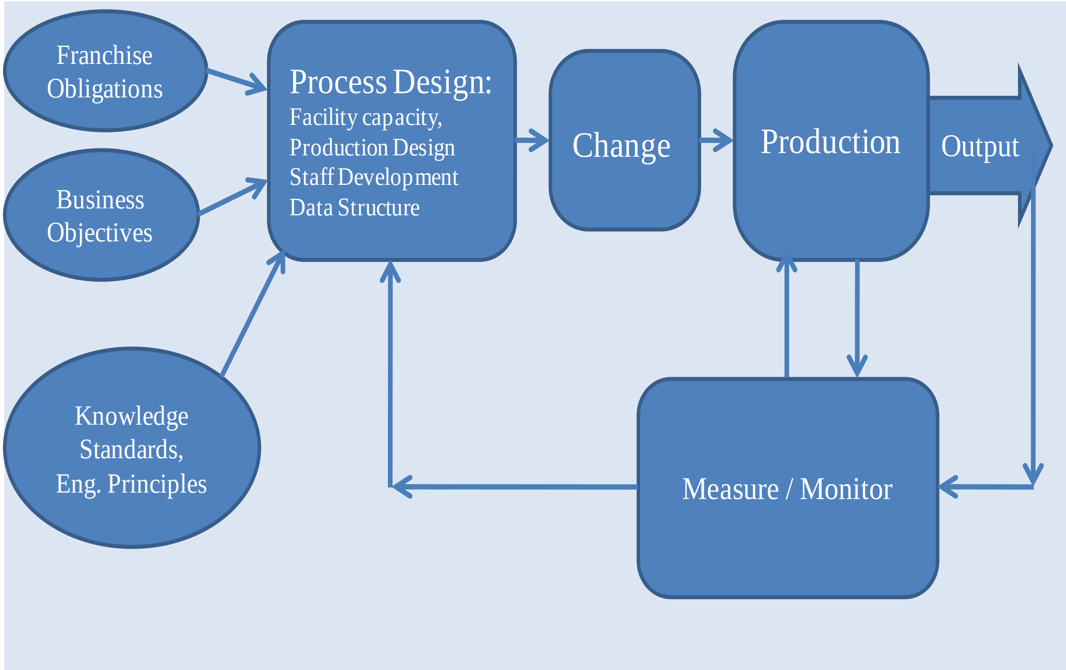
B) Change projects should:

i. Ensure all staff are fully aware of changes and participate in them and are competent to perform new roles where required
ii. Ensure all risks and cross-functional links are identified and appropriately managed
iii. Be coordinated to ensure that the extent and pace of each one does not put overall performance (or that of other change projects) at risk

C) Sustaining processes should:

i. Establish, integrate and analyse all data sources, including measuring the effectiveness of change projects
ii. Identify where and how to change and improve process design

In summary, a structured management process framework for reliability improvement can look like this:



3.2 Risk Evaluation

It is often difficult to apply a management process framework. It should be led by business priorities, with an underpinning engineering risk assessment to inform decision-making and achieve timely and effective improvements. TOCs need to understand the relationship between operational performance and the work undertaken on vehicles.

An example methodology is set out in 3.2.1. below. Whatever method is used, the outcome should:

- Identify the most important maintenance tasks (including intrusive tasks, e.g. component exchange and overhauls, which are major risk sources)
- Review and restructure internal training and competence development techniques to minimise risks
- Inform decisions on the procurement of any maintenance and/or design services
- Motivate relationships with suppliers of services, especially overhauls and any contracted-out maintenance work
- Inform the analysis of engineering design changes

Note: The Railway Undertaking is accountable for controlling the same risks, whoever performs the work on the vehicle. This document does not discuss procurement decisions (as we reiterate in *Section 17*), but the management of underlying engineering risks is crucial to performance and an essential element in any robust decision-making process.

1.2.1 Risk Evaluation Examples

In this approach, a model of the vehicle/train is the foundation for all subsequent work. Firstly, all recognisable components are identified uniquely and grouped into systems, such as air, brakes and doors. However, each system encapsulates all the components required for it to perform its specified functions, regardless of the components' specific characterisation. As a result, the system may contain a complex combination of mechanical, electrical, pneumatic and other types of component. Clear system boundaries and unambiguous function definitions are required.

Operational events are then associated with the degradation of systems and their constitutive components, identifying those that pose the greatest potential risk to operational safety and reliability. It is helpful to use the RSSB publication, "Profile of Safety Risk in UK Mainland Railway" as a basis for systematically identifying a comprehensive and realistic set of failure scenarios. One immediate consequence is that a single outcome may arise from many potential root causes.

