OM94003

MTMV Code

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Contents

1. Introduction

1.1 Purpose

This Code outlines the engineering requirements needed to ensure appropriate and successful MTMV's and other infrastructure maintenance rail vehicles across:

- Equipment requirements and specification covering;
  - Production
  - Safety
  - Asset needs
- Supplier selection.
- Project processes.
- Technical machine requirements.

The purpose of this code is to deliver appropriate and successful equipment by outlining the engineering requirements.

This Code covers the overall procurement process from the business need through specification to supplier selection and equipment delivery into service.

1.2 Status

This Code is a Mechanical Code Supporting Document. It is to be used in conjunction with the following mandatory documents

- M2000 Mechanical Code
- NRSS/6 Engineering Interoperability (subject to section 7.3, Interoperability requirements).
- NRSS/4 Risk Management
- KiwiRail Specification 307 Solid Wheels
- KiwiRail Specification 401 Rolling Stock Dynamic Performance

The following documents are noted for guidance as applicable:

- NZ ACoP Cranes
- NZ ACoP EWP

1.3 Change requests

Please send any requested changes to this document to the document controller**:**
document.controller@kiwirail.co.nz

1.4 Background

This Code outlines engineering requirements and responsibilities that are needed to manage specification and selection of MTMVs and their admission to the Network:

- Project Management
- Governance
- Procurement

- Implementation

Small teams using simple processes can successfully source proven catalogue equipment, however, proportionality should be used to resource larger teams with risk and QA based approaches for higher risk projects.

This code builds on experience with previous equipment procurements and emphasises supplier capabilities and reputation, the need to manage high risks associated with novel or complex features and prototype machines, the need for procurement management to balance the operational, asset and business needs, and applies proven techniques to equipment specification, procurement and implementation.

This code emphasises the importance of supplier capabilities and reputation and the need to balance the operational, asset and business needs of KiwiRail. The risk of under-performing equipment with increased cost and delivery times rises with inexperienced suppliers and or the development of novel, complex or prototype solutions.

A flexible performance-based approach across broad technical requirements is adopted at the procurement stage over detailed prescription.

1.5 Scope

This Code is generally in two parts:

- Best practice project management for procurement of capital plant (Sections 4 to 6)
- Specific MTMV technical requirements (from section 7).

The code also covers leasing or renting existing machines (note Appendix C Quick check for an existing MTMV).

This Code applies to the design, build, test, approval and maintenance of all MTMVs on the Controlled Network or under KiwiRail's Safety Case from the effective date of the document.

It covers the overall procurement process from the business need through specification to supplier selection and equipment delivery into service.

The code should also be applied to infrastructure maintenance rail vehicles such as materials handling wagons not covered by other codes, in which case best practice project management for procurement will likely apply in full and general technical requirements can be applied to the extent applicable.

Any procurement project will require this Code, specified production requirements, and standard KiwiRail project management processes.

The code focuses on generic machine requirements and project implementation. A specific procurement specification will define machine performance requirements e.g. specific production rates.

Application:

1. For new equipment procurement this Code and a specific performance specification outline all technical requirements.
2. For leased, second hand or existing vehicles this Code allows a compliance assessment to be made that should be used as the basis of operational and safety risk reviews.
3. It may also be applied to large or specialist hi-railed plant for aspects not covered by the Hi-Rail Vehicle Code OM94001.

4. It should also be applied to infrastructure maintenance rail vehicles, including but not limited to such as materials handling wagons for aspects not covered by other codes. This includes, but is not limited to, wagons handling ballast, rail, sleepers and support vehicles. Best practice project management for procurement will likely apply in full and general technical requirements are to be applied to the extent that they are relevant.
5. Machines already in operation on the Network will generally be exempt more onerous requirements of this code other than when a requirement is specifically applied retrospectively, in which case a date for compliance date will be set.

Machine elements that warrant particular focus are:

6. Human interfaces across entire machine via ergonomic review and HAZOP analysis.
7. Cab and control stations for function, performance.
8. Control options especially fit-for purpose and balance of technology and manual use.
9. Safety systems such as fire, tunnel safety, crashworthiness.
10. Overall configuration and layout where options exist.
11. Network interfaces.
12. Productivity & functionality.
13. Maintainability.

For the following proven or proprietary systems or modules KiwiRail may adopt a higher level safety and quality assurance approach (but with increased focus for higher risk suppliers and adapted systems):

14. Propulsion and braking systems.
15. Wheelsets, suspension systems.
16. Hydraulic systems.
17. Control systems

This Code covers all new vehicles from the date of issue. Existing (second hand) vehicles that are new to the network are to follow review and approval process with identified exceptions and risks mitigated and necessary modifications performed.

1.6 How to use this document

☼ Tips and hints
Helpful recommendations and other useful information, including key points to note, is included throughout the Code in boxes like this.

2. Definitions

Term	Definition
ACoP	Approved Code of Practice issued by others, e.g, for cranes, EWPs.
AFFSS	Automatic Fixed Fire Suppression System. An installed fire suppression system that includes automatic activation in the event of a fire.
BAU	Business as usual (routine service and maintenance operations).
Catalogue equipment	Equipment that has already been made and ideally could be inspected somewhere.
Configuration (of MTMV)	Packaging, arrangement and layout of equipment etc.
Consist	An MTMV alone or connected to another MTMV or support vehicles.
EOI	Expression of Interest stage of procurement where any potential supplier is invited to register general proposals.
Established Supplier	A supplier that has delivered equipment to KiwiRail before with acceptable performance.
FAI	First Article Inspection for acceptance of first customer items – may be concurrent with type testing.
FAT	Factory Acceptance Testing: All testing before vehicle leaves supplier, includes Development (mock-up and prototype) testing, Type testing, FAI and Integration (combined) testing.
FRACAS	Failure, Reporting and Corrective Action System - agreed process to capture all failure reports and how they will be reported and closed out on the equipment.
Fail-safe	If a component fails the system or vehicle fails in a safe condition eg, brakes applied rather than brakes released.
HRV	Hi-Rail Vehicle
HAZID	Hazard Identification
HAZOP	Hazard and Operational assessment.
Loco 155B	Rail Certificate of Fitness (sticker displayed in vehicle cab) issued by KiwiRail; referred to as Loco 155B RcoF sticker.
Loco 160A	HRV Inspection Checksheet. Applies to all HRVs initially, then at 6 monthly intervals as periodic inspection.
MTMV	Mobile Track Maintenance Vehicle.
Modules (of MTMV)	Major sub-systems of MTMV e.g. cab, propulsion units (engine bay, transmission, axle units), working/implement heads, hydraulic system, air system, underframe, running gear.
Network	For the purpose of this Code, Network represents both NRSS/1 definitions: 1) Controlled Network: all track where occupancy and movement by rail vehicles is under the control of KiwiRail.2) National Rail System: the rail network comprising the Controlled Network and Operator Controlled Territory. It includes all track owned or managed by KiwiRail (including private sidings) and all retained track, unless specifically defined as unavailable for rail activity.
NRSS	National Rail System Standard. These are available from KiwiRail or can be downloaded from the KiwiRail website http://www.kiwirail.co.nz

Term	Definition
On-track plant	MTMV
Pre-Qualified Supplier	A short-listed supplier selected from the EOI stage that is invited to formally tender for the supply contract.
PHA	Preliminary Hazard Analysis.
RAMS	Reliability, Availability, Maintainability, Safety: Suite of four subjects that must be assessed in combination and individually to ensure sustainable outcomes are acceptably achieved.
Supplier (of an MTMV)	A builder, hirer/leasor or contractor providing its own machine.
Tunnel Suitability	Designates machines deemed suitable for use in tunnels longer than 200m by virtue of configuration, condition, fire safety. As new MTMV Tunnel Suitability is assured by specification. During ongoing use, Tunnel Suitability is dependent on condition.
Unknown Supplier	A supplier without a proven track record with KiwiRail. A supplier that has either not delivered new equipment to KiwiRail before, or that has and that equipment was problematic (whether that equipment was new or existing).

3. Policy

3.1 Compliance with this Code

This Code influences the entire life cycle of MTMVs. Management of all stages is needed to ensure compliance with KiwiRail's Safety Case and Rail Licence. All stages are interlinked and specific to a particular vehicle or equipment type.

3.2 Certification and inspections

Inspection, maintenance and certification requirements for each machine must be defined and compliant with this code and documented e.g. in the machine operating or maintenance manuals.

3.3 Risk management

Risks must be managed in accordance with this Code and the requirements of NRSS/4 – Risk Management. Type approval or Loco 155B RCoF sticker will not be granted until KiwiRail has approved the risk assessment.

When a new project involves any significant aspects untried in NZ, an initial, specific risk assessment will be needed before procurement. The risk assessment must be updated and endorsed during the procurement and implementation stages.

Suppliers should discuss requirements with KiwiRail at an early stage before committing to production for new machines or modifications for existing machines.

Risk assessments will need to be selectively reconsidered after vehicle modifications.

3.4 Equipment

All MTMV's must carry the following equipment:

- approved operating manual.
- approved maintenance requirements so far as might need to be applied in the field.
- a full set of safety equipment including:
    - red and green signalling flags
    - detonators
    - fire extinguishers (see section 14.7.1)
    - first aid kit
    - torch
    - RPE as required
    - spill kits

3.5 Statutory requirements

This Code focuses on MTMVs and assumes statutory requirements have been satisfied. Statutory requirements are not specifically listed in this Code.

3.6 Fault and repair booking

All MTMV's must have a recording method kept in the operating cab or control station which allows operating crew to view and record faults, problems and repairs needed, and, allow maintenance staff to record corrective actions.

An owner or operator that has an alternative 'in-house' recording process that is acceptable to KiwiRail may use that system instead.

3.7 Documentation

Comprehensive manuals covering operating instructions, servicing, maintenance, training and competency must be provided.

3.8 Training and competency

Operators of MTMV's must hold appropriate Network and machine-specific competencies before driving a machine on the Network. Network competencies are not part of this code.

MTMV's documentation must include training and competency assessment including a training syllabus/requirements and an operator certification. A check-sheet may be used. Training and documentation may stand alone or be provided as an appendix to the operator's manual.

Documentation and any assessments are to be reviewed after any vehicle modifications affecting operating methods or safety.

Operator certification for specialist equipment such as crane and EWP use is in addition to requirements of this Code.

