

# Engineering Manual Case Study

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## Background

We were engaged to assist the client to review and update their Engineering Management Manual (EMM). The client runs a major project program comprising 4 separate billion \$ projects. During our work, the engineering services team was restructured and these changes were incorporated into the new manual.

The EMM was approximately 100 pages long and had evolved over time. It referred to up to 10 subprocesses which were documented separately, with each subdocument up to 100 pages.

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## The Challenge

Key issues were that

- readers found it difficult to find information in the EMM. Known contributing factors were
    - a poor structure
    - limited or no navigation support
    - that some content was too detailed or technical for some audiences
  - some information was out of date, redundant or missing.
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## Scope of work

The main aim of the update was to

- to restructure and redraft the EMM from a project-based manual to a program level plan that would provide the rules for the creation of specific project-level plans.
- to unify a suite of engineering and assurance documents and duties across the Program.

In addition, the client wanted to ensure that complicated engineering, assurance and other tasks, process and duties were articulated in clear concise and readily usable guidance documents.

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## The Vision

The vision was for an engineering management plan that:

- was part of the project management framework
  - was project agnostic
  - clearly demonstrated compliance with TfNSW AEO requirements
  - comprised a series of sections that covered
    - what (scope)
    - why (purpose and value of each topic/activity)
    - where (reference to relevant document).
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## The Process

The first step was to develop a suitable template, map the information to the key government requirements and restructure the information to better meet their needs (see before and after Table of Contents). Working with the stakeholders and the client, we then identified gaps and which information was required to meet the vision. We then rewrote the content using clear concise language.

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## Before and After Example

The change is best illustrated using some Before and After versions of

- Requirements Management – shows linking to AEO requirements, manual includes a summary table as an appendix and How To blocks to avoid the need to refer to another document.
  - Table of Contents
  - Competencies – enhanced information from using the standard sections, definitions provided when needed without the need to look up in a glossary.
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## Requirements Management

The purpose of the requirements management element is so that there are defined requirements at each stage of the lifecycle, which capture requirements, are defined using terminology appropriate to the phase, and where design outputs may be assessed to determine if the criteria for acceptance has been satisfied.

This is achieved by eliciting, generating and maintaining a set of valid requirements in which stakeholder expectations are cascaded into detailed technical requirements, against which engineering deliverables (e.g. designs, delivered systems/sub-systems) may be verified.

This element of the EMM documents the high level activities to be undertaken for requirements management on The Project, and is applicable to all engineering and all stages of the engineering lifecycle. More detailed descriptions of the process are documented in the SMDO Requirements Management Plan.

Requirements should be managed around specific engineering tasks and activities. The Requirements Management process followed by Design and Construct (D&C) Contractors must be documented in their Engineering or Design Management Plans as required by the services brief or appropriate Contract Deed. The requirements Scheme is to follow the ASA standard - [Requirements Schema \(T MU AM 06004 ST\)](#) as tailored for The Project to support specific assurance requirements as described in section 3.6.4.1.

## 6.3 Requirements management

### Purpose (Why we do this)

To ensure that there are defined product requirements at each stage of the asset lifecycle, which:

Clearly  
stated  
reasons

- capture stakeholder requirements
- are defined using terminology appropriate to the phase
- provide outputs that can be progressively assessed to determine if the criteria for acceptance has been satisfied.

Effective requirements management is critical as it

Direct  
link to  
relevant  
AEO  
(for  
audit)

- reduces the risk of project time and cost overruns
- builds in safety
- ensures that required project and product outcomes are achieved.

In undertaking structured requirements management activities, the Project satisfies AEO requirement [ENM2](#).

### Approach (What we must do/undertake)

During project definition, a broad stakeholder engagement plan must be agreed and a set of business requirements must be developed and agreed. These business requirements must be progressively cascaded into detailed technical requirements (system and sub-system) against which designs are delivered.

Project requirements are defined at a high level driven by a set of agreed Business Requirements (BRS) with further detail contained in the System Requirements (SRS) and progressively on to more detailed procurement requirements while maintaining traceability. During this process, verification evidence is collected progressively at the appropriate levels.

During production/construction, installation, integration testing and commissioning, verification and validation activities will be undertaken to confirm that delivery has met the design/requirements.

Each project must:

Bullet  
points to  
show  
exactly  
what is  
required

- develop a suitable project specific Requirements Management Procedure in accordance with 19-00048239 Requirements Management Procedure
- develop Business Requirements Specification (BRS), System Requirements Specification (SRS) and Subsystem Requirements Specification (SSRS)
- maintain trace between all requirements levels
- maintain trace between hazard log controls and requirements (i.e. safety requirements)
- progressively record verification and validation evidence against requirements.