Components may be ranked according to their propensity (when degraded) to lead to specific operational hazards and events. For example, in terms of safety-related risks, a single point component failure leading to a catastrophic consequence would naturally rank more highly than a minor hazard involving the simultaneous and serial degradation of a combination of components.

To complete the analysis, the maintenance plan should be reviewed

- to identify possible omissions;
- to rank all tasks in relation to their potential to affect the vehicle risk profile; and
- to identify the impact of internal and supply chain activities.

See below for some (worked) examples.

Defect Condition	Failure Effect	Hazardous Consequence	Principal performance improvement factors to be considered
Wheel pan casting defect, notch or other similar condition affecting mechanical integrity	Crack propagation leads to fragmentation of wheel	Vehicle derails Collision with infrastructure Collision with another rail vehicle Flying debris impacts adjacent infrastructure and/or staff and customers	Single point failure with potentially catastrophic consequences All tasks associated with the manufacture and maintenance of wheelsets are critical Internal training and staff competence are critical Supply chain relationships and competences critical Training and competences internally and in supply chain must include importance of adherence to standards and consequences of poor compliance At level 4, instructions required specifically to assist identification of degraded conditions
Brake actuator slack adjustor mechanism failure	Actuator fails to apply brake on one wheel	Marginal effect on braking performance	A single point failure with little potential to cause significant risk
Multiple brake actuator slack adjustor mechanism failures	Many actuators fail to apply brake causing significant loss of brake force	Station overruns SPAD Collision with infrastructure or other rolling stock	The simultaneous failure of many components is required to produce a significant consequence This could be associated with accumulating unnoticed degradation of equipment over time requiring a review of level 4 maintenance tasks, training and competence arrangements This could alternatively be associated with overhaul standards requiring review of supply chain relationships, application of maintenance tasks and use of appropriate competences
Combined power brake controller internal component loose, degraded, worn	Power demand cannot be removed without recourse to emergency override device Brake cannot be applied without use of emergency override device	Station overruns SPAD Collision with infrastructure or other rolling stock	Single point catastrophic failure affecting whole train brake, mitigated by emergency override device but dependent upon driver response Status of component therefore critical Design standards and materials used for controller components are critical Manufacturing process control critical to operational reliability of component Maintenance and overhaul standards and supply chain relationships are critical
Threaded fixings of incorrect grade or surface finish used to assemble bogie	A single component failure likely to lead to cumulative failures of others Performance of affected major components compromised Potential for major component to come adrift Structural integrity of bogie at risk	Loss of brake system functionality Derailment Detached component strikes adjacent infrastructure or staff and passengers Vehicle strikes infrastructure or other rolling stock Loss of traction system performance	A single point failure possessing the potential unless detected to degrade performance and safety All maintenance tasks requiring use of threaded fixings are critical. Work control for this type of task is critical Material management activities, kitting and access/ availability of material are critical Both logistics and maintenance services supply chain are critical Training and competence must include guidance on the identification of degraded components and failure mechanism to mitigate risk of compromised performance and structural integrity

1.3 Day-to-day processes

Reliability is improved through sustained and rigorous attention to detail and compliance with published standards, with ownership of all issues.

Robust management

- ensures that routine maintenance tasks are always performed in accordance with standards;
- ensures that defective equipment conditions and remedial actions are always recorded;
- asks repeatedly, “why?” to get to the root cause of an issue. Once the real root cause is understood, it can be addressed and fixed.

It is common knowledge that typically half of TOC fleet root causes are not about modifying the train, but due to other issues, such as:

- maintenance quality (which may relate to staff morale, training, facilities);
- defect management (to get to the root cause, e.g. including train drivers in closed loop processes);
- management of contingency and redundancy (including robust plans and feedback on performance).

Maintenance quality and **defect management** should be measured and trended, e.g. % maintenance ‘own goals’ (errors, failure to remedy all issues so repeat defect arises).

Example: Northern undertakes routine ’in-process’ audits of equipment condition and evaluates the findings using a rigorous condition-based quantitative assessment. The results are linked to compliance with maintenance standards. Trends over time are used to tackle poorly performing systems and components. The data is being developed to assess staff competence too. Feedback is used to review maintenance standards, material and component quality and staff training programmes.

Example: South West Trains ask “why?” through their defect management process and classify every incident into 10 different cause codes. These go beyond naming the failed parts to assigning management responsibility. Each cause code (including No Defect Found) has an ’owner’ in fleet management, whose objective is to reduce the number of incidents. In the example below from a best practice TOC, maintenance own goals are 11%.

