

**Specification (Measurement)**

**Transport and Main Roads Specifications  
MRS334 Rolling Stock**

**May 2026**

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## 1 Introduction

This Specification applies to rolling stock.

This Specification shall be read in conjunction with MRS01 *Introduction to Specifications* and other Specifications as appropriate.

This Specification forms part of the Transport and Main Roads Specification Manual.

## 2 Measurement of work

### 2.1 Standard Work Items

In accordance with the provisions of Clause 2.1.3 of MRS01 *Introduction to Specifications*, the Standard Work Items incorporated in this Specification are listed in Table 2.1.

**Table 2.1 – Standard Work Items**

Standard Item No.	Description	Unit of Measurement
<b>Multiple Unit Trainsets – by Trainset</b>		
81251	Multiple Unit Trainsets, [EMU   DMU], [description]	each
<b>Multiple Unit Trainsets – by Subsystem</b>		
81256	Structure and Body, [description]	each
81257	Doors, [description]	each
81258	Bogies, [description]	each
81259	Interior, [description]	each
81260	Lighting, [description]	each
81261	Heating, Ventilation and Air Conditioning, [description]	each
81262	Energy Supply, [description]	each
81263	Traction, [description]	each
81264	Braking, [description]	each
81265	Passenger Information and Communication, [description]	each
81266	Train Control, Information and Communication Technology, [description]	each
81267	Coupling and Interconnection, [description]	each
<b>Other Rolling Stock</b>		
81281	Light Rail Vehicles, [description]	each
81282	Locomotives, [description]	each

<b>Standard Item No.</b>	<b>Description</b>	<b>Unit of Measurement</b>
81283	Passenger Carriages, [ <i>description</i> ]	each
81284	Wagons, [ <i>description</i> ]	each
81285	Track Vehicles, [ <i>description</i> ]	each
<b>Miscellaneous</b>		
81296	Rail Freight Containers, [ <i>description</i> ]	each
81297	Simulators, [ <i>description</i> ]	each
81298	Mock-ups, [ <i>description</i> ]	each

## 2.2 Work Operations

Work Operations included in the Standard Work Items are specified in the relevant clause adjacent to each Standard Work Item listed in Table 2.1.

### 2.2.1 Multiple Unit Trainsets – by Trainset

#### **Item 81251 Multiple Unit Trainsets, [EMU | DMU], [*description*]**

Work Operations incorporated in the above include the following as appropriate:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supply of multiple unit trainsets, including but not limited to the following subsystems:
  - i. structure and body, as described in Item 81256
  - ii. doors, as described in Item 81257
  - iii. bogies, as described in Item 81258
  - iv. interior, as described in Item 81259
  - v. lighting, as described in Item 81260
  - vi. heating ventilation and air conditioning, as described in Item 81261
  - vii. energy supply, as described in Item 81262
  - viii. traction, as described in Item 81263
  - ix. braking, as described in Item 81264
  - x. passenger information and communication, as described in Item 81265

- xi. train control, information and communication technology, as described in Item 81266, and
  - xii. coupling and interconnection, as described in Item 81267.
- c) design and development:
- i. preparation of detailed design documentation
  - ii. engineering analysis including structural, dynamic, thermal, electrical, human factors, electromagnetic compatibility, cyber security, reliability, availability and maintainability analysis, as required
  - iii. interface design and management between all rolling stock subsystems
  - iv. interdisciplinary design coordination and design reviews
  - v. design against all applicable specifications, standards and regulations, and
  - vi. risk assessments and safety case development.
- d) fabrication, integration and assembly:
- i. factory assembly of complete vehicle from individual subsystems
  - ii. installation and integration of all mechanical, electrical, and electronic systems
  - iii. wiring, cabling, and connection of all systems
  - iv. quality control and inspection during assembly process, and
  - v. resolution of interface issues and design modifications, as required.
- e) verification, validation, testing and commissioning:
- i. factory acceptance testing, including component level, sub-system level and complete vehicle level as appropriate
  - ii. site integration testing, including static testing and dynamic testing
  - iii. design / site / user acceptance testing, including static testing and dynamic testing
  - iv. verification and validation against all applicable specifications, standards and regulations
  - v. documentation of all test results, certification and safety case development, and
  - vi. interim certification and compliance documentation as safe to operate in limited test service.

f) delivery:

- i. preparation for transport including securing and protection
- ii. loading onto transport mode (rail, road, or sea as appropriate)
- iii. transport to project site or designated delivery location
- iv. unloading and positioning at site
- v. initial inspection following delivery, and
- vi. storage and protection prior to commissioning, as required.

g) handover:

- i. provision of operations and maintenance manuals, as required
- ii. provision of technical documentation including as-built drawings and specifications, as required
- iii. provision of spare parts, as required, including consumables, rotatable spares, and high value or long lead-time spares
- iv. training of operations personnel including rail traffic crew, station staff, rail control centre staff, as required
- v. training of maintenance personnel, as required
- vi. warranty documentation and defects liability arrangements, and
- vii. final acceptance, certification and compliance documentation as safe to operate in revenue service.

## 2.2.2 Multiple Unit Trainsets – by Subsystem

### Item 81256 Structure and Body, [*description*]

Work Operations incorporated in the above include the following as appropriate:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supply of structure and body subsystem of a complete multiple unit trainset, including but not limited to:
  - i. structural members including chassis, longitudinal beams and cross-members
  - ii. car body shell including floors, side walls, roof, and end modules
  - iii. crash energy management systems and collision protection devices
  - iv. windows, windscreens, and glazing
  - v. external body panels, aerodynamic fairings, and access covers

- vi. anti-corrosion treatments, protective coatings, weatherproofing systems, paint and livery, and
  - vii. all associated fixings, fasteners, and sealing systems.
- c) design and development, fabrication, integration, assembly, verification, validation, testing, commissioning, delivery and handover as described in Item 81251 (Multiple Unit Trainsets) as applicable to the structure and body subsystem.

**Item 81257 Doors, [description]**

Work Operations incorporated in the above include the following as appropriate:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supply of doors subsystem of a complete multiple unit trainset, including but not limited to:
  - i. door assemblies including passenger bodyside doors, intercar doors, and rail traffic crew cab doors, complete with door leaves, frames, seals, gaskets, weatherproofing and threshold plates
  - ii. door operating mechanisms including actuators, motors, and drive systems
  - iii. door control systems including control units, audible and visual indication systems, obstacle detection systems, status monitoring and safety interlocks
  - iv. manual open, closing and locking mechanisms
  - v. emergency door release systems and emergency egress provisions, and
  - vi. all associated cabling, fixings, and mounting hardware.
- c) design and development, fabrication, integration, assembly, verification, validation, testing, commissioning, delivery and handover as described in Item 81251 (Multiple Unit Trainsets) as applicable to the doors subsystem.

**Item 81258 Bogies, [description]**

Work Operations incorporated in the above include the following as appropriate:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supply of bogies subsystem of a complete multiple unit trainset, including but not limited to:
  - i. bogie structure including bogie frames, side frames, transom beams, and structural members

- ii. running gear including wheelsets, wheels, axles, axle bearings, axle boxes, and wheel flange lubrication systems
  - iii. primary suspension including springs, dampers, bushings, and mounting components
  - iv. secondary suspension including air springs, dampers, levelling valves, height control systems, and anti-roll bars
  - v. bogie-to-carbody interfaces including centre pivot, traction rods, lateral stops, and mounting connections
  - vi. equipment mounting provisions for traction and brake systems
  - vii. bogie earthing and bonding systems
  - viii. sand boxes and sanding equipment, where applicable, and
  - ix. all associated cabling, piping, fixings, and mounting hardware.
- c) design and development, fabrication, integration, assembly, verification, validation, testing, commissioning, delivery and handover as described in Item 81251 (Multiple Unit Trainsets) as applicable to the bogies subsystem.

**Item 81259 Interior, [*description*]**

Work Operations incorporated in the above include the following as appropriate:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supply of interior subsystem of a complete multiple unit trainset, including but not limited to:
  - i. passenger seating including seats, frames, upholstery, and mounting systems
  - ii. rail traffic crew seating and associated equipment
  - iii. accessibility spaces and equipment
  - iv. interior wall panels, partitions, bulkheads, ceiling panels, and floor coverings
  - v. handrails, handholds, and poles
  - vi. interior signage, route maps, decals, trim, finishes, and decorative elements
  - vii. luggage racks and storage areas
  - viii. emergency equipment including emergency hammers, fire extinguishers, and first aid equipment
  - ix. toilet facilities and sanitary systems, where applicable
  - x. galley and catering facilities, where applicable

- xi. interior fixtures, fittings, covers, grills and diffusers for lighting and HVAC, and
  - xii. all associated fixings, brackets, and mounting hardware.
- c) design and development, fabrication, integration, assembly, verification, validation, testing, commissioning, delivery and handover as described in Item 81251 (Multiple Unit Trainset) as applicable to the interior subsystem.

**Item 81260 Lighting, [description]**

Work Operations incorporated in the above include the following as appropriate:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supply of lighting subsystem of a complete multiple unit trainset, including but not limited to:
  - i. interior lighting including passenger saloon lighting, vestibule lighting, toilet lighting, galley lighting, rail traffic crew cab lighting and control panel illumination
  - ii. exterior lighting including headlights, taillights, marker lights, position lights, warning / signalling lights and ditch lights
  - iii. emergency lighting including battery-backed emergency luminaires and emergency exit lighting
  - iv. lighting control systems including dimmers, sensors, switches, and control units
  - v. lighting power supplies and distribution systems, and
  - vi. all associated cabling and mounting hardware.
- c) design and development, fabrication, integration, assembly, verification, validation, testing, commissioning, delivery and handover as described in Item 81251 (Multiple Unit Trainsets) as applicable to the lighting subsystem.

**Item 81261 Heating, Ventilation and Air Conditioning, [description]**

Work Operations incorporated in the above include the following as appropriate:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supply of heating, ventilation and air conditioning (HVAC) subsystem of a complete multiple unit trainset, including but not limited to:
  - i. air conditioning systems including air conditioning units, compressors, condensers, and evaporators

- ii. heating systems including heating elements, heat pumps, and heating control systems
  - iii. ventilation systems including ventilation fans, air handling units, and fresh air intake systems
  - iv. air distribution systems including ductwork, grilles, diffusers, and dampers
  - v. air filtration systems including filters, air quality sensors, and filtration control systems
  - vi. refrigerant systems including refrigerant pipework, valves, drains, and associated equipment
  - vii. HVAC control and monitoring systems including thermostats, temperature sensors, and zone control systems
  - viii. HVAC equipment mounting frames, brackets, and vibration isolation systems, and
  - ix. all associated cabling, piping, connectors, and mounting hardware.
- c) design and development, fabrication, integration, assembly, verification, validation, testing, commissioning, delivery and handover as described in Item 81251 (Multiple Unit Trainsets) as applicable to the heating, ventilation and air conditioning (HVAC) subsystem.

**Item 81262 Energy Supply [*description*]**

Work Operations incorporated in the above include the following as appropriate:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supply of energy supply subsystem of a complete multiple unit trainset, including but not limited to:
  - i. electric energy supply systems including pantographs, main transformers, rectifiers, and high voltage switchgear, where applicable
  - ii. diesel-electric energy supply systems including diesel engines, generators, alternators, fuel systems, fuel tanks, exhaust systems, and emissions control equipment, where applicable
  - iii. battery energy supply systems including battery packs, battery management systems, battery cooling systems, and charging systems, where applicable
  - iv. auxiliary power supply systems including auxiliary converters, inverters, and auxiliary power units

- v. power distribution systems including busbars, contactors, isolators, and power distribution units
  - vi. energy storage systems including onboard batteries and charging equipment
  - vii. voltage and current monitoring and protection systems
  - viii. earthing and bonding systems for energy supply equipment
  - ix. cooling systems for energy supply equipment including fans, radiators, heat exchangers, and cooling circuits
  - x. energy management and control systems, and
  - xi. all associated cabling, piping, connectors, and mounting hardware.
- c) design and development, fabrication, integration, assembly, verification, validation, testing, commissioning, delivery and handover as described in Item 81251 (Multiple Unit Trainsets) as applicable to the energy supply subsystem.

**Item 81263 Traction, [*description*]**

Work Operations incorporated in the above include the following as appropriate:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supply of traction subsystem of a complete multiple unit trainset, including but not limited to:
  - i. traction motors including motor housings, motor cooling systems, and motor mounting systems
  - ii. traction power and control systems, including traction inverters, traction converters, motor control units, regenerative braking systems, wheel slip/slide protection and adhesion control systems
  - iii. gearboxes and transmission systems including gear units, couplings, drive shafts, final drives and axle gear units
  - iv. traction equipment cooling systems including cooling fans, heat exchangers, and coolant circuits
  - v. traction equipment mounting frames, brackets, and vibration isolation systems
  - vi. earthing and bonding systems for traction equipment, and
  - vii. all associated cabling, connectors, and mounting hardware.
- c) design and development, fabrication, integration, assembly, verification, validation, testing, commissioning, delivery and handover as described in Item 81251 (Multiple Unit Trainsets) as applicable to the traction subsystem.

**Item 81264 Braking, [description]**

Work Operations incorporated in the above include the following as appropriate:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supply of braking subsystem of a complete multiple unit trainset, including but not limited to:
  - i. friction braking systems including brake discs, brake pads, brake callipers, and brake actuators
  - ii. dynamic and regenerative braking systems including dynamic braking resistors and regenerative braking control equipment
  - iii. parking brake systems including parking brake actuators and locking mechanisms
  - iv. emergency braking systems including emergency brake valves and emergency brake activation equipment
  - v. brake pneumatic systems including cylinders, pipes, valves, compressors, reservoirs, and dryers
  - vi. brake control systems including brake controllers, anti-skid systems, wheel slide protection, and brake force management systems
  - vii. brake cooling systems and heat dissipation equipment
  - viii. brake equipment mounting frames, brackets, and supports
  - ix. earthing and bonding systems for brake equipment, and
  - x. all associated cabling, piping, connectors, and mounting hardware.
- c) design and development, fabrication, integration, assembly, verification, validation, testing, commissioning, delivery and handover as described in Item 81251 (Multiple Unit Trainsets) as applicable to the braking subsystem.

**Item 81265 Passenger Information and Communication, [description]**

Work Operations incorporated in the above include the following as appropriate:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supply of passenger information and communication subsystem of a complete multiple unit trainset, including but not limited to:
  - i. passenger information display systems including dynamic route displays and destination indicators

- ii. passenger information audio systems including public address systems, speakers, amplifiers, and automated announcements
  - iii. security monitoring systems including CCTV, cameras, monitors, recording equipment, and surveillance systems
  - iv. passenger emergency intercoms and help points
  - v. exterior passenger information displays and audio systems
  - vi. passenger Wi-Fi and connectivity systems, where applicable
  - vii. USB charging points and power outlets, where applicable
  - viii. passenger counting and monitoring systems, where applicable, and
  - ix. all associated cabling, mounting hardware, and network equipment.
- c) design and development, fabrication, integration, assembly, verification, validation, testing, commissioning, delivery and handover as described in Item 81251 (Multiple Unit Trainsets) as applicable to the passenger information and communication subsystem.

**Item 81266 Train Control, Information and Communication Technology, [*description*]**

Work Operations incorporated in the above include the following as appropriate:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supply of train control, information and communication technology subsystems of a complete multiple unit trainset, including but not limited to:
  - i. driver's desk and control consoles including control panels, handles, switches, indicators, and display screens
  - ii. train control and monitoring systems, including train location systems, onboard diagnostics systems and condition monitoring systems
  - iii. fire and smoke detection systems
  - iv. automatic train protection and warning systems, including Automatic Train Protection (ATP), European Train Control System (ETCS), Automatic Warning System (AWS), station protection and vigilance systems, as applicable
  - v. automatic train operation (ATO) and platform screen door (PSD) interfaces, as applicable
  - vi. data recording systems including event recorders and data loggers
  - vii. communication systems including voice radio systems, data radio systems, onboard to offboard radio systems, antennas, and communication equipment

- viii. network and data distribution systems
  - ix. all associated firmware, software, applications, operating systems and databases, and
  - x. all associated cabling, antennas, mounting hardware, and network equipment.
- c) design and development, fabrication, integration, assembly, verification, validation, testing, commissioning, delivery and handover as described in Item 81251 (Multiple Unit Trainsets) as applicable to the train control, information and communication technology subsystem.

### **Item 81267 Coupling and Interconnection, [*description*]**

Work Operations incorporated in the above include the following as appropriate:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supply of coupling and interconnection subsystem of a complete multiple unit trainset, including but not limited to:
  - i. couplers including coupler heads, mechanisms and drawgear
  - ii. electrical jumper connections for power, control and communication between vehicles
  - iii. pneumatic hose connections for brake systems between vehicles
  - iv. gangway connections including bellows, gangway platforms, and weatherproofing systems
  - v. coupler mounting systems, brackets, and support structures
  - vi. coupling status monitoring and indication systems, and
  - vii. all associated cabling, piping, connectors, and mounting hardware.
- c) design and development, fabrication, integration, assembly, verification, validation, testing, commissioning, delivery and handover as described in Item 81251 (Multiple Unit Trainsets) as applicable to the coupling and interconnection subsystem.

### **2.2.3 Other Rolling Stock**

#### **Item 81281 Light Rail Vehicles, [*description*]**

#### **Item 81282 Locomotives, [*description*]**

#### **Item 81283 Passenger Carriages, [*description*]**

#### **Item 81284 Wagons, [*description*]**

**Item 81285 Track Vehicles, [*description*]**

Work Operations incorporated in the above include the following as appropriate:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supply of vehicles, including but not limited to the following subsystems as appropriate:
  - i. structure and body
  - ii. doors
  - iii. bogies
  - iv. interior
  - v. lighting
  - vi. heating ventilation and air conditioning
  - vii. energy supply
  - viii. traction
  - ix. braking
  - x. passenger information and communication
  - xi. train control, information and communication technology, and
  - xii. coupling and interconnection.
- c) design and development:
  - i. preparation of detailed design documentation
  - ii. engineering analysis including structural, dynamic, thermal, electrical, human factors, electromagnetic compatibility, cyber security, reliability, availability and maintainability analysis, as required
  - iii. interface design and management between all rolling stock subsystems
  - iv. interdisciplinary design coordination and design reviews
  - v. design against all applicable specifications, standards and regulations, and
  - vi. risk assessments and safety case development.
- d) fabrication, integration and assembly:
  - i. factory assembly of complete vehicle from individual subsystems
  - ii. installation and integration of all mechanical, electrical, and electronic systems
  - iii. wiring, cabling, and connection of all systems

- iv. quality control and inspection during assembly process, and
  - v. resolution of interface issues and design modifications, as required.
- e) verification, validation, testing and commissioning:
- i. factory acceptance testing, including component level, sub-system level and complete vehicle level as appropriate
  - ii. site integration testing, including static testing and dynamic testing
  - iii. design / site / user acceptance testing, including static testing and dynamic testing
  - iv. verification and validation against all applicable specifications, standards and regulations
  - v. documentation of all test results, certification and safety case development, and
  - vi. interim certification and compliance documentation as safe to operate in limited test service.
- f) delivery:
- i. preparation for transport including securing and protection
  - ii. loading onto transport mode (rail, road, or sea as appropriate)
  - iii. transport to project site or designated delivery location
  - iv. unloading and positioning at site
  - v. initial inspection following delivery, and
  - vi. storage and protection prior to commissioning, as required.
- g) handover:
- i. provision of operations and maintenance manuals, as required
  - ii. provision of technical documentation including as-built drawings and specifications, as required
  - iii. provision of spare parts, as required, including consumables, rotatable spares, and high value or long lead-time spares
  - iv. training of operations personnel including rail traffic crew, station staff, rail control centre staff, as required
  - v. training of maintenance personnel, as required

- vi. warranty documentation and defects liability arrangements, and
- vii. final acceptance, certification and compliance documentation as safe to operate in revenue service.

#### **2.2.4 Miscellaneous**

##### **Item 81296 Rail Freight Containers, [*description*]**

Work Operations incorporated in the above include the following as appropriate:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supply of rail freight containers, including but not limited to the following subsystems as appropriate:
  - i. structure and body
  - ii. doors, gates, hatches, and access openings
  - iii. passive or forced air ventilation systems, as applicable
  - iv. internal fittings and equipment for specialised applications, such as livestock feeding and watering systems, refrigeration systems, as applicable
  - v. lifting points, stacking fittings, corner castings, and securing mechanisms
  - vi. identification markings, signage, and labelling
  - vii. anti-corrosion treatments, protective coatings, weatherproofing systems, and paint, and
  - viii. all associated fixings, fasteners, brackets, and sealing systems.
- c) design and development:
  - i. preparation of detailed design documentation
  - ii. engineering analysis including structural, dynamic, thermal, electrical, human factors, electromagnetic compatibility, cyber security, reliability, availability and maintainability analysis, as required
  - iii. design against all applicable specifications, standards and regulations, and
  - iv. risk assessments and safety case development.
- d) fabrication, integration and assembly:
  - i. factory assembly of complete vehicle from individual subsystems
  - ii. installation and integration of all mechanical, electrical, and specialised systems as applicable

- iii. quality control and inspection during assembly process, and
  - iv. resolution of interface issues and design modifications, as required.
- e) verification, validation, testing and commissioning:
- i. factory acceptance testing, including component level, sub-system level and complete vehicle level as appropriate
  - ii. verification and validation against all applicable specifications, standards and regulations, and
  - iii. documentation of all test results, certification and safety case development.
- f) delivery:
- i. preparation for transport including securing and protection
  - ii. loading onto transport mode (rail, road, or sea as appropriate)
  - iii. transport to project site or designated delivery location
  - iv. unloading and positioning at site
  - v. initial inspection following delivery, and
  - vi. storage and protection prior to commissioning, as required.
- g) handover:
- i. provision of operations and maintenance manuals, as required
  - ii. provision of technical documentation including as-built drawings and specifications, as required
  - iii. provision of spare parts, as required, including consumables, rotatable spares, and high value or long lead-time spares
  - iv. training of operations personnel including freight handlers, rail traffic crew, as required
  - v. training of maintenance personnel, as required
  - vi. warranty documentation and defects liability arrangements, and
  - vii. final acceptance, certification and compliance documentation as safe to operate in revenue service.

**Item 81297 Simulators, [*description*]**

Work Operations incorporated in the above include the following as appropriate:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

- b) supply of driver training simulators, including but not limited to:
  - i. simulator cab including cab shell, driver's desk, consoles, seats, and interior fitout
  - ii. all in-cab equipment, systems, screens, indicators, lamps, controls, switches, handles, and pedals replicating the rolling stock configuration
  - iii. visual display systems including screens, projectors, graphics rendering systems, and visual databases of routes, infrastructure, and operating environments
  - iv. motion platform systems including actuators, motion control systems, and platform structure, as applicable
  - v. audio systems including speakers, amplifiers, and sound generation equipment replicating operational sounds and warnings
  - vi. simulation software including train dynamics models, traction and braking simulation, system behaviour models, fault simulation, emergency scenarios, and route databases
  - vii. environmental systems for simulator facility including HVAC, lighting, and power distribution, and
  - viii. all associated cabling, connectors, mounting hardware, and network equipment.
- c) design and development:
  - i. preparation of detailed design documentation
  - ii. engineering analysis including structural, dynamic, thermal, electrical, human factors, electromagnetic compatibility, cyber security, reliability, availability and maintainability analysis, as required
  - iii. software development including simulation software, route databases, training scenarios, and user interfaces
  - iv. design against all applicable specifications, standards and regulations including simulator requirements specifications, and
  - v. development of training scenarios, including normal, degraded and emergency scenarios.
- d) fabrication, integration and assembly:
  - i. factory assembly of simulator hardware components

- ii. installation and integration of all mechanical, electrical, electronic, and software systems
  - iii. wiring, cabling, and connection of all systems
  - iv. software integration, configuration, and route database development
  - v. quality control and inspection during assembly process, and
  - vi. resolution of interface issues and design modifications, as required.
- e) verification, validation, testing and commissioning:
- i. factory acceptance testing including hardware functionality testing, software validation, and integrated system testing
  - ii. site integration testing including installation verification, system integration, and performance testing
  - iii. fidelity validation testing against actual rolling stock performance and driver operating experience
  - iv. user acceptance testing with representative drivers and instructors
  - v. verification and validation against all applicable specifications, standards and simulator requirements, and
  - vi. documentation of all test results and certification.
- f) delivery and installation:
- i. preparation for transport including disassembly as required, securing and protection
  - ii. transport to designated training facility location
  - iii. site installation including reassembly, positioning, leveling, and anchoring
  - iv. connection to site services including power, data networks, and environmental control systems
  - v. site commissioning and performance verification, and
  - vi. final calibration and tuning.
- g) handover:
- i. provision of operations and maintenance manuals, as required
  - ii. provision of technical documentation including as-built documentation, software documentation, route databases, and maintenance procedures, as required

- iii. provision of spare parts, as required, including consumables, rotatable spares, high value or long lead-time spares
- iv. training of instructors including simulator operation, scenario development, as required
- v. training of maintenance personnel, as required
- vi. warranty documentation and defects liability arrangements, and
- vii. final acceptance, certification and compliance documentation.

**Item 81298 Mock-ups, [*description*]**

Work Operations incorporated in the above include the following as appropriate:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supply of mock-ups, including but not limited to:
  - i. structural framework and support systems for mock-up assembly
  - ii. external body shell sections including external panels, roofs, nose cones, windows and glazing systems
  - iii. doors and door systems including passenger bodyside doors, intercar doors, and rail traffic crew cab doors, and operating mechanisms
  - iv. interior fitout including seating, wall panels, ceiling panels, floor coverings, and interior fixtures
  - v. lighting systems and controls
  - vi. control consoles, instrumentation, and operator interfaces
  - vii. accessibility features and equipment
  - viii. finishes, paint, livery, and surface treatments representative of final design, and
  - ix. all associated fixings, fasteners, brackets, and mounting hardware.
- c) design and development:
  - i. preparation of design documentation for mock-up installation and construction
  - ii. design against specifications for mock-up, and
  - iii. coordination with rolling stock design to ensure accurate representation.

- d) fabrication and assembly:
  - i. factory assembly of mock-up components and systems
  - ii. quality control during fabrication and assembly process, and
  - iii. resolution of interface issues and design modifications, as required.
- e) delivery:
  - i. preparation for transport including securing and protection
  - ii. loading onto transport mode (rail, road, or sea as appropriate)
  - iii. transport to project site or designated delivery location
  - iv. unloading and positioning at site
  - v. initial inspection following delivery, and
  - vi. storage and protection prior to user group consultation activities.
- f) handover:
  - i. provision of documentation including as-built drawings, Technical Specifications, and manuals as required, and
  - ii. training of project staff, including designers, project managers, and user group consultation coordinators, as required.
- g) disassembly and removal:
  - i. disassembly of mock-up materials, components and systems
  - ii. disposal or salvage of materials, components and systems
  - iii. transport of salvaged materials, components and systems to designated storage location, and
  - iv. site restoration and making good following removal.

## **2.3 Measurement**

If any item for which a quantity of work is listed in the Schedule of Rates has not been priced by the Contractor, it will be deemed that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

### **2.3.1 Measurement of Multiple Unit Trainsets**

This Specification provides Standard Work Items for Multiple Unit Trainsets as either a complete trainset or individual subsystems.

Where a Standard Work Item for a complete trainset is included in the Schedule of Rates, no Standard Work Items for individual subsystems shall also apply to that trainset.

Where Standard Work Items for individual subsystems are included in the Schedule of Rates for a trainset, no Standard Work Item for a complete trainset shall also apply to that trainset.

The decision to price Multiple Unit Trainsets procurement using either:

- a) complete trainset, or
- b) individual subsystems

shall be made by the Principal and indicated in the Schedule of Rates.

### **2.3.2 Allocation of fixed costs**

Rolling stock procurement typically involves fixed costs for design, type testing, and construction readiness activities. These fixed costs apply regardless of the order quantity.

This Specification allows for these fixed costs to either be amortised across all units in the order quantity or allocated to first of class unit(s) separately from production units.

The decision to price these fixed costs using either:

- a) amortised unit rates, or
- b) first of class unit rates vs production unit rates

shall be made by the Principal and indicated in the Schedule of Rates.

## **2.4 Calculation of quantities**

### **2.4.1 Quantities of Multiple Unit Trainsets**

The quantity of Multiple Unit Trainsets shall be calculated on the basis of the number of complete trainsets supplied, tested, commissioned, and handed over in accordance with the Contract, irrespective of whether payment is structured as complete trainsets (Item 81251) or as individual subsystems (Items 81256 through 81267).

### **2.4.2 Quantities of Other Rolling Stock and Miscellaneous**

The quantity of Light Rail Vehicles, Locomotives, Passenger Carriages, Wagons, Track Vehicles, Rail Freight Containers, Simulators, and Mock-ups shall be calculated on the basis of the number of complete units supplied, tested, commissioned, and handed over in accordance with the Contract.

