TS 01463:1.0
T MU AM 06008 GU
Guide

Guide to Operational Concept Definition Development

Issue date: 29 June 2023

Effective date: 29 June 2023

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Document information

Owner: Director Asset Management Partnering and Services
Asset Management
Safety, Environment and Regulation

Mode: Multimodal

Discipline: Systems engineering

Document history

Revision	Effective date	Summary of changes
1.0	28 May 2015	First issue as T MU AM 06008 GU *Operational Concept Definition*.
1.0	29 June 2023	First issue as TS 01463. Version numbering recommenced in line with new designation. Changes from the previous version include: extend applicability to all transport modes; update to reflect current practice.

Preface

This document is the first issue as TS 01463 and supersedes T MU AM 06008 GU *Operational Concept Definition*.

This document provides supporting guidance to TS 01472 to develop operational concept definitions for multimodal transport projects, programs, and portfolios. These undertakings range from simple to highly complex and the guidance follows a structured approach.

This guide is placed within the context of systems engineering as an integrated methodology to support the TfNSW asset management framework. Requirements for systems engineering are specified in TS 01471 and supported by TS 01462.

This document has been developed in consultation with key stakeholders within TfNSW.

Changes from the previous version include the following:

- extend applicability to all transport modes
- update to reflect current practice.

This guide may be updated as improved best practice emerges in the development of OCDs.

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1 Scope

This guide refers directly to the OCD requirements in TS 01472, which are described in the relevant sections of this document.

This document is neither an OCD nor a mandated template for an OCD. It provides guidance on, and examples of, OCDs to ensure that all key operational aspects of a transport system change are considered and defined to support the development of a final business case and business requirements.

While this guide describes how to define the whole-of-life operational concept for new or altered transport systems, it does not describe how life cycle costs are derived. TS 01505 provides requirements for deriving life cycle costs and TS 01471 defines what a system is.

2 Application

This guide applies to organisations involved in the planning, investment and specification of TfNSW infrastructure, active transport and fleet assets (outlined in Appendix A), and collaboratively developing an OCD, including, but not limited, to the following:

- The transport services contract manager – owner of the service contract with the operator and maintainer, demand analysis and service design. For example, the Greater Sydney business units of Public Transport Contracts, Operations, and Network and Assets.
- The passenger transport service customer engagement entity – passenger service customer inputs and demand identification. For example, Planning and Programs, Greater Sydney; Planning and Programs, ROM; Customer Strategy and Experience, CST.
- The transport network investment capability and capacity planning entity – sponsor and owner (these are two distinct roles) of the OCD and BRS, and developer of the business case and business requirements. For example, Transport Planning, CST; Planning and Programs, Greater Sydney; Planning and Programs, ROM.
- The freight transport service customer engagement entity – freight demand identification through freight customer inputs. For example, Freight branch, ROM.
- Transport capital program delivery entities – project development including BRS and SRS, and review and agreement on capital expenditure (CapEx) costs. For example, Planning and Programs, Greater Sydney; Planning and Programs, ROM; most of Infrastructure and Place.
- Transport operators and maintainers – operating and maintaining the proposed new or altered system, and review of expected operational expenditure (OpEx) costs.
- Industry suppliers providing technical advisor support to TfNSW in preparing an OCD.

This guide applies to all TfNSW public transport modes, assets and services.

This guide should be applied at a scalable level for the following operational scenarios:

- transport integrated network level – for example, all transport modes
- transport mode level – for example, fleet asset, road and active transport
- transport corridor level – for example, fleet asset and active transport routes
- local sites and multimodal sites – for example, interchanges, yards, depots, wharves, shipyards, bus stops and termini, control centres and junctions.

This guide is applied in the concept phase of the Plan stage of the asset life cycle, prior to finalising the business case and request for full capital investment funding. The concept phase is described in the TfNSW asset life cycle model in TS 01471.

The elements described in this guide should be tailored and scaled to suit the needs of each transport investment project, program or portfolio. Not every element of this guide applies to every project, and the user should select those elements that apply. Projects, programs or portfolios that apply international standards may refer to Appendix B for guidance on alignment between the information contained in this guide and ISO/IEC/IEEE 29148:2018.

The preferred physical solution may not be well defined at the concept phase of the asset life cycle. An operational concept is developed around an assumed range of asset types and solutions to fulfil the business aims.

3 Referenced documents

The following documents are cited in the text. For dated references, only the cited edition applies. For undated references, the latest edition of the referenced document applies.

International standards

ANSI/AIAA G-043B *Guide to the Preparation of Operational Concept Documents*

ISO/IEC/IEEE 29148 *Systems and software engineering – Life cycle processes – Requirements engineering*

ISO/IEC/IEEE 29148:2018 *Systems and software engineering – Life cycle processes – Requirements engineering*

Australian standards

AS/NZS ISO/IEC/IEEE 42010 *Systems and software engineering – Architecture description*

Transport for NSW standards

TS 01455 *Configuration Management*

TS 01462 (T MU AM 06006 GU) *Systems Engineering*

TS 01471 (T MU AM 06006 ST) *Systems Engineering*

TS 01472 *Operational Concept Definition*

TS 01474 (T MU AM 06011 MO) *Transport Network Architecture Model*

TS 01505 (T MU AM 01001 ST) *Life Cycle Costing*

TS 04976 (T MU HF 00001 GU) *Guide to Human Factors Integration*

Legislation

Disability Discrimination Act 1992 (Cth)

Rail Safety National Law (NSW)

Other referenced documents

Austroads, *Level of Service Metrics (for Network Operations Planning*)

TfNSW, *NSW Freight and Ports Plan 2018-2023*

TfNSW, *Future Transport Strategy*

4 Terms, definitions and abbreviations

The following terms, definitions and abbreviations apply in this document:

BCM business capability model

BRS business requirements specification

CST Customer Strategy and Technology

MCD maintenance concept definition

OCD operational concept definition

ROM Regional and Outer Metropolitan

SCADA supervisory control and data acquisition

SRS system requirements specification

TfNSW Transport for New South Wales

5 General

This guide is meant to be illustrative and not exhaustive. The principles used in this guide have been applied to rail, bus and ferry and road systems but they are equally applicable to any engineered transport system. Noting that all engineered systems delivered through a project are unique, this information should be questioned in order to elicit required information and not taken verbatim.

TS 01472 gives background information on how an OCD is used over the system life cycle and sets a basis for systems engineering activities.

6 Relationship to maintenance concept definition

TS 01472 contains a requirement concerning the interrelationship between the OCD and the MCD.

The OCD should be produced in conjunction with the MCD document, to ensure that the two documents align.

An OCD and an MCD are required to understand how a new or altered system will be operated and maintained over the asset life cycle. The OCD and MCD are developed after initial business requirements are developed and used to support the development of actual business requirements in the BRS, which is linked to derived solution requirements in the SRS.

The operational concepts articulated in the OCD should align with the MCD to ensure that both operation and maintenance of the new or altered system are considered in an integrated way over its lifetime. The MCD may be merged with the OCD to form a single integrated operational and maintenance concept document.

MCD development may lag the development of the OCD due to the primary need to define the operations to support the service demand and maintenance of assets (that is, the MCD) to support the operational capability.

The OCD and MCD may be used as the basis for validation throughout the asset life cycle and as the point of reference where conflicts between requirements need to be resolved.

7 Operational concept definition development

Sections 7.1 to 7.8 provide background information on OCD development and offer guidance on complying with the requirements around roles, responsibilities and resources for OCD development for TfNSW transport projects in accordance with TS 01472.

Examples of OCD structures are provided in ISO/IEC/IEEE 29148 and ANSI/AIAA G-043B.

7.1 Need for an operational concept definition

An OCD helps frame the operations and the expected operational environment and context of a new or altered system in a way that supports the translation of the initial service demand or need into a credible set of operational and business requirements on which a robust system design is developed.

7.2 Operational concept definition development responsibility

TS 01472 specifies requirements that set out responsibilities for developing an OCD.

These responsibilities are ordinarily executed by a Transport planning or project development entity, who may work in conjunction with systems engineers to ensure appropriate language is used and the document complies with requirements in TS 01472.

For example, there may be situations where the operator and maintainer consider making relatively minor transport network asset and service changes (that is, changes that are not of a significant capital value and not driven by Transport planning or project development entity) to the way in which it will carry out operations or maintenance to deliver against its agreed or contractual commitments more effectively.

> Note: Initiatives may be driven by the maintainer where the operator and maintainer are not the same entity. That is, the fleet asset operator may engage another organisation to maintain these assets.

However, in the case of the situations described above, the default responsibility to comply with the OCD standard and for multiple stakeholder engagement lies with Transport planning or the project development entity.

7.3 Stakeholder consultation

TS 01472 contains requirements for the OCD developer about stakeholder consultation.

Key stakeholders, internal and external to TfNSW, should be engaged in defining and agreeing the operations and maintenance of the new or altered system over its lifetime due to the multiple stakeholder nature of a transport operational change.

Stakeholders involved in the development of OCD should be authorised and relevant to the proposed change. To avoid the problem of managing excessive numbers of stakeholders, each relevant organisation should authorise a representative for their interests in the development of the OCD, and that representative should engage in the development of the OCD during the concept and specify phases of the asset life cycle.

Lack of engagement at the appropriate time, followed by late objections to operational concepts during the later phases of the project, can have adverse effects on time, cost, quality, risk and system acceptance of new or altered assets and services.

Stakeholders involved should be relevant to the OCD under development. For example, it would be inappropriate to involve transport interchange operators in developing the operational concept for a fleet stabling facility or fleet maintenance facility, and vice versa.

The following authorised stakeholders may be consulted in developing and agreeing an OCD, depending on the scope and type of the proposed new or altered system:

- the transport services contract manager
- the passenger transport service customer engagement entity
- the freight transport service customer engagement entity
- transport capital program delivery entities
- transport operators and maintainers
- Asset Management Branch, TfNSW
- TfNSW safety, security and emergency management entities
- other transport operators (including operators, multimodal facility operators and network owners, network operators)
- local government authorities and utilities.

Authorised representatives of the key stakeholders should actively engage and consult in development of the operational concepts associated with the proposed new or altered system.

These representatives (as applicable to the proposed new or altered system) should review the OCD.

These representatives that operate within the scope of TfNSW governance practices (as applicable to the proposed new or altered system) should approve the OCD.

7.4 Position within enterprise business capability model

TS 01472 contains a requirement concerning positioning the OCD within the enterprise BCM.

To understand where the OCD sits in the enterprise business model, the developer should connect with the relevant enterprise architecture structure that will register the OCD.

The structure to select depends on whether the OCD is about information technology, or customer and operational technology. The structures are as follows:

- for information technology – TAC (Transport Architecture Council) and PDA (Portfolio Design Authority)
- for customer and operational technology – CT/OT TDA (Technical Design Authority) and TIASC (Technology and Innovation Architecture and Security Committee).

After registration, the governance process determines where the OCD will sit within the Transport enterprise architecture through the BCM. Positioning OCDs this way is essential for transparency, reducing duplication and strategic planning.

These enterprise architecture structures will advise OCD developers on both BCM placement and on which Transport outcomes the OCD is most likely to enable.

7.5 Operational concept definition process

This guide elaborates on and provides guidance to comply with TS 01472, but does not mandate the approach to be followed.

The suggested process for preparing an OCD is as follows:

1. Identify source documents that set out high level demand and transport goals, for example, the *Future Transport Strategy*, *NSW Freight and Ports Plan 2018-2023* and supporting operational performance capabilities, including draft service timetables.
2. Develop a plan, resources and schedule for developing the OCD, identifying and engaging with key stakeholders, modelling concepts, and reviewing and approving the OCD.

   The OCD should be prepared during the Plan stage of the TfNSW asset life cycle, following demand analysis, transport modelling, and analysis of different service and timetable options, in order to select and define the operational concept for the preferred option.

   The concept phase (when the OCD is produced) of the Plan stage is identified in the TfNSW asset life cycle model in TS 01471.

   The OCD naming convention should reference the system that the OCD applies to.
3. Develop models of the proposed new or altered service performance required, to be used as a basis for developing operational concepts.
4. Develop the OCD via a consultative process led by a core group and supported by advisors who represent a range of disciplines and functional areas (systems engineering, operations, maintenance, engineering, business, asset management, customers, project development and delivery).
5. Review this material collaboratively to decide on an appropriate approach, including development of draft operational processes, assumptions, dependencies and constraints, scenarios, modes, life cycle considerations and future proofing.
6. Schedule and hold workshops involving specialists from the following areas, including, but not limited to, the following (at the discretion of the planner or project development manager):
   - operations
   - maintenance
   - major upgrade programs
   - transport strategy (the transport contract manager or TfNSW planners)
   - asset performance

- safety, environment and regulation functions
- security.

7. Prepare a draft OCD from the workshop outputs.
8. Validate the draft OCD by a series of workshops involving specialists, where DITLO (day in the life of) scenarios are used to validate proposed operational concepts.
9. Conduct key stakeholders final review and approve the final OCD as a basis for the business case and associated business requirements.

7.6 Coordination with other operational concept definitions

In the complex and interrelated world of the multimodal public passenger and freight transport network, a project introducing new or altered systems and services should consider the related operational concepts and needs of other projects and modes.

TS 01472 specifies a requirement for OCD developers to coordinate their development with other OCDs in development or existing.

The team responsible for leading the development of the OCD should ensure that it is aware of, and makes other parties aware of, changes to operational concepts that affect different parts of the wider transport network.

Examples of changes to operational concepts that may affect other projects or modes include the following:

- changes to passenger service operations on a line, junction or interchange may have impacts on concurrent changes in freight services and associated operational concepts
- road network changes may require increased services arriving at a particular transport interchange, such as additional bus services, taxi ranks or private motor vehicle parking
- introduction of driverless trains on a line that previously had driver-based operations may impact on stabling yard operations, network management and line control operations
- freight-related operational changes, for example, introduction of digital train radio on freight trains, or freight corridor projects.

7.7 Resources and tools for developing an operational concept definition

TS 01472 specifies a requirement for OCDs to be prepared by appropriate staff.

Appropriate staff resources and associated competencies required to support the OCD may include the following:

- transport strategy and planning

- portfolio development and management
- stakeholder engagement and communication
- transport economics
- transport statistical analysis
- transport service modelling (for example flow models, timetable modelling)
- transport operations analysis, design and development
- options analysis and cost benefit analysis
- asset management and systems engineering
- reliability and availability prediction and analysis
- maintenance analysis and planning
- requirements definition and analysis
- human factors integration
- integration of services into the network or freight operators with the current network and main line accessibility due to land acquisition and council developments.

A single individual may not have all the above competencies at a sufficient proficiency level, and therefore a core team may be formed with the required blend of competencies to engage with authorised stakeholders to develop a robust OCD.

TS 01472 specifies a requirement for the use of suitable tools for developing OCDs.

Modelling and simulation are a virtual approximate representation of the real world that allows investigation and, in some cases, prediction of future outcomes. Usually a specialised computer-based software application tool is needed to facilitate the modelling and simulation, for example, modelling to ensure rail fleet assets are able to operate reliably with sufficient headway and robustness.

Many tools are available to support the analysis and validation of a proposed change to a transport system and service and associated operational concept.

7.8 Scheduling of operational concept definition

TS 01472 contains a requirement detailing the scheduling of the OCD in the context of the asset life cycle.

The OCD should be prepared during the Plan stage of the TfNSW asset life cycle. See Section 7.5 for the OCD process.

As well as informing the MCD (see Section 6), the OCD provides input to the development of the preferred concept design, business case and final BRS.

8 Operational performance capability metrics

TS 01472 requires the OCD to identify operational performance capabilities and agreed performance metrics. These capabilities should address transport enterprise objectives, future operational capabilities and the rationale for operational change.

8.1 Transport objectives

8.1.1 General

TS 01472 contains a requirement concerning traceability from enterprise goals to the OCD attributes.

To develop an operational concept (and associated maintenance concept), TfNSW enterprise level goals and objectives should be identified, understood and traced to the required supporting operational capabilities, supporting concept activities, organisation and assets.

Transport objectives should be supported by a clear vision and strategy that clearly articulate the transport service of the future in broad terms of achieving this service.

At the highest level, the *Future Transport Strategy* identifies outcomes to ensure that TfNSW provides an integrated transport service across all modes and geographic areas. These outcomes are achieved by identifying the future transport operational capability.

The systematic identification and synthesis of operational activities and functions to support the TfNSW outcomes and capabilities are supported by TS 01474 (transport network architecture model). The TRAK (railway architecture framework) metamodel is widely available and can be used to develop an architectural model. TRAK is based on AS/NZS ISO/IEC/IEEE 42010 and derived from the UK Ministry of Defence Architecture Framework (MODAF).

Operational capability metrics associated with an operational concept are necessary to provide a basis for validating achievement of higher-level enterprise goals.

TS 01472 contains a requirement concerning future operational capability.

The OCD should support the introduction and use of new or novel systems and technologies.

Examples of new technologies include Barangaroo transport interchange ferry (semi-floating pontoons), light rail (wireless traction using onboard energy storage), Sydney Metro (driverless trains), and digital systems such as the European Train Control System (ETCS).

8.1.2 System-level capability

When defining an OCD, a top-down analysis of system-level performance capabilities should be done to ensure that long-term strategic transportation objectives are achieved.

Fleet asset system capability metrics may include, but are not limited to, the following:

- morning, afternoon and off-peak plan (origin, destination, via interchange or junction)
- dwell time at stations, stops, wharves (minutes)
- headway (minutes per service) in weekday morning and afternoon peak
- annual vehicle service kilometres
- annual vehicle service hours.

Road system capability metrics may include, but are not limited to, the following (based on the *Level of Service Metrics (for Network Operations Planning)*):

- private motorists – for example congestion, travel time reliability, and travel speed
- transit user – for example, service schedule reliability, operating speed, and crash risk of transit vehicle
- pedestrian – for example, footpath congestion, grade of path, and crossing delay or detour
- cyclist – for example, travel speed, congestion, and grades
- road freight – for example, congestion, travel time reliability, and travel speed.

8.1.3 Fleet capability

The primary consideration for passenger and freight transport begins with the fleet capability, as this is the means for transporting passengers and freight across the network.

Fleet asset capability metrics may include, but are not limited to, the following:

- fleet size (in service) – number of assets configuration
- fleet size (in reserve) – number of operationally-ready standby services
- fleet size (in maintenance) – maximum number of unserviceable assets
- interoperability
- route wharves, bus stops or interchanges served.

8.1.4 Transport interchange capability

As the primary means of accessing public transport, the multimodal transport interchange is an essential element in defining the operational capability of the multimodal transport system.

Typical interchange capability metrics may include, but are not limited to, the following:

- connectivity to other transport modes
- passenger flow (mode-to-mode, car park to concourse, concourse to stopping place, stopping place to fleet asset)

- concourse capacity
- number of stopping places
- stopping place capacity (standing, seated, walking, *Disability Discrimination Act 1992* requirements).

8.1.5 Infrastructure capability

When developing a new or altered service and associated new or altered systems to support that service, the infrastructure capability before and after the change should be defined and understood.

Typical infrastructure capability metrics may include, but are not limited to, the following:

- throughput of fleet assets
- maximum permissible speeds, including differential speeds for different services, and fleet assets
- interoperability (for example, fleet asset control, communications)
- clearances and envelopes
- energy supply.

8.1.6 Control and communications capability

Typical control and communications capability metrics may include, but are not limited to, the following:

- fleet asset signalling and traffic control capability
- fleet asset signalling system interoperability
- telecommunications capability
- telecommunications system interoperability
- road or motorway traffic management and control capability.

8.1.7 Stabling yard or overnight facility capability

When determining fleet size to meet a particular operational capability, how and where to park the fleet while not in operation should be considered.

Typical capability metrics may include, but are not limited to, the following:

- rate of acceptance – the capacity to receive maximum number of fleet assets per hour
- rate of despatch – the capacity to despatch maximum number of fleet assets per hour
- number of assets

- number of roads
- access (number of crossings).

8.1.8 Maintenance depot capability

While maintenance depot capability should be considered in detail in the MCD, the operations associated with withdrawing rolling stock, infrastructure and systems from operational use to repair and maintain them may be included in the OCD.

Typical maintenance depot capability metrics may include, but are not limited to, the following:

- number of fleet assets that can be serviced simultaneously
- maintenance turnaround times for different activities
- frequency of utilisation
- electrical service types
- signals and control service types.

8.1.9 Freight terminal capability

Where a freight service should be supported within the network, the operational concept may need to consider the capability of the freight terminal.

Freight terminal operational capability metrics may include, but are not limited to, the following:

- conveyance (for example, truck, ferry, train or bus)
- type (freight (bulk or containerised) and passengers) and commodity (for example, coal, mineral, perishable goods, liquids and gas, timber)
- loading and unloading rates
- annual throughput (for containerised facilities)
- auxiliary services (for example, refrigerated storage, fumigation and quarantine areas).

8.1.10 Security operations capability

Security operational capability metrics may include, but are not limited to, the following:

- cybersecurity software
- surveillance coverage, for example, number of cameras
- consignment visibility technology
- security staffing levels at key points
- incident response times.

8.2 Rationale for operational change

Operational capability changes for any transport mode should be based on sound business decisions which are based on business objectives and socio-economic outcomes and benefits.

TS 01472 contains a requirement concerning rationale for operational change.

The OCD is part of the rationale for any change in operational capability and it should provide clear, measurable expected benefits to support the business case for the proposed change. These benefits should be defined in terms of whole-of-life cost models.

9 Assumptions, dependencies and constraints

TS 01472 contains a requirement concerning recording assumptions, dependencies and constraints.

Since the OCD is developed early in the asset life cycle, unknown factors may only be clarified later, when a particular system solution has been selected. All assumptions, dependencies and constraints should be recorded as soon as possible and continue to be verified as the solution becomes apparent later in the procurement and design phases of the asset life cycle.

Operational assumptions are contextual conditions that can be accepted as true without having to prove them. For example, there may be an assumption that a proposed new bridge over a river may be subject to a 1-in-100-year flood event, but later analysis using latest NARCliM (NSW and Australian Regional Climate Modelling) data may reveal that flooding will be more frequent and severe in 50 years' time.

Operational dependencies exist when functions are controlled wholly or partly by other functions. For example, fleet asset operations rely on functions such as route planning, service schedule, and interchange and stopping assets.

Operational constraints are any limitations of a physical, geographic, policy, industrial relations or security nature, that place limits on the range of options to be considered when developing an operational concept.

The following are examples:

- fleet asset operating staff constraints, such as staff numbers, capabilities and competencies
- operating staff facilities, such as mess facilities, ablutions, rest areas and proximity to services
- easy access constraints, such as mobility constraints and constraints due to hearing and vision impairment.

There may be additional operational constraints unique to a specific project.

Note: A cyber attack should be considered for any project that introduces or modifies any software element directly or indirectly interfacing transport network or assets.

10 Operational risks

Operational risks are managed to mitigate effects of uncertainty on operational objectives. These objectives are realised, or otherwise, in the Operate/Maintain asset life cycle stage and typically fall into various categories. Examples of objective categories are economic, social and environment categories.

Note: Objectives may overlap, for example, safety risks can result in economic and social objectives.

TS 01472 contains a requirement concerning operational risks.

Operational risks may include, but are not limited to, the following:

- operations staff not trained or aware of operational changes
- customers not aware of operational changes that affect them (for example, changed traffic flow)
- external stakeholders (for example, emergency services) not aware of operational changes.

11 Operational impacts

Operational impact information is used by affected entities to prepare for changes that will result from the new or altered system. These impacts may be permanent (if realised in the Operate/Maintain asset life cycle stage) or temporary (if realised in the Create/Acquire asset life cycle stage).

Identified impacts should reference the relevant operational scenarios, operational activities, actors and operational interfaces between current and future states.

TS 01472 contains a requirement concerning operational impacts.

Operational impacts may include, but are not limited to, the following:

- enterprise or organisational, for example, changed responsibilities and accountabilities
- procedural
- modelling
- information provision and exchange
- training and competency.

Note: The operational change may also be described in terms of associated business capability. This will allow a broader enterprise view to be leveraged when considering change to a particular system's operational context.

12 Operational service levels

TS 01472 contains a requirement detailing operational service levels.

Breaking the system up into levels makes it easier to manage. The degree to which the operating system is broken up depends on the complexity of the system. This may be achieved by categorising operational services into the following levels:

- level 1 – strategic
- level 2 – tactical
- level 3 – operational.

12.1 Level 1 – strategic

This level is policy based at a TfNSW enterprise level and is applicable to high complexity systems with a transport network or mode-wide scope and implications.

It deals with long-term changes to the transport network and is non-routine and generally forms part of a portfolio of programs.

At this level, the pattern of service is determined for the working schedule in effect.

Examples of strategic level operational concepts are decisions to introduce driverless and or zero emissions fleet assets, and variable motorway speed limits.

12.2 Level 2 – tactical

This level is plan, process and procedure based and deals with how to achieve policy and strategy. It is applicable to new or altered medium complexity systems delivered at a program or project level.

It deals with medium-term operational arrangements for achieving service outcomes and timetables, routing and regulation.

At this level, parameters are set for service regulation and intervention decisions.

Examples of tactical operational concepts are an existing corridor or junction performance upgrade, widening an existing road or motorway, upgrading existing fleet assets, additional capacity or resilience upgrades.

12.3 Level 3 – operational

This level deals with routine operations and decisions in each operational area of the transport mode, including degraded and emergency operations, short-term changes, and is routine.

At this level, day-to-day decisions are made on routing and regulating fleet services under abnormal conditions, excluding incident management. Decisions on what regulation and intervention are required are based on parameters set at level 2.

This level involves activities from operating fleet assets and granting authorities through to implementing decisions made at level 2 on regulation and intervention.

13 Operational assets and facilities

Transport operations, for example, fleet assets and roads, require some form of physical assets or support facilities. The assets and facilities required to support the operational concept and its associated services should be functionally described at a minimum.

TS 01472 contains a requirement concerning operational assets and facilities.

Operational assets and facilities may include, but are not limited to, the following:

- parking facilities for example, stabling, depot or