Fleet Incidents by Cause Code		TOTAL
9	Material Quality / Supply	1%
8	External / Passenger	0%
7	External / Network Rail	0%
6	Traincrew Error	2%
5	Climatic / Railhead	2%
4	Maintenance (Non) Compliance	11%
3	No Defect Found	24%
2	No Fleet Awareness	1%
1	Confirmed Technical Fault	42%
0	Asset / Heavy Maintenance	18%

Significant improvement can often be made without making changes to the train itself.

Example: Class 333 reliability doubled without any modifications thanks to a joint effort between Northern Rail, Angel Trains and Siemens involving high-level buy-in (steering group attended by 3 directors), plus a project manager from each company, working groups and team ethos.

The same maintenance quality and defect management principles apply equally to specific systems and whole fleets.

Example: recommendations from the sliding door comparison made across several fleets

- Cultivate good train reporting
- Do not attempt to rectify door faults in service – lock them and label them out of use until they can be properly rectified
- Remember the importance of staff training and the benefits of having only competent staff maintaining and repairing doors
- Ensure sufficient time is allowed for door maintenance to encourage attention to detail and to find and rectify faults
- Consider the benefits of increasing the content and frequency of door mechanical jobs and door pocket cleaning
- Avoid extended time between door overhauls

Example: TPE were seeing 10-12 flat battery incidents on Class 185 per period. Battery discharge was compared with design capability and changes made to maintenance, cleaning and traincrew practices (e.g. using shore supply) to better suit battery capability. The revised train disposal arrangements are checked through periodic TMS downloads which identify potential problems. The incidence of flat batteries is now so low that a technical modification is not considered necessary.

Contingency management includes robust planning processes where the benefits (e.g. of having sufficient trains and enough time to maintain them properly) are weighed against the costs (e.g. of leasing additional stock). Significant, cost-effective improvements can be made through timetabling and clever use of the timetable.

Example: Chiltern have some short diagrams that return to Aylesbury depot on which units with hard-to-identify faults can be deployed. This reduces the risk of service disruption and enables in-service monitoring with full rectification later.

Redundancy management includes feedback to understand whether levels are correctly set.

Example: Virgin Trains West Coast/Alstom used OTMR/TMS to count how many more yellow signals trains see in practice. With the high number of yellow signals on certain routes, trains cannot run to timetable if one traction pack is out. As a result, they revised their redundancy plan accordingly and are working with Network Rail to resolve the root cause.

Collective sharing includes learning from the successes (and failures) of others, pooling data and combining efforts, e.g. user groups, ReFocus meetings and visits, best practice sharing.

1.4 Periodic review and feedback

Diligent day-to-day activities support the routine periodic review of operational performance and process KPIs. Periodic reviews should use quantitative evidence to verify that the design analysis of depot capacity, resource levels and production planning arrangements continues to be adequate. Results should be used to revisit underlying assumptions, assess the effectiveness of change projects and as a basis for further improvement projects.

Routine activities are performed within a designed environment (*see 3.1 above*) and even the most competent frontline manager will be overwhelmed by over-optimistic availability targets, insufficient resources or inadequate depot capacity. *Section 7* looks at the depot in more detail.

1.5 Change management

Key elements of change management include: cross-functional, senior level commitment; involvement from all staff; working towards a common project structure; planned and staged implementation of individual projects; sufficient resources and feedback.

Robust day-to-day management can be undermined by inadequate change processes.

Overall, industry best practice includes:

- Strategic analysis of objectives to identify and prioritise processes/activities which need improvement
- Early engagement of all relevant stakeholders at a sufficiently senior level
- Publishing a structured plan showing the staging and implementation of all projects (to prevent detrimental impact on day-to-day routines)
- A risk-based approach covering both technical and soft issues, as well as cross-functional links
- A clear and common template for all projects
- Recognising the link between technical and process change, simplifying management controls and training requirements
- Configuration controls for vehicles, maintenance plan and supply chain

and for every project:

- A clear and achievable remit and timescales
- An appropriately skilled project manager supported by a suitable team
- Sufficient resources
- Strong involvement of staff whether directly associated with the project or not

Example: Northern Rail has developed a comprehensive set of business objectives and identified the management processes to improve in order to achieve them. This means focusing on input to achieve fundamental and sustained output improvements. Using this structure, a standard change implementation plan has been developed to ensure that each project is fully resourced and can be completed on time without posing significant risk to day-to-day service delivery. All projects follow an identical template for easy monitoring by managers and staff.

Example: Class 350 new train introduction. Siemens Northampton's major project involved training maintenance staff and drivers in Germany many months before the start of service.

Example: Northern Rail trains staff to participate fully in change projects and to understand what is happening when they are briefed on progress and impact.