KiwiRail maintains a register of personnel holding KiwiRail qualifications. Minimum requirements for preparing a training and competency syllabus are in Appendix B Training and competency syllabus.

4. Project management

4.1 Project processes, scope and risk

This section outlines the requirements to manage the project workload which will vary with scope and risk involved.

Unlike the HRV Code where most engineering project management is contracted out, this Code outlines engineering management requirements and responsibilities that are needed to directly manage this process internally by KiwiRail. Importantly it emphases the proportionality needed to manage the great variety of projects ranging from proven catalogue equipment through to complex and higher risk prototype equipment.

Project Management, governance, procurement and technical reviews will vary from simple scope for existing or proven equipment through to risk based and thorough QA processes for novel or complex approaches.

Proven catalogue equipment from Established Suppliers is relatively low project risk. Project risk increases whenever the equipment involves changes in detail, configuration or operation from that which the supplier has delivered before or modifications to meet NZ requirements or performance specification.

The focus on project management with Established Suppliers is not intended to double-up on the core competencies of the supplier, rather it is to ensure the vehicle will be entirely fit-for-purpose and suitable for its intended uses considering local requirements, safety, operational and asset aspects the supplier may not fully appreciate. The emphasis is to create a successful product, not just a compliant product.

With an Unknown Supplier, or when novel or less well proven features are involved with an Established Supplier, project risk increases and more emphasis will need to be placed on fundamental machine concepts and subsystems.

Table 1 outlines the processes that need to be applied when managing MTMVs new to the network.

4.1.1 Stages of a project:

Each row in Table 1 displays a stage of the project. The stages are the same irrespective of project scope and risk:

Row A: Business need (KiwiRail):

- Production requirements (these are not specified in this Code).
- Safety requirements.
- Asset expectations.

Row B: Project governance (KiwiRail):

- Process framework and documentation.
- Risk & quality controls.
- Management & Governance resources and expertise.

Row C: Procurement (KiwiRail and Supplier):

- Contractual arrangements.
- Process of either direct procurement, open tender or pre-qualified tender.

Row D: Technical reviews (KiwiRail and Supplier):

- Design:
    - Concept Design: Evidence that the proposal will be compliant to all requirements.
    - Preliminary Design: Evidence that systems and sub-systems will be complaint to all requirements.
    - Detail Design: Evidence that implementation documentation is compliant to all requirements.
- Build.
- Commission.
- Safety Case Milestones: Provision for up to three stages of consultation with NZTA as relevant. Particular requirements will need to be checked at the time.

4.1.2 Scope and risk of a project:

Four columns or lanes in Table 1 outline the project processes that are needed to manage the different degrees of project scope and risk. These processes reflect the project management resources and expertise needed. Each lane covers progressively increasing project scope and risk from Lane 1towards Lane 4.

When specifying new plant and selecting a supplier, two considerations that need to be assessed concurrently are the risk involved from the scope of the equipment being sort and the ability or track record of suppliers to deliver that equipment.

Lane 1:

- Existing machine.

Lane 2:

- New machine from an Established Supplier that is an already developed catalogue offering.

Both lanes 1 and 2 involve well defined scope and risk such that procurement (Row C) could be an open tender process.

Lane 3 covers either:

- New machine from an Established Supplier that uses already developed modules or sub-systems but is uniquely packaged, or re-configured, for this order, or
- new machine from an unknown supplier that is an already developed catalogue offering (complete design exists).

Lane 4 covers either:

- New machine from an Established Supplier that uses newly developed modules or sub-systems and packaging or configuration, or
- new machine from an unknown supplier that is offering a machine that is not an already developed catalogue offering (complete design does not exist). At its fullest extent, this element could be considered a high risk full prototype project and is not recommended.

Both lanes 3 & 4 involve significantly increased scope and risk such that consultation with the market is needed to help refine options and establish a short list of pre-qualified suppliers that would be invited to submit formal tenders.

This code is not complete with respect to project governance and assumes the adoption of KiwiRail standard processes. Relevant technical aspects of project governance are included at section 4.2.

Non-technical aspects such as the business need and procurement are covered by established KiwiRail processes with appropriate technical input to achieve sign-off. These subjects are not covered in this code.

The implementation stage is covered in section 4.3.

Table 1 Stages, scope and risk of projects

PROJECT STAGE	LANE 1	LANE 2	LANE 3	LANE 4
	Existing MTMV	New MTMV		
Row A Business need		Existing design	Existing modules in unique configuration	Unique modules in unique configuration
Row B Project governance (Section 4.2)	**Simple scope** Existing benchmark Document review (supplier manuals etc)	**Simple scope** Existing benchmark Document review (supplier manuals etc)	**Moderate scope** Existing benchmark Document review (supplier manuals etc) Risk assessment	**Complex scope** Benchmark? Document review (supplier manuals etc) Risk assessment Governance review
Row C Procurement (purchase or lease)	Procurement plan	Procurement plan	Procurement plan	
		Catalogue selection Possible suppliers	Market options assessment (EOI) Supplier range Supplier reputation Solution types	
			Specifications developed from finalised requirements	
	Direct acquisition	Approach to market	Tenders invited from pre-qualified suppliers	
Row D Technical reviews (Section 4.3) Design	Concept	Concept	Concept	Concept
				Preliminary
			Final	Detail
	Safety Case Milestone			
Build	Modifications (minor only)			Manufacture
		Factory acceptance testing (FAT)	Factory acceptance testing (FAT)	Factory acceptance testing (FAT)
	Documentation operation maintenance training	Documentation operation maintenance training	Documentation operation maintenance training	Documentation operation maintenance training
	Safety Case Milestone			
Commission	Field test	Field test	Field test	Field test
	Final support	Final support	Final support	Final support
	Safety Case Milestone			
BAU	Entry into service			

4.2 Project governance and management

The following sections outline an abbreviated summary of best practice procurement that applies to any major capital plant.

MTMVs are highly specialised pieces of equipment, so in addition to underlying KiwiRail project management and procurement processes (or embedded in them) regular reviews by a governance group of a project dashboard will be needed to demonstrate that the project is proceeding in compliance with this Code.

Benchmarking against previous projects and known equipment and methods should be used to assess project risks, resource needs and governance reviews. This should be undertaken or reviewed by people who have managed previous MTMV procurement projects.

Following is guidance for scope and risk covered by lanes 2-4. An abbreviated guidance for lane 1 is provided in Appendix C Quick check for an existing MTMV. For Lane 4 code compliance is to be checked at all stages shown in Table 1, however, for Lanes 2-3 compliance is to be checked at a fewer number of stages because they present less risk and the process can be more condensed. Therefore, for Lane 2-3 projects, delivery of supplier documentation will need to be aligned to the number of review stages incorporated in the supply agreement.

Document reviews to be agreed between the supplier & KiwiRail and incorporated in the supply agreement should cover the following documentation suites. An example matrix of how these documentation suites are phased with respect to project stages is included in section 19, *Appendix E Example matrix of scheduled deliverables*.

1. Delivery.
2. Assurance – safety & quality.
3. Design.
4. Accreditation.
5. Test & Acceptance.
6. Operational acceptance.

These documentation suites are outlined below. Each is most completely covered by the supplier submitting documentation for KiwiRail review. The subject remains at the supplier's risk in all regards until KiwiRail accepts each document in the required order and considering all interrelated aspects. The requirement for every plan listed following, and if required the degree of detail within each, is to be assessed and defined before each stage is started. As much as possible the supplier should be offered the chance to answer each plan through their routine documentation processes to avoid unnecessary cost and distraction.QA processes

The following aspects should be assessed against whole-of-life requirements and incorporated into the supply agreement as relevant to the scope and risk of each project.

1. Delivery: [Due as part of contract agreement]
    a) Schedule / Programme – plans, design, manufacture, test, commission, etc..
    b) Contractual risks – include on risk registers
    c) Reporting – contents, frequency.
2. Assurance: [Acceptable documentation due before preliminary design acceptance]
    a) Compliance:

i) Requirements (How agreed outcomes and compliance with specified codes and standards will be checked and assured at each review stage).

ii) Quality plan (expectations across entire supply chain that can be audited).

iii) Auditing (including of configuration & compliance, which will be more common when multiple vehicles are to be the same).

iv) Parts management

b) RAMS:

i) Reliability & Availability

a) Failure predictions
b) Demonstration plans

ii) Maintenance

c) Schedules
d) Manuals
e) Demonstration plan
f) Training
g) Environmental considerations

iii) Safety (see Section 6)

h) Hazard analysis (HAZID)
i) Preliminary hazard analysis (PHA)
j) HAZOP
k) Safety assurance
l) Reports

3. Design:

a) Design stages (as defined at 4.1.1 and Table 1). An overall report is required at each design stage acceptance as well as the following specific reports.

b) The following specific reports are required on key subjects. Note that reports must summarise how compliance for each subject will be achieved against all relevant Code requirements, and all subjects are compatible with each other e.g. crashworthiness is achieved and is also compatible with human factors and general requirements.

i) Fire and tunnel suitability. The points of section 14.6 and subsidiary clauses are to be covered in the report.

ii) Mass (including distribution, CoG heights, balance, axle loads).

iii) Crashworthiness (survival space, penetration resistance, secondary impact, ejection, fire and escape from machine).

iv) Clearances (loading gauge, vertical and horizontal track curvature).

v) Resistance to vandalism and tampering.

vi) Human factors (accessibility, ergonomics, work station design, work site safety), to include a mock-up plan acceptable to the purchaser that will describe aspects of the vehicle to be demonstrated by physical or virtual mock-up.

c) Interface management (evidence that all systems and requirements should work together).

d) Configuration (how systems will be defined to cover variations and modifications).

4. Accreditation (integrated safety management – all the steps to allow product into use):
   a) Legislation / Regulation (NZTA, ACoP etc.)
   b) Operators, users – consultation and review
   c) Supply contract
   d) Road-map, hold-points, signatories, Type Acceptance.
5. Test & Acceptance (to demonstrate that the final design meets requirements):
   a) Test Specification & reports (what reports are expected and how tests will be undertaken).
   b) Factory Acceptance Tests (all tests undertaken before equipment is allowed to leave the supplier or sub-supplier factory):
      i. Development tests (Mock-up or prototype assessments).
      ii. Type tests (formally demonstrate requirements are achieved, usually at component and sub-system level. May be concurrent with development tests).
      iii. FAI.
      iv. Integrated testing (functionality of entire machine at agreed state or completion).
   c) Commissioning tests (all tests required before equipment starts operational tests in a real railway environment).
   d) Operational tests (limited real use).
   e) FRACAS.
6. Operational acceptance:
   a) Training manual and competency assessment.
   b) Certification of operators.
   c) Operational risk review across design, operations and maintenance responsibilities.
   d) Documentation covering maintenance manuals (including 3rd party equipment), operation, training and acceptance certificates.

NOTE: Spare parts and maintenance support will also be included in the procurement contract.

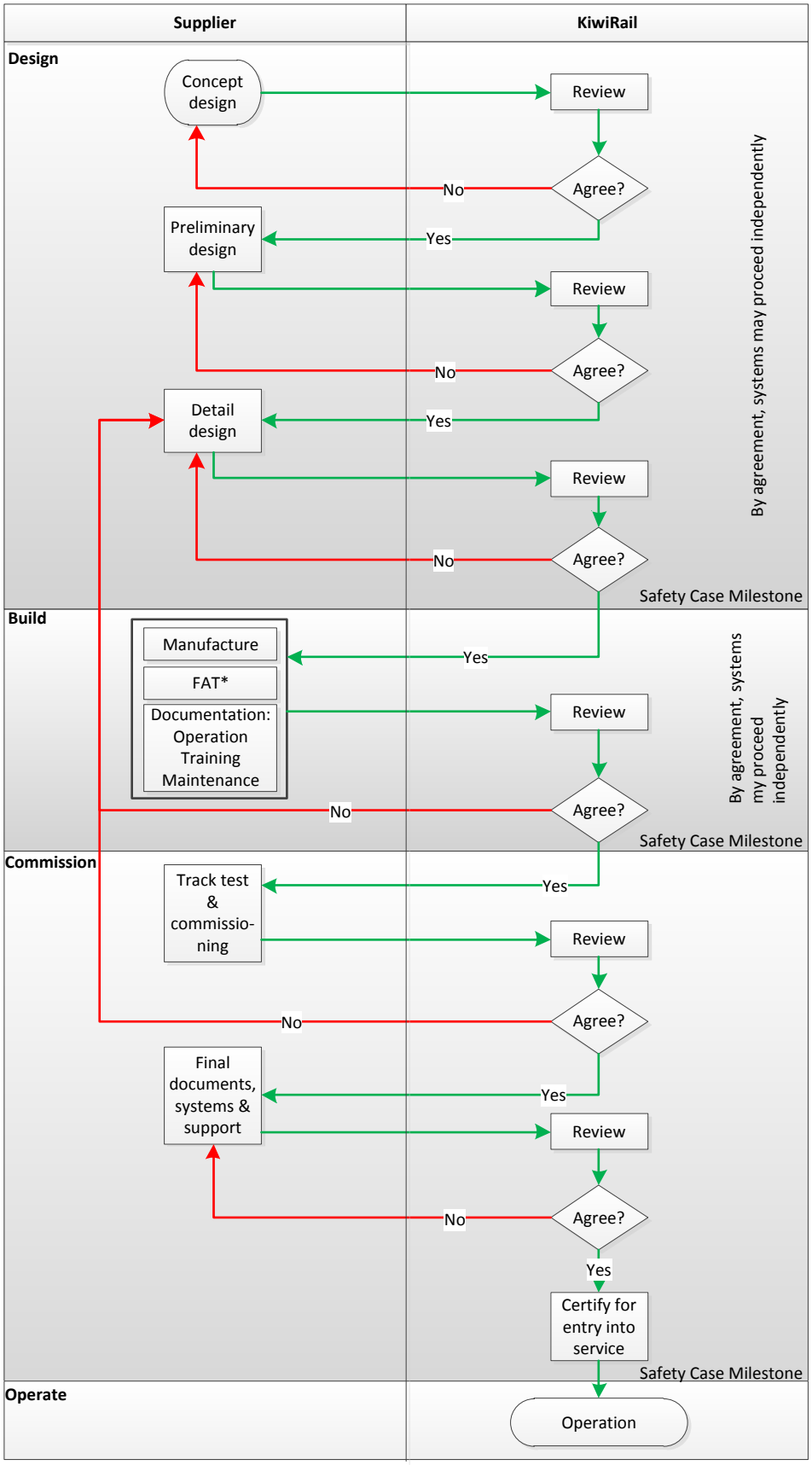
4.3 Project implementation

Table 2 provides a detailed flowchart of the implementation stage for the largest scope and or highest risk project (Lane 4). This chart shows the sequencing of reviews and iterative exchanges anticipated to be necessary for approval of each review.

The processes outlined in Table 2 and Appendix E Example matrix of scheduled deliverables, jointly cover the requirements for documentation reviews and how reviews will be phased and iterated. Successfully integrating these requirements is fundamental to efficient project management and a successful product.

For projects of smaller scope and or lower risk (Lanes 1-3), the relevant review loops can be simplified or deleted in accordance with Table 1.

Table 2 Implementation stage for most complex scope and risk (matches Lane 4 Row D in Table 1.



5. Risk management

The fundamental objective of the risk management process is to influence safety by identifying potential hazards and then ensuring engineering and operational mitigations are in place and supported by hardware, manuals, and training.

Overview:

1. Risk management starts at the design stage to ensure appropriate design mitigations are incorporated and then updated as necessary through the design stages and as the machine takes shape, is tested and presented for approval.
2. Risks will be mitigated across design, maintenance and/or operations as agreed at each review stage.
3. RAMS and Human Factors reports are the key processes to manage and document risks from the outset of the project.
4. Risk assessments are to include foreseeable as well as historical scenarios. Novel features and points of difference to other machines are to be included in risk assessments.
5. Final agreement on risk mitigations will be achieved and documented by the operational risk review (see Operational acceptance in section 4.2). This covers responsibilities across design, maintenance, training and operations, and concludes management of residual risks. Operational risk mitigations are to be incorporated into vehicle manuals, instructions and training. Key risks must be included in the vehicle manual in a form readily understandable to the crew.

6. Safety consultation

MTMV's are complex machines with regard to human factors and safe person-machine interactions.

This section outlines the reviews to be undertaken with operators and maintainers of the MTMV early in the project to ensure all possible design mitigations are considered. Mitigation of the safety issues will be agreed across design (features to be incorporated in the machine), operation and maintenance (to be incorporated in operating, maintenance and training manuals). Outcomes from this section need to be concluded in the Design Reports (see section 4.2, section3 b).

Examples are given of hazards that need to be considered and human factors assessments that need to be undertaken. These prompts are the minimum scope for consultation reviews.

6.1 Overview of safety critical vehicle systems

Safety critical vehicle systems subjects for risk assessment are:

1. Wheel/rail
2. Clearances
3. Braking
4. Crashworthiness
5. Fire and tunnel safety
6. Human factors
7. Resistance to vandalism and tampering

6.2 Initial hazard considerations – HAZID and PHA

Initial hazard considerations need to take into account historical incidents and anticipate the hazards that may be encountered by the MTMV in all its operating and maintenance environments.

HAZID and PHA will be used as 'lead controls' in the concept design stage to identify opportunities to achieve inherent safety, and provide early input essential to project development decisions.

The following are examples of broad hazard types that should be mitigated by early design consideration wherever possible.

1. Derailment
2. Runaway
3. Overturning during operation or travel
4. Collision (Visibility, sight lines, conspicuity, mirrors, cameras, lighting, warning devices, proximity warning devices)
    a) MTMV – MTMV
    b) MTMV – road vehicle (level crossings)
    c) MTMV collision with Network impingements
    d) Overturning
    e) MTMV – person
    f) Operator (workstation) protection (survival space, penetration resistance, secondary impact, ejection)
5. Fire (machine and environment)
    a) Grinding operations;
    b) Welding operations;
    c) On-board systems.
6. Tunnel safety
    a) Fire.
    b) Gases.
    c) Escape and evacuation.
7. Electrical
8. Maintenance, repair and recovery activities in the field and depot, both routine and emergency.

6.3 Human factors for concept design – HAZOP

HAZOP review and consultation will be used to review the detail of the developing design as soon as the design can be visualised by operators. The safety review and consultation may need to occur during each of the three design stages. HAZOP involves production and asset management, on-board and ground crew.

Typical HAZOP issues are as follows, reviewed against all tasks in a 'day in the life of' assessment considering initial inspection, start-up, operations, stable, shut-down & secure:

1. Ergonomics;
    a) 5%-95% male and female (Dreyfus or equivalent)
    b) Controls & hand grabs usable with gloves and PPE
    c) Lighting and visibility
    d) Roof heights for hard hat
    e) All work stations (including non-driving)
    f) Accessibility
2. Moving parts.
3. E-Stops – around machine (fire and movement stops).
4. Trips, slips, falls;
    a) Barriers to protect from falls;
5. Electrical/shocks;
    a) Roof barrier protection (OLE);
    b) Aerials (OLE).
    c) Machine electrical systems
6. Heat/burns.
7. Crush/pinch.
8. Noise.
9. Vandalism (loss of features).
10. Signage/labels.
11. On-board & ground crews (all issues including escape & evacuation).
12. Communication methods (all crew and work stations).
13. Acceptance of residual design risks across training, operations and maintenance.

7. Operating conditions

New Zealand's rail network is a narrow gauge lightly built railway that is relatively tightly curved, with moderate quality track. Most lines have NZRC type 50kg/m rail or NZRC type 91 lbs/yard (as per NRSS 6 clause 6.3 and Dwg 64000/1 respectively) rail on timber or concrete sleepers, with canted bedplate assemblies, screw spikes and spring washers or Pandrol fasteners. Rail joints are directly opposite in the track. Four-hole bolted fishplates, flash butt or Thermit welds join the rails. Individual rail segments are nominally 12.8 m long before joining. Sleeper spacing is nominal.

7.1 Climatic conditions (see also NRSS/6)

For New Zealand climatic conditions, each consist shall be capable of operation under the following environmental conditions:

1. Wind loadings of up to at least 130 km/h gale-force are occasionally experienced throughout the country, and it is essential that the consist remains stable while travelling at normal speeds.

2. Water and salt laden atmosphere. In the areas where the consist will be in service, some track is next to the coast and subject to high wind forces that cover the track and track vehicles with salt spray. In extreme conditions, broken waves could strike the side of a consist. Levels of environmental atmospheric pollution are relatively low, so corrosion from this source is relatively mild.
3. Altitudes ranging from sea level to a maximum of 807m above mean sea level.
4. Mean annual temperature of 12.5°C. Normal ambient temperatures experienced by railway vehicles are in the range of -15°C to 40°C. Rail temperatures can reach a maximum of 60°C, frequently 50°C in summer months. Ambient temperatures in tunnel operation, with locomotive cooling, radiator and combustion air can reach 70°C or higher at hood (roof) level.
5. Humidity averaging 70–75% and ranging from 10–100%.

7.2 Track Conditions (see also NRSS/6)

Each Consist shall be dynamically compatible with the following in all load conditions:

a) Track gauge of 1068 mm with a construction tolerance of +5 mm and -0mm. This applies to curves down to 250 metre radius. Curves of radius less than 250 metres have track gauge of 1074 mm +5mm and -0mm. Maximum cant on any curve is 70 mm. Each consist must accommodate 70 mm cant deficiency without risk of overturning.

b) The extremes of track geometry within the New Zealand national rail network in all load conditions, including:

i) a curve of centreline radius 70m reference NRSS 6 clause 7.1.1 a)

ii) 1:7.5 turnouts forming an 82m radius reverse curve between parallel tracks 3800mm apart. Reference NRSS 6 clause 7.1.1 b)

iii) maximum track twist of 40 mm over four metre length may be encountered at slow speed, and

iv) a vertical curve (both convex and concave) of 100m radius while coupled.

v) Main line curvatures as follows (minimum cant run out for curves is 1 in 500):

Radius (m)	Speed (km/hr)	Cant (mm)	Gauge (mm)
100 - 110	35	70	1074
111 – 140	40	70	1074
141 – 170	45	70	1074
171 – 210	50	70	1074
211 – 250	55	70	1074
251 – 300	60	70	1068
301 – 350	65	70	1068
351 – 400	70	70	1068
401 – 460	75	70	1068
461 – 540	80	60	1068
541 – 620	85	60	1068
621 - 700	90	60	1068
701 - 800	95	60	1068
801 - 900	100	50	1068
901 - 1100	105	50	1068
1101 - 1200	110	50	1068
1201 - 1500	110	40	1068

1501 - 2000	110	30	1068
2001 - 2400	110	20	1068
Over 2400	110	0	1068

7.3 Interoperability requirements

1. The Consists shall be designed in accordance with the National Rail Safety Standard NRSS/6 Engineering Interoperability Standards, where applicable and specifically referenced throughout these specifications. Where conflict exists between the Technical Specifications and the NRSS 6 Standard, the worst case shall take precedence unless agreed otherwise.
2. Without limitation, the following NRSS/6 Issue 4 sections are specific to the Technical Specifications:
   a) Running Rights – Clause 4.2.1;
   b) Axle Loads – Sections 6.1, 6.2 & 6.4;
   c) Curve Negotiation & Stability – Clause 7.1.1 (a) & (b);
   d) Wheels & Axles – Sections 8.1, 8.2 & 8.6;
   e) Braking and Acceleration – Section 9.3 & 9.6;
   f) Maximum Speeds – Section 10.3;
   g) Safety Equipment – Section 12.4 & 12.9 & Clause 12.8.3;
   h) Instruments & Monitoring equipment – Section 13.1;
   i) Vehicle Identification – Section 14;
   j) Environmental Restrictions – Section 15.2 & 15.4; and
   k) Appendix A, Section B.
3. The NRSS/6 Standard is available on the KiwiRail website.

7.4 Gauge clearances

The MTMV's, as individual machines, and as integrated into a single Consist, must be able to travel throughout the KiwiRail network and in travelling mode shall fit within the New Zealand Standard Loading Gauge as defined in NRSS/6 clause 4.2.1 and Appendix B, or as otherwise agreed with KiwiRail.

8. KiwiRail drawings

Drawings to be provided to suppliers of new equipment.

1. Ferry tie down and hook details dwg 12050570 and dwg 15001753A
2. Ferry access vertical curve profile dwg 15001764A
3. 91lb Rail Profile dwg 64000/1
4. Rail Sections – Fig 1.3.1 Properties & Dimensions of NZ Rail Sections
5. Signal Viewing Envelope A268
6. Futuris Industrial Products Dwg 151

9. Materials

The materials and parts used by the Supplier shall unless specified otherwise, meet the applicable New Zealand Australia, British or American Standards and to the highest or most onerous level of compliance where there are any differences between the requirements of each of the applicable standards.

10. Construction requirements and workmanship

1. Construction
    a) All joints, seams and spaces where moisture may collect shall be effectively sealed and protected against electrolytic or corrosive action.
    b) The Supplier shall provide adequate drainage in all areas subject to condensation or ingress of moisture. All RHS box section must have drain holes to allow water to escape.
    c) The supplier shall avoid so far as is reasonably practicable, pockets, cavities and recesses where moisture, dirt, oil or grime might accumulate and which would be difficult to clean.
    d) The Supplier shall design and assemble under frame sections to eliminate all recesses, or cavities that could retain water or flying ballast from the track.
2. Inter-changeability
    a) All Parts and items of equipment, units and other components used by the Supplier across multiple MTMV's and/or Consists shall be consistent and interchangeable where appropriate and possible.
    b) All Parts shall be drilled, machined, cut and assembled, to jig or template and be so accurately made as to be strictly interchangeable in every way without recourse to selective assembly.
3. Welding
    a) All welding shall comply with the requirements and tests of an approved welding standard such as AWS D15.1 or an equivalent weld procedure based system that applies to the welding of railway equipment. All welders will be qualified under these standards.
4. Auditing and inspection
    a) Parts and assemblies will be checked as per the Supplier's quality assurance programme (as accepted by the Purchaser) and as required on a random basis by the Purchaser.
    b) Any part and any assembly at any facility may be inspected at any reasonable time by the Purchaser.

11. General requirements

These requirements must be met for machines new to the KiwiRail network unless specifically agreed otherwise. Existing machines should be upgraded to these requirements as appropriate when modifications or overhaul allow. Mandatory upgrades required of all machines will be specified with an effective date.

1. MTMV's shall generally be of proven design and performance and shall have a design service life of at least 25 years.
2. Components used in the manufacture of the machine replacement components must be supported by the manufacturer for a minimum of 10 years.
3. Speeds for new machines will be given in the performance specification for the machine for travel up a 1:28 gradient travel and on level track. Ride performance must be safe and acceptable at all operating speeds.
4. MTMV's shall be self-contained so no additional machinery is needed for the operation.
5. Fuel capacity shall be sufficient for minimum 16 hours of operation.
6. Refuelling arrangements shall be designed for ease of use in the field with straight forward access and without spillage or need to work at heights or with additional ladders or platforms and be achievable under electrical overhead equipment.
7. Environmental noise levels of the machine are to be to agreed levels considering night work in built-up areas. Excessive noise may require mitigation.
8. MTMV's shall have an emergency stop system (e-stops), which will stop all systems that shall be accessible from multiple points on the MTMV. The functionality of the emergency stop system with respect to halting movement or shutting down shall be agreed. (Note that e-stops for fire safety are also required.)
9. An Auto Lube greasing system shall be fitted.
10. Invertors supplying 230 volt, 1500 Watt minimum shall be fitted. A minimum of two number NZ-standard outlets are required per cabin or workspace. At least one USB outlet for charging electronic devices shall be provided at each power outlet. Electrical systems [consolidate with previous]
11. Electrical systems will normally be 12 or 24 Volts DC. Vehicles incorporating equipment operating above 50 volts AC or 120 Volts DC are subject to the inspection and Warrant of Electrical Fitness requirements applicable to caravans with their own internal power supply.
12. Access to battery terminals for jump starting is required.
13. The MTMV shall be secure and vandal resistant, including lockable covers over all external control points. Vulnerable cables, tubes etc. shall be discretely located or protected. (See also paint system requirements.)
14. Train control radio and antenna to be installed at the factory, KiwiRail will supply the train control radio & antenna. Train control radios require a 12 volt power supply. The radio needs to be mounted within comfortable reach of the operator seat and requires space of approximately 300mmW x 75mmH x 250mmD
15. A Kupe Mobile Controller (KMC) is to be installed at the factory using parts supplied by KiwiRail. (For information, KMC provides vehicle location information to Train Control.)
16. Storage shall be provided for:
    a) Spill kits.
    b) Tools, spare parts.
    c) First aid kits
    d) PPE including hard hats

e) Respiratory protective equipment for each crew member - mask and filter at minimum and further requirements are to be advised with new equipment.

f) Emergency equipment (detonators, flags etc.)

g) Any recovery equipment such as rerailing shoes.

h) Substantial crew bags.

In principle all storage solutions should provide containment in the event of an incident.

11.1 Earth path [see also NRSS/6]

All MTMVs must be provided with an "earth path" to the rail for working in electrified areas.

Earth cabling is to have a cross-sectional area of 35 mm^2. The "earth path" may include a spark gap. Spark gap units must be approved by KiwiRail and tested after installation.

12. Main systems

1. Cabin/s

   a) All cabins shall be fully enclosed, sound proofed and lockable with internal noise levels not exceeding 85 dB(A).

   b) The main operator's position shall provide a clear view of the respective work zones.

   c) Visibility - the operator view lines must meet the Policy Statement – Signal Viewing Envelope A268 referenced from NRSS/6.

   d) All cabins shall be designed for good ergonomics, be readily and safely accessible and meet all relevant standards and regulations for Occupational Health and Safety.

   e) Cabins shall, at a minimum, meet the UK crashworthiness standard GM/RT2100 for Type 2 - Non Passenger Vehicles. The cab structure and under frame are to be considered holistically as a colliding vehicle to KiwiRail satisfaction.

   f) At each design stage submission the cab design(s), Human Factors Report, and Crashworthiness Report (section 4.2) will be reviewed together.

   g) Windows, front and side, shall be clear glass, without tints and shall comply with an acceptable standard for railway glass with regard to signal sighting and strength.

   h) Heating, ventilation and air conditioning shall be supplied in all cabins.

   i) Reversing mirrors and/or cameras shall be fitted to provide visibility when reversing, or when there is not clear visibility ahead from the controlling work station.

   j) CCTV shall be fitted to allow monitoring of work heads and other critical systems out of sight of the operator.

   k) A minimum of two seats shall be provided in the operator's cabin(s). The number of seats to be provided is to be agreed with KiwiRail with the intention of providing safe accommodation for all crew members while working or travelling.

2. Braking System

   a) Fail-safe braking on all axles shall be provided.

   b) Service braking must be effective on a 1:28 gradient.

c) Stopping distance from 32 km/h shall not exceed 45m using full brake application on dry, level track. There shall be no wheel lock up.

d) The retardation rate shall never exceed 1.2m/s^2 to meet the performance criteria specified. This statement is equivalent to the allowable maximum wheel – rail coefficient of friction criteria.

e) An effective park brake (spring applied air release) shall be provided to hold the machine indefinitely on a 1:28 gradient. (The gradient may be relaxed to 1:33 for non-CRL machines.)

f) Brake blocks shall be standard AAR HA30 high friction.

g) Provision shall be made to release the brakes on a MTMV during recovery.

h) Service and park brake requirements apply to both an MTMV operating alone or in a consist, including where control is from another vehicle.

i) Brake couplings shall be fitted at both ends of the vehicle.

j) Any requirement for the MTMV to have a train compatible braking system to enable it to be towed as part of a scheduled freight train will be determined on a case by case basis. In any case, in infrequent emergency situations where a machine is unable to move under its own power, a safe method shall be provided for the brakes to be managed or isolated to enable it to be retrieved by a locomotive

3. Traction System

a) The traction system shall be designed to transmit power smoothly and uniformly. Preference is that each vehicle (including each vehicle in a semi-permanently coupled set) shall have two driven axles to manage gradient and slippery conditions e.g. a two bogie vehicle shall have at least two driven axles and both axles will be driven on a two-axle vehicle. Any proposal for alternative arrangements must be supported by calculation or precedent demonstrating adequacy.

b) The traction system shall be hydro-static.

c) The transmission shall have a mechanical disconnect for use during emergency recovery.

d) The transmission shall ensure all travel and work functions can be performed without wheel spin or stalling of the machine across the performance envelope of the machine.

4. Engines

e) Shall be diesel powered.

f) Shall be of well proven design and of a type well supported in New Zealand.

g) Fire protection shall be provided in any engine and hydraulic pump bay.

h) All fuel lines shall be protected from engine and exhaust heat.

i) All fuel tanks shall be protected with external fuel cut off valves.

j) Exhaust (system features)

i. Exhaust systems shall be shielded, shall include silencers and shall direct the fumes away from the operators

ii. The exhaust system must include a muffler.

iii. The exhaust system must be so designed and shielded where necessary to avoid contact with fluid splashes and burn injury while carrying out routine operational or maintenance functions.

iv. Exhaust system routing and heat shields should not be horizontal or otherwise allow the accumulation of oil, dirt and debris.

k) Emissions (products of the exhaust system)

i. KiwiRail wishes to optimise emission performance in tunnels and other restricted spaces. All engines shall be low emission to best practice performance. Emissions shall be to an agreed emission standard.

ii. Suppliers shall demonstrate that the emissions system will operate as intended by the engine OEM.

iii. The emission system of vehicles in-service, must operate as originally intended, both hardware and software, unless KiwiRail has authorised a modification. For example, a selective catalytic reduction (SRC) exhaust system must operate correctly, including correct dosing.

The maintenance interval between incidents of clearly visible smoke is to be optimised (time interval vs maintenance intervention) to support NZ Tunnel Suitability requirements.

☼Information – Exhaust emissions and ventilation in tunnels

MTMV systems alone are not sufficient to assure tunnel air quality. Tunnel site safety plans will impose requirements for positive ventilation to dilute and remove harmful exhaust emissions and improve safety should a fire occur. All vehicles may be required to cease operation should the ventilation become inadequate.

All engines, and especially older engines, need to be managed as if they are producing toxic and asphyxiant emissions.

13. Detailed component requirements

1. Body Structure

a) Shall have non-slip flooring on walkway areas.

b) Shall have side steps and hand-grabs as required to enable easy access to the machine.

c) MTMV's shall be fitted with a roof to protect personnel from proximity to overhead line equipment.

d) There shall be no sharp edges or protrusions that might cause injury.

2. Body Underframe and Fittings

a) Shall have standard ferry tie down hooks to allow for transport on the rail decks of interisland rail ferries, as per drawing 120500570. The ferry tie down hooks will be provided by the Purchaser. The Supplier shall weld ferry tie down hooks to meet the following design criteria; A maximum lateral acceleration of 0.65g acting on the load and structure and reacted by the bogies centres, side bearers and ferry tie down hooks. This is equivalent to the static load at 40^0 heel, and allows for a dynamic roll of approximately 30^0 on an interisland ferry. The Ferry lashing rails are at rail level

at 1295mm either side of the track centreline and at 1625mm either side of the track centre line.

b) Provision shall be made for lifting, jacking and re-railing the MTMV and agreed at the Design Concept stage. Lifting and jacking points shall be rated for the maximum gross vehicle load. Lifting and jacking points shall be clearly labelled.

3. Hand-grabs and footsteps

a) The Supplier shall provide hand-grabs at each step.

b) Handrails, grabs, steps, and guards shall be structurally secure, without deformation, unobstructed and visible.

c) Adequate access to all work and deck areas of the vehicle must be provided. Where this requires the use of ladders, footsteps or handgrabs, these must be positioned in an ergonomic arrangement (the most efficient way for the human body to use them), and be within the profile limits in 14.1 Profile and height.

d) The upper surface of all footsteps shall be free of all paint, contaminants or lubricants. All hand grabs and steps are to be painted white with non-slip grit on the handrails.

e) Stirrup steps shall have a guard if fitted close to the bogie or other hazards.

4. Couplers

a) Drawgear shall be fitted at both ends. Drawbars that must be manhandled will not be accepted for new machines unless by specific agreement.

b) The Supplier shall ensure that operators can couple and uncouple machines in a consist with minimal effort. Release mechanisms shall be operable from the side without reaching across to the coupling to activate.

c) MTMV's shall be able to be towed by a locomotive or placed in a train as the last vehicle on a train.

5. Axles and Wheel sets

a) The wheel shape and tread profile shall conform to profile B1 on drawing 7604/11 in New Zealand National Rail Safety Standard NRSS/6.

b) The Supplier shall mount wheels at ambient temperature centrally on the axle and at a back-to-back distance as per NRSS/6. After mounting, the Supplier shall check the gap between wheels at three equidistant points on the rim.

c) The diameter of two wheels on the same axle shall not differ by more than 1mm.

d) Wheel and axle assembles are to be to an agreed standard

e) Wheel and axle assembles are not to be insulated.

6. Bogies

a) The bogies and all bogie components shall comply with a recognised international standard approved by the Purchaser.

b) Bogies shall be quiet in operation, have excellent riding qualities and operate without introducing undue stresses in the MTMV structure or on the track.

c) Bogies shall be designed for minimum maintenance with the least number of wearing parts, and minimum wheel wear and railhead wear.

d) For an Established Supplier the vehicle must pass the twist test documented in KiwiRail Specification 401. For an unknown supplier the requirements of KiwiRail Specification 401 or an agreed equivalent must be met.

7. Audible features and lighting

a) All tail, stop and amber flashing lights must be LED lights.

b) Ditch lights to NRSS/6 are required on all vehicles new to the network. As per NRSS/6.

c) Headlights shall have a suppression feature and on/off switch.

d) Head and tail lights are to automatically switch when changing direction.

e) Amber flashing lights shall be mounted on the cabin roof or at each corner of the machine for use while on track. The light must not be obscured at a distance of 5 m from the front or back of the vehicle and must be visible for at least 150 m.

f) Audible movement indicators are to activate when the operator changes or engages direction, the warning to sound six times then cancel out. The emitted sound must be directional and appropriate for night time use in suburban areas.

g) Strobe/warning lights are to be provided and must flash when the operator changes or engages direction as per audible warning devices.

8. Safety features

a) Vigilance / dead man at driving positions for use when travelling.

b) Provision shall be made for the future installation of an event recorder.

c) Provision shall be made for the future installation of ETCS.

d) Secondary restraint shall be provided for extendable items not naturally restrained (i.e. tamper measuring bogies).

e) Proximity warning devices shall be fitted to alert the operator to the presence of personnel or objects in the path of the machine. The specification of the system shall be agreed with KiwiRail.

14. Common technical requirements

14.1 Profile and height

All parts of the vehicle and its secured load and equipment must be within the limits of the standard loading gauge (drawing 13090429).

14.2 Pressurised systems

New MTMVs must meet the requirements of this section to qualify as Tunnel Suitable.

The design, construction and maintenance of pressurised systems, both hydraulic and pneumatic, must:

1. incorporate a suitable and adequate relief system
2. provide adequate means for the control of generated heat
3. minimise the types of movement in hoses that can significantly reduce service life, such as bending, twisting, stretching and vibration beyond the hose's reasonable capability, for example, by incorporating elbows, rotating fittings and clamps

NOTE
Hydraulic hose life is often determined by the internal failure of the reinforcement, mainly from fatigue caused by pressure pulsations or hose flexing. Unlike external damage, internal hose fatigue failure cannot be inspected for or reliably predicted. The often used ratio of static burst pressure to operating pressure does not address fatigue degradation.

4. protect hoses from the risk of impact and crushing
5. incorporate control and operating functions that provide adequate protection from malfunction or uncontrolled action due to pressure hose, pipe or fitting failure.

   Note: It is recommended to follow an industry standard such as SAE J1273 – Recommended practices for hydraulic hose assemblies.
6. Specify, and include in the vehicle manual, the service life of hydraulic hoses in normal use.

14.3 Mechanical systems

All mechanical systems must be of adequate design to meet all foreseeable overload requirements throughout the design life of the equipment, including those of impact (both internal and external), shock, and vibration.

14.4 Machine controls

Electronic controls, software and electrical control systems present the difficulty of verifying and validating their safety integrity, particularly when using components or sub-systems of unknown individual safety integrity, and considering the number of components in an end-to-end system, ie, from crew control input to machine physical output.

The use of PLCs, customised software and associated system elements or components to control safety critical functions must be fully supported by best practice assessments and preferably independent verification and validation. Provision must be made for the restoration of software and control system(s) from back-up in the event of component replacement or system failure.

KiwiRail's preference and expectation is that such systems are fail-safe and have manual work-arounds to allow, for example, retrieval of extended equipment and recovery of a failed machine.

All controls must be of robust construction and, where required, waterproof.

All controls must be positioned and protected to prevent accidental operation.

Controls must be positioned in a logical sequence.

All controls must be clearly marked to show their function in permanent legible letters or symbols. Any words must be in NZ English.

Arrows on or beside the appropriate control should indicate movements of arms, beams, hoists, etc.

All controls must be of the "dead-man" type that automatically return to the neutral or off position when they are released or, alternatively, all controls may be over-ridden by an emergency stop.

An emergency stop control, which will stop motion and/or cut off power to all systems, must be provided at each operator position. The chosen effect of emergency stop actuation will be that which provides best safety and is to be reviewed and agreed. The stop control must be placed in a prominent position and be coloured red.

Where required, interlocks must be provided to ensure that contrary operations or movements do not occur.

14.5 Interlocks

Interlocks must be fail-safe. If a component fails (cable, micro-switch etc.) the system must fail to a safe condition, and allow the machine to return to a safer state.

Interlocked systems must be configured so that they do not prevent the machine (or the feature) being safely retrieved and stowed. Interlocks should not cause the machine to "freeze" and means shall be provided to enable safe retrieval.

The vehicle manual is to contain instructions on how to maintain sensors and test that all interlocks are operating correctly.

☼ **Information – Interlock failure examples**
Out of adjustment EWP interlocks have sensed an unsafe state and prevented any movement at all, freezing the vehicle in extended mode blocking the track.

14.6 Tunnel Suitability

MTMV's operating in tunnels longer than 200 m must be rated as "Tunnel Suitable". In general this requirement applies to all MTMV's. The only exceptions will be where a particular machine has either been allowed onto the network under a specific site safety plan that provides for fire safety and air quality, or a machine is granted a temporary exemption allowing it to continue to operate but not enter tunnels.

Unlike HRV's MTMV's are not issued with Tunnel Suitable/Tunnel Restricted stickers. Day to day MTMV condition and "housekeeping" is the responsibility of the machine crew.

All MTMV's must be Tunnel Suitable. During on-going use Tunnel Suitability is dependent on condition. If at any time an MTMV does not meet the requirements for Tunnel Suitability and does not have a specific exemption its 155 will be withdrawn.

To qualify as Tunnel Suitable MTMV's must meet the relevant requirements of sections:

- 14.2 Pressurised systems
- 14.7 Fire safety, and
- 12 Emissions clauses of Engines section
- Plus, for new machines, any tunnel-related vehicle-specific requirements identified by the Human Factors analysis and listed in the Manual for the vehicle.

Note that personnel training is also required before operating in tunnels.

MTMV's must also carry RPE for all on board.

14.7 Fire safety

☼ WARNING
Fires in tunnels or on bridges are particularly hazardous because of the limited ability to fight a fire and escape from it. Fires in tunnels can grow dangerously fast and rescue from outside is often not possible.

Fire safety covers:

- Hardening. Avoidance of ignition sources, resistance to burning, etc. Expected to be met from inbuilt product integrity.
- Containment. Avoiding or minimising energy-fed fires, including use of engine shut-downs, electrical circuit isolation systems, enclosures.
- Fire fighting. Manual and automatic extinguisher systems.
- Machine condition. Fire defences must be sustained by a high standard of vehicle maintenance, servicing and cleaning, and a high standard of "housekeeping" during normal operation.

For new machines a fire and tunnel safety report must be prepared as per section 4.2, Project governance and management. It is to include a fire risk assessment to assign suitable fire fighting mitigations.

Key machine fire causes include: engine, fluid and electrical issues.

Fire safety equipment will only ever be fully tested in a real emergency so it is important that vehicle systems are designed to be obvious and simple to access and operate in conditions that may be dark, shadowed, noisy, or disorienting. Operator's manuals and Training and Competency Syllabuses must clearly illustrate the systems and provide familiarity with them.

14.7.1 Fire fighting

All the following items are required;

1. Portable fire extinguishers must be provided as follows:
   a) In the cabs accessible to the driver or operator
   b) Accessible from track level located for easy stowage, rapid removal as necessary, and security from interference
   c) At least one extinguisher accessible to fight a fire in an engine bay or any other fire source. Extinguishers to be available for approach to fire from either direction.

   Extinguishers must be easily accessible in an emergency. Extinguishers may be stored away from their operating location but must be in place, unlocked and directly accessible when the MTMV is travelling or working.

☼ Design note
When choosing extinguisher size take into account: ease of retrieval, the ability to physically hold the extinguisher up to a fire fighting point (such as a porthole), and the ability to provide an obvious storage location.

2. Conduits or portholes must be provided to fire risk areas with difficult access (including where it would be dangerous to open access covers or doors). Conduit must:

a) be fire protected if in an area that may be exposed to flame, for example, a flame-proof sleeve

b) incorporate a nozzle to deliver the required spray pattern

c) be accompanied by signage for connecting and operating a fire extinguisher.

3. Portable fire extinguishers must:

a) all be dry powder type so that they can be discharged through access conduits

b) have discharge hoses to assist access to fires.

4. Automatic Fixed Fire Suppression Systems

AFFSS performance should be assured to protect the capital plant in addition to protecting the crew. Coverage must be extensive including engine bay and key electrical and hydraulic fire risks.

The driver must be able to override automatic shut-downs to allow the MTMV to be moved for safety. (For information, this is similar to the requirement for running capability on a train and the ability to move a vehicle to clear an egress route in a mine.)

AFFSS must be able to be reset after use to allow the machine to be restarted by the crew.

AFFSS systems must be robust and reliable and must not cause additional hazard when they discharge in the restricted space of a tunnel. Gas systems are not acceptable. Foam or water mist or dry powder systems are acceptable.

AFFSS systems must be supplied and installed by an accredited supplier. Selection criteria will consider: media type, capacity, coverage and reliability. An installation report must be provided that addresses the specific risks of that vehicle. The installation report must include a risk assessment to an internationally recognised fire safety standard, and will be a factor in acceptance of the Fire Report for vehicle design acceptance.

☼Caution – AFFSS
AFFSS systems are not a remedy for all fires. They have coverage limits, may not extinguish all fires, and fires may reflash. There may still be a need to deploy fire extinguishers. Hence the other provisions of this section must still be applied generally as if AFFSS was not fitted.

14.7.2 Thermal protection for fire safety

NOTE
Any surface at more than 150°C is considered a hot surface. The following are always assumed to be hot surfaces and potentially dangerous: • exhaust manifold • turbocharger • catalytic converter(s)

1. Cables, tubes and hoses must not be close to a hot surface.

2. Thermal protection should be provided by a shield, flame-proof or insulated sleeve or jacket over cabling, tubing or hoses.
3. Shielding in barrier or conduit form must allow adequate ventilation to avoid the prolonged heating of any fluid vapours, and must be shaped to avoid the accumulation of debris, oil or grease.

14.7.3 Electrical protection – fire and general

1. Electrical system isolation must be provided at least by isolation of the positive pole as close to the battery as possible.

   E-stops must be located in the cab, on the front and at the rear of the machine (for accessibility from either end in a tunnel), at control stations (e.g. platform and ground level controls on EWP's), and anywhere else that risk assessment designates.

   Where auxiliary engines or self-powered units are fitted operation of any e-stop must shut down both the parent vehicle and the auxiliary unit.
2. Battery, generator and power outlet terminals must be covered.
3. The positive cable from the battery must be protected by tube or additional sheathing along its entire circuit length.
4. Every circuit must be adequately protected from over-current and fault currents.
5. Cabling must be adequately rated for its duty, with multi-stranded cable for flexibility and fatigue resistance.
6. Cabling must be protected from mechanical damage including abrasion, cutting, impacting, crushing, and stressing, and it must be clamped and supported against vibration.
7. Cabling is not to be attached to fuel lines. If attached to hydraulic lines, cabling must be low voltage and fused below 10 amp. Above 10 amp fusing, cables must be inside protective tubes.
8. Safety critical functions such as back-up lighting and radio must remain connected after e-stop activation long enough for immediate incident response. Protection circuits to avoid flattening the battery due to incorrect e-stop use e.g. after hours vandalism, are acceptable.
9. Control, warning or emergency equipment that is connected to the battery before the isolator must be separately fused with the minimum amperage and enclosed in protective tubes.

14.7.4 Fluid containment

Most of the pressurised fluids in engine bays will burn or "flare off" if sprayed onto hot surfaces (>150°C). This includes glycol coolant mixes as well as brake fluids, lubricating fluids and fuel.

1. Fluid system shut-down must be achieved by e-stops.
2. Fluid lines near to a hot surface must be 360° enclosed to contain spray from any burst fault with a product rated as fireproof and, for containment of burst hydraulic hose, possibly of 'woven sleeve' type.
3. Leaking fluid from enclosed fluid lines must drain safely away.
4. Where a large number of hoses are in close proximity to a hot surface, an alternative is to separate such hose groups by an extensive barrier or enclose them within

compartment(s) to contain and safely drain spray type leakage in order to achieve an equivalent 360° enclosure.

14.8 Painting and lettering

Paint Specification

1. The paint system shall suit the intended use and shall meet AS2312 or another Purchaser approved standard.
2. Selected livery colour - Daffodil Yellow RAL 1007 shade 43622 line # PSX1025A
3. An anti-graffiti coating shall be applied.
4. See also Hand-grabs and footsteps in section 13.

The following information must be clearly displayed in NZ English or approved symbol on the vehicle:

5. On any vehicles with ladders, handgrabs or any other facility allowing access to a standing position higher than 1.8 metres above rail level, clearly legible labels or lettering with the wording "Danger Live Wires Above" with the electricity hazard symbol. Suitable labels are available from Admark Visual Imaging Ltd.
6. Any warnings, cautions or restrictions for safe operation.
7. Loading instructions, where applicable.
8. Operating instructions, where applicable e.g. correct stowage of equipment.
9. Safe working loads or capacities where applicable in a prominent position in lettering 150 mm high (or, if this is not possible, as high as available space permits).
10. Individual axle loads.
11. Ferry tie down points, lifting points, jacking points.
12. Vehicle fleet number and owner identify.
13. Display owner brand
14. KiwiRail machines will be given the national rail classification EMT Numbers measuring ~700mm x 200mm. The Supplier shall take delivery of decals provided by the Purchaser and adhere them to each side of each machine prior to shipping.
15. KiwiRail machines will display the “Kiwi Rail” logo measuring ~ 1500mm x 300mm. The Supplier shall take delivery of decals provided by the Purchaser and adhere them to each side of each machine prior to shipping.

15. Specific design requirements

15.1 Tampers

a) Tampers shall be designed such that the reaction forces from the lifting and slewing of the track shall be transferred to the rail.

b) Tampers shall have four axles in a bogie/bogie configuration.

c) Tampers shall be of the continuous action type unless agreed otherwise by KiwiRail. Alternative actions will only be considered by KiwiRail if it can be convinced that any adverse effects of stop-start or other actions on personnel and

systems can be mitigated. Any application for acceptance of alternatives must include a risk assessment.

d) Capability to tamp turnouts will be specified on a case by case basis.

e) Noise mitigation levels to be agreed for any new machines. Proposals for noise mitigation options are to be offered.

15.2 Regulators

a) Rail head sweeps are to be fitted.

b) Dust suppression options shall be offered.

15.3 Ballast cleaners

a) Rail head sweeps are to be fitted.

16. Appendix A Type approval certification

16.1 General

The general requirement for vehicles to be certified before network access will be granted is covered in NRSS/6. This section lists specific requirement for MTMV's.

Certification shall specifically include compliance to this Code, taking into account differences in scope and risk across the project stages illustrated by Table 1. See Appendix D for guidance on the evidence required. Note that certification is to include all documentation for the acceptance and ongoing operation of the MTMV.

16.2 Change of ownership

KiwiRail MTMV change of ownership requirements have not been tested at the time of issue of this Code. Registration of the MTMV to operate on the network will be revoked and the new owner/operator must be able to demonstrate that it has systems & processes in place that enable the vehicle to be maintained and operated safely on the network. The requirements for MTMV re-registration by a new owner will be determined by its particular circumstances taking into account at least:

- Risk assessment and provision of a risk management plan by the new owner with evidence that it is in place and sustainable.
- Capability of the new owner for maintenance, operating and training responsibilities.
- Proposed Safety Case cover.

The change of ownership processes set out in the hi-rail code may also provide useful reference.

Appendix B Training and competency syllabus

16.3 Overview

The fundamental objective is to ensure operating crew understand the equipment and are adequately competent and experienced.

16.4 Content

Training requirements are to include how to operate safely, including tunnel fire safety, operating restrictions, key maintenance tasks, control layout, recovery in the event of breakdown, and best-practice operation of the machine. The check-list must include the following:

1. Evidence that the operator meets the requirements to operate on the network.
2. Personal protective equipment requirements specific to the machine.
3. Key outputs from the Operational risk review (see section 5).
4. Familiarity with the content and layout of the operator's manual. Know where to find the key information below.
    a) All safety and quick reference information.
    b) Identification of major hazards of this equipment. Include generic requirements, such as fire safety in tunnels, runaways, derailments, overturning, loading gauge, electrocution etc., and machine-specific hazards.
    c) Inspection sheets.
    d) Fault and repair booking process to be covered.
    e) Location and contents of safety equipment- detonators, flags, first aid, MSD folder.
    f) Maximum speed on track and any specific speed restrictions.
5. Operator responsibilities including operating restrictions such as in electrified areas and tunnels.
6. Determining that servicing and maintenance is current for operation.
7. Daily operator inspection and pre-start procedures.
8. Operator inspection and maintenance tasks (where required).
9. Procedures to be followed when leaving the cab.
10. Procedures to be followed when leaving the vehicle unattended at a worksite.
11. Stabling procedures including shutdown and security.
12. Procedures to be followed to ensure staff safety before undertaking inspection, servicing, maintenance or repair tasks; including dealing with operational problems such as blockages and equipment malfunctions.
13. Familiarity with lockouts and interlocks.
14. Operation on rail including park and service brake configuration and operation.
15. Maximum permitted height of vehicle and any load, including any features that change vehicle shape.

16. Where a crane or EWP or other shape changing features are fitted - rules for safe operation and any certification required before a person can operate it. Emergency lowering procedures.
17. Retrieval and safe stowage of extended equipment in the event of malfunction or emergency.
18. Driving technique in all conditions eg, wet rail, ice, slippery rail.
19. Setting up vehicle for movement or operation, alone or in a consist.
20. Preparing a vehicle for routine towing or recovery after breakdown or damage.
21. Safe ride positions e.g. the vehicle cab and any other designated position.
22. Tunnel Suitable requirements for the vehicle, including fire safety and tunnel operation.
23. Position, operation and reset of e-stops and movement stops, if fitted.
24. Familiarity with AFFSS system and status monitoring.
25. Fire extinguisher (type, location, status). Use with fire ports and ducts.
26. Any other operating or safety requirements unique to the vehicle.
27. Assessor's judgement of whether or not the candidate demonstrates the appropriate maturity and attitude for the task.

To be deemed competent to operate the machine alone the candidate must successfully demonstrate competence in each of the theoretical and practical tasks above.

As well as listing the points of training and assessment, the training form must include:

28. The printed name of the person giving training.
29. Sign-off by the person giving training certifying that the recipient has demonstrated competence in each of the theoretical and practical tasks listed and that a copy of the form has been retained for the trainer's records.
30. The printed name of the person receiving training and being assessed.
31. Sign-off by the person receiving training certifying that they have received the instruction set out before taking charge of the vehicle and that a copy of the form has been provided for his/her records.
32. Location and date of training.
33. Trainer and trainee to retain copies of the training material and form.

17. Appendix C Quick check for an existing MTMV

17.1 Overview

This section provides a quick check that can be used when first assessing existing (second hand) MTMV's for potential lease, hire or purchase.

This assessment will help identify compliance issues and likely costs for acceptance on the network before embarking on the Procurement (purchase or lease) stage of this code.

This appendix provides guidance for the cell in Table 1 covered by Lane 1 and Row B, and, section 18.1.1 following.

17.2 Content

- Provision of good quality clearance diagram(s), preferably in a CAD format such as dxf, so that clearances can be properly assessed. Drawing should include travelling and working configurations.
- Height / clearance checks.
- Axle loads - details of individual axle loads, tare & loaded, spacing
- Gradient and curvature restrictions on travel and work.
- Restrictions on use of any shape changing components e.g. cranes, conveyors: information about maximum crane height and any height limiters in use.
- Cranes and EWP's will require NZ certification.
- Performance against NRSS/6 e.g. braking, lights.
- Information on cab strength and crash worthiness particularly compliance to GM/RT standards. Crashworthiness of the cab interior etc. should also be reviewed e.g. driver's desk, protrusion and security of cab fittings etc.
- Fire safety needs to be assessed:
    - Tunnel suitability (fire hardening, fire containment and firefighting).
    - What is the arrangement of extinguishers and shut downs? AFFSS fitted and what fire safety plans are available?
    - Clearance diagrams and the ability to evacuate the machine in all tunnels (leading to development of work plans for all tunnels).
- Operational e-stops (ability to stop movement or shut down in the event of a safety risk)
- Engine type and emissions standard.
- Operating noise levels – in cab and external.
- Air conditioning – system capability and condition. Noise levels in cab.
- Operational safety inspection for tight spots, pinch points, protection from hot surfaces etc.
- Glazing – front for signal sighting and front and side windows for strength (penetration resistance).

- Ease of towing (repositioning by freight service and breakdown recovery). Check brake system compatibility if required e.g. are brake pipe pressures the same?
- Rerailing & recovery arrangements.
- Operational suitability for NZ conditions and track components e.g. ballast grade (size/shape) requirements
- Suitability of machine productivity rates, maintenance and crewing requirements. Routine maintenance requirements, pre-start checks, planned maintenance requirements (including wearing parts)? Interval between replenishments if appropriate e.g. water tanks for dust control, hopper refills.
- Operational constraints such as sleeper spacing (and variation thereof), sleeper detection systems etc.
- Communication between crew members.
- Time to re-commission machine in NZ, training requirements and duration etc.
- Maintenance history, operational reports e.g. productivity, disruptions due mechanical intervention or blockages/jams.
- Identify the next scheduled maintenance and pending overhaul activities.
- Why is the machine being released? Are there any operational or maintenance performance issues?
- Consider any environmental factors. Are there systems for dust management etc.
- Availability of maintenance, operations and training manuals.
- Copy of risk assessments, H&S assessments etc.
- Details of current/previous certifications/accreditations held. Have these been withdrawn for any reason?

18. Appendix D Checklist for stages, scope and risk of project

The following sections outline the evidence that should be provided for Table 1 (section 5) to allow adequate review within KiwiRail.

18.1 Lane 1: Purchasing an existing MTMV

18.1.1 Project governance (Row B), see also section 22

	Yes	No
1. Are similar MTMVs are currently operating? a) Do you know these MTMVs are operating satisfactorily? b) Give relevant details of their ownership and use. c) Are you aware of any deficiencies, differences or limitations in their use, such as tunnels, gradients, clearances and so on? d) Give relevant details.		
2. Supplier manuals, specifications and drawings: a) have been obtained and reviewed, and b) meet the requirements of OM94003 and NRSS/6 for operation, maintenance and training. c) Identify and document any deficiencies that exist and any plans to address them, including quality assurance and risk management.		

18.1.2 Procurement (Row C)

	Yes	No
1. Does a KiwiRail procurement plan exist, of sufficient scope, covering spare parts, training, handbooks and conditions?		
2. Is the MTMV being procured directly from the existing owner? If not, how is the MTMV being procured?		
3. What contractual arrangements will be entered into?		

18.1.3 Technical review (Row D)

	Yes	No
1. The MTMV design complies with the requirements of: a) NRSS/6? Supply the evidence. b) OM94003? supply the evidence Evidence should include mitigations for any non-compliance.		
2. Has the MTMV been, or will it be, modified from the original design? Give details.		
3. Do any modifications affect the MTMV's compliance with NRSS/6 or OM94003? If so, have the necessary exemptions been applied for and granted?		
4. Safety Case communication with NZTA as relevant		
5. Is all the necessary documentation in place for operating, maintaining and training, and is it suitable for operational handover of the MTMV? a) Operating instructions? b) Maintenance plan? c) Training plan? d) Deficiencies identified earlier have been addressed? e) Operational risk review?		
6. Has a commissioning plan been prepared, detailing how the MTMV will be field tested for full functionality, including handover to operators? Supply the commissioning plan, identifying any functions that will not be used.		
7. Safety Case communication with NZTA as relevant		
8. Has the commissioning plan been successfully completed? If not, give details of how deficiencies will be addressed.		
9. Safety Case communication with NZTA as relevant		
10. Are final support arrangements in place, including warranty, introductory and on-going support, such as contact phone numbers? Give details.		
11. MTMV complies with requirements (including the granting of network access and running rights, and any necessary exemptions), has been successfully commissioned, and is fit to enter service.		

18.2 Lane 2: Purchasing a new MTMV to an existing design

18.2.1 Project governance (Row B)

	Yes	No
Project governance		
1. Are similar MTMVs are currently operating? a) Do you know these MTMVs are operating satisfactorily? Give relevant details of their ownership and use. b) Are you aware of any deficiencies, differences or limitations in their use, such as tunnels, gradients, clearances and so on? Give relevant details.		
2. Supplier manuals, specifications and drawings: a) have been obtained and reviewed, and b) meet the requirements of OM94003 and NRSS/6 for operation, maintenance and training. c) Identify and document any deficiencies that exist and any plans to address them, including quality assurance and risk management.		

18.2.2 Procurement (Row C)

	Yes	No
1. Does a KiwiRail procurement plan exist, of sufficient scope, covering spare parts, training, handbooks and conditions?		
2. Is the MTMV available from more than one supplier? If the MTMV is available from more than one supplier, what approach will be made to the market?		

18.2.3 Technical review (Row D)

	Yes	No
1. The MTMV design complies with the requirements of: d) NRSS/6? Supply the evidence. e) OM94003? supply the evidence		
2. Is there any modification from the original design? Give details		
3. Do any modifications affect the MTMV's compliance with NRSS/6 or OM94003? If so, have the necessary exemptions been applied for and granted?		
4. Safety Case communication with NZTA as relevant		
5. Has Factory Acceptance Testing (FAT) been completed and approved by the Project Manager?		

Supply the FAT Plan and records.		
6. Safety Case communication with NZTA as relevant		
7. Is all the necessary documentation in place for operating, maintaining and training, and is it suitable for operational handover of the MTMV? f) Operating instructions an? g) Maintenance plan? h) Training plan? i) Deficiencies identified earlier have been addressed? j) Operational risk review?		
8. Has a commissioning plan been prepared, detailing how the MTMV will be field tested for full functionality, including handover to operators? Supply the commissioning plan, identifying any functions that will not be used.		
9. The commissioning plan has been successfully completed? If not, give details of how deficiencies will be addressed.		
10. Safety Case communication with NZTA as relevant		
11. FRACAS plan compliance is being achieved?		
12. Are final support arrangements in place, including warranty, introductory and on-going support, such as contact phone numbers? Give details.		
13. MTMV complies with requirements (including the granting of network access and running rights, and any necessary exemptions), has been successfully commissioned, and is fit to enter service.		

18.3 Lane 3: Purchasing a new MTMV: existing modules in a new configuration

18.3.1 Project governance (Row B)

	Yes	No
Project governance		
1. To establish existing benchmarks, what similar MTMVs, with the same modules, are currently operating? a) Identify owners and operators known to you: b) Do you know these MTMVs are operating satisfactorily? Give relevant details of their use. c) Are you aware of any deficiencies or limitations in their use? Give relevant details. d) Has a risk assessment been carried out that addresses inherent machine and vehicle risks as well as those that are particular to the operating environment? Supply the risk assessment.		
2. Documentation reviews should cover supplier manuals, specifications and drawings: a) have been obtained and reviewed for all the modules, and b) meet the requirements of OM94003 and NRSS/6 for operation, maintenance and training. Identify any deficiencies in the documentation and any plans to address them.		

18.3.2 Procurement (Row C)

	Yes	No
1. Has a procurement plan been agreed? Supply the procurement plan.		
2. Has a market options assessment been carried out that discovers the range of suppliers in the market, and have potential pre-qualified suppliers been identified? Supply a list of possible suppliers, with evidence of their reputation and their solution types. Supply justification for pre-qualification of some suppliers.		
3. Have all the requirements for going to market been finalised, including legal, financial, procurement, and a system for assessing the evidence of supplier capability? Supply the requirements.		
4. Have tenders been invited from pre-qualified parties?		
5. Has a preferred supplier been chosen according to the procurement plan?		

Supply the evidence.		

18.3.3 Technical review (Row D)

	Yes	No
1. The MTMV concept design documentation complies with the requirements of: a) NRSS/6? Supply the evidence. b) OM94003? supply the evidence		
2. The MTMV final design documentation complies with the requirements Give details		
3. Safety Case communication with NZTA as relevant		
4. Has Factory Acceptance Testing (FAT) been completed and approved by the Project Manager? Supply the FAT Plan and records.		
5. Safety Case communication with NZTA as relevant		
6. Is all the necessary documentation in place for operating, maintaining and training, and is it suitable for operational handover of the MTMV? a) Training plan? b) Maintenance plan? c) Operating instructions? d) Deficiencies identified earlier have been addressed? e) Operational risk review?		
7. Has a commissioning plan been prepared, detailing how the MTMV will be field tested for full functionality, including handover to operators.? Supply the commissioning plan, identifying any functions that will not be used.		
8. The commissioning plan has been successfully completed? If not, give details of how deficiencies will be addressed.		
9. Safety Case communication with NZTA as relevant		
10. FRACAS plan compliance is being achieved?		
11. Are warranty and introductory support arrangements in place, such as contact phone numbers, repair and adjustment arrangements? Give details.		
12. MTMV complies with requirements (including the granting of network access and running rights, and any necessary exemptions), has been		

successfully commissioned, and is fit to enter service.		

18.4 Lane 4: Purchasing a new MTMV: unique modules in a unique configuration

18.4.1 Project governance (Row B)

	Yes	No
1. Prepare requirements for the supplier to provide manuals, specifications and drawings: a) For all the modules, and the whole vehicle configuration b) will meet the requirements of OM94003 and NRSS/6 for operation, maintenance and training. Supply evidence.		
2. Prepare requirements for the supplier to provide documentation for novel items in relation to the requirements of OM94003 and NRSS/6? Provide the plan.		
3. Has a risk assessment been carried out that addresses inherent machine and vehicle risks as well as those that are particular to the operating environment? Prepare requirements for the supplier to provide a risk management plan for the MTMV that addresses those risks.		
4. Has a governance review been carried out and agreed by all relevant authorities in relation to the project team, human resources, funding, and facilities? Supply the governance review.		

18.4.2 Procurement (Row C)

	Yes	No
1. Has a procurement plan been agreed? Supply the procurement plan.		
2. Has a market options assessment been carried out that discovers the range of suppliers in the market, and have potential pre-qualified suppliers been identified? Supply a list of possible suppliers, with evidence of their reputation and their solution types. Supply justification for pre-qualification of some suppliers.		
3. Have all the requirements for going to market been finalised, including legal, financial, procurement, and a system for assessing the evidence of supplier capability? Supply the requirements.		
4. Have tenders been invited from pre-qualified parties?		

5. Has a preferred supplier been chosen according to the procurement plan? Supply the evidence.		

18.4.3 Technical review (Row D)

	Yes	No
1. The MTMV concept design documentation complies with the requirements of: a) NRSS/6? Supply the evidence. b) OM94003? supply the evidence		
2. The MTMV preliminary design documentation complies with the requirements Give details		
3. The MTMV final design documentation complies with the requirements Give details		
4. Safety Case communication with NZTA as relevant		
5. Has Factory Acceptance Testing (FAT) been completed and approved by the Project Manager? Supply the FAT Plan and records.		
6. Safety Case communication with NZTA as relevant		
7. Is all the necessary documentation in place for operating, maintaining and training, and is it suitable for operational handover of the MTMV? a) Training plan? b) Maintenance plan? c) Operating instructions? d) Deficiencies identified earlier have been addressed? e) Operational risk review?		
8. Has a commissioning plan been prepared, detailing how the MTMV will be field tested for full functionality, including handover to operators? Supply the commissioning plan, identifying any functions that will not be used.		
9. The commissioning plan has been successfully completed? If not, give details of how deficiencies will be addressed.		
10. Safety Case communication with NZTA as relevant		
11. FRACAS plan compliance is being achieved?		

12. Are warranty and introductory support arrangements in place, such as contact phone numbers? Give details.		
13. MTMV complies with requirements (including the granting of network access and running rights, and any necessary exemptions), has been successfully commissioned, and is fit to enter service.		

19. Appendix E Example matrix of scheduled deliverables

Delivery of supplier documentation will need to be aligned to the number of review stages incorporated in the supply agreement.

This table provides an example of the project stages likely for a Lane 4 project (in terms of Table 1) at which submissions from the documentation suite described in section 4.2 are submitted for review and accepted. Because systems are interrelated a stage can only be completed once all submissions for that stage have been accepted.

Lane 2-3 projects are likely to have fewer review stages but the full documentation suite still needs to be covered.

By agreement systems may proceed independently through each design stage.

The primary point of agreement is marked “X” but the subject matter may be continuous throughout the project.

Documentation Suite (section 4.2)	**Procurement**	**Design - concept**	**Design – preliminary**	**Design - detailed**	**Build - Manufacture**	**Build - FAT**	**Build - Documentation**	**Commission – field test**	**Commission – final support**
1. Delivery									
a. Schedule	X								
b. Risks (contractual)	X								
c. Reporting	X								
2. Assurance									
a. Compliance		X							
b. RAMS		X	X	X					
3. Design									
a. Overall design report*		**X**	**X**	**X**					
b. Tunnel & fire safety		X	X						
c. Mass		X	X						
d. Crashworthiness		X	X	X					
e. Clearances		X	X						
f. Vandalism		X	X	X					
g. Human factors		X	X	X		X			

Documentation Suite (section 4.2)	Procurement	Design - concept	Design – preliminary	Design - detailed	Build - Manufacture	Build - FAT	Build - Documentation	Commission – field test	Commission – final support
4. Accreditation				X			X		X
5. Test & acceptance									
a. Reports			X	X					
b. Development tests						X			
c. Type tests						X			
d. FAI						X			
e. Integration tests						X			
f. Commissioning tests								X	
g. Operational tests								X	
h. FRACAS						X	X	X	X
6. Operational acceptance									
a. Training & competency				X				X	X
b. Certification (operators)									X
c. Risk (operational)				X		X	X	X	X
d. Manuals				X				X	X

* Each design stage is complete only when all the documentation is complete and accepted. The Overall design report cannot be accepted until all other documentation has been accepted.