### Outputs (What we require)

- Project specific Requirements Management Procedure Business Requirements Specification (BRS)
- System Requirements Specification (SRS)
- Subsystem Requirements Specification (SSRS)
- Verification and validation evidence.

Outputs specified in separate section

### Procedure (How we do it)

See 19-00048239 Requirements management procedure.

### Accountabilities (Who is accountable)

Role	Is accountable for .....
Internal Client Group (ICG)	Reviewing and endorsing the BRS/SRS/SSRS.

Labels make it easy to find information

## Competency

This section describes the framework upon which competent people with the necessary knowledge, experience, and skills may undertake engineering tasks.

All design and construction activities carried out on behalf of the Project during all phases of the project life-cycle must be carried out by 'competent persons'. Specific competence requirements apply for rail safety work where this is applicable. For more information, refer to PHSMF Standard [PS-ST-210 Training & Competence Management Standard](#).

Personnel carrying out the engineering activities must be competent on the basis of appropriate education, training, skills and experience as defined in the Project Engineering Capabilities Definition. Only staff with suitable competence shall conduct verification or checking of designs. More junior staff or less competent staff must be appropriately supervised and their work output checked by suitably competent managers or engineers.

For all MP&I Senior Manager positions, the Senior Manager will be assessed by the Project competency managers against the [Engineering Competency Management Plan EM-ST-202](#).

The Technical Advisors will be required to perform a competency self-assessment. The Senior Managers will then assess the Technical Advisors within their specific discipline.

The scope of application for engineering competency management encompasses all roles engaged in engineering tasks, broadly categorised as:

- Technical Management
- Technical Review
- Design

The competency management framework for the Project in relation to engineering is formalised within the Project Competency Assessment Plan and all design activities and management of design delivery and assurance within the Project AEO must be carried out by competent personnel as defined within these documents. This forms part of the Project AEO accreditation and is applied and maintained by the Program Level Technical Director. Works-specific EMPs must include arrangements for working within the Project competency framework.

Consistent  
blocks for  
each  
section

## Technical competence management

### Purpose (Why we do this)

To ensure that only persons with the appropriate knowledge, skills and behaviours are engaged to perform activities defined for a specific function, within a specific engineering, design or architect service area or discipline.

This contributes to the overall assurance of engineering services or products of the supplier organisation, and mitigation or elimination of risk.

Railways rely on a complex mix of hardware, software, human factors safety management systems, regulations, instructions, procedures and norms to operate safely and efficiently. The knowledge and experience of engineers, designers and architects is vital in controlling risks.

Where the Project has engaged an AEO, the AEO is required to maintain a competency management system for their staff. When a supplier is operating under the Project AEO, staff shall undertake competency assessments under the Project competency management system.

In implementing a competency management system, the Project satisfies AEO requirements [CPM1](#) to [CPM8](#).

### Approach (What we must do/undertake)

We must employ staff with appropriate competency for the role in which they are employed.

Staff undertaking engineering, design and/or assurance activities must

- **have appropriate domain knowledge** and competence demonstrated through formal competence assessment in accordance with the engineering competency management system: EM-ST 202 Engineering Competence Management Plan
- **maintain competence** in accordance with the Engineering Competency Management Plan.

Staff must be aware of the extent and limitations of their competency. They should not practice outside or above their areas of competence without engaging appropriate competent input and oversight.

Staff must monitor expiry of their competency and ensure reassessments are undertaken in a timely manner.

### Definition: Competence

Competence is the combination of technical knowledge, skills (technical & non-technical) and relevant experience that enable an individual to undertake defined role responsibilities and perform activities.

Definition  
where  
needed



### Outputs (What we require)

The competency workbook is to be completed by all staff undertaking engineering or design activities.

Competency assessors assess matrices in their domain area.

If ..then ..table  
for more visual  
presentation

If ..	Then assessors are to ..
further supporting information is required	liaise directly with candidate to request information
candidate is assessed as not competent	provide guidance on experience that the candidate can acquire to work towards competency

### Procedure (How we do it)

See EM-ST 202 Engineering Competence Management Plan.

### Accountabilities (Who is accountable)

Role	Is accountable for ....
Training & Competence Manager	maintaining the competence management system, associated records and any changes to competence management processes.
SME Assessor	<ul style="list-style-type: none"><li>assessing the engineering staff against defined criteria.</li><li>making recommendations on training requirements.</li></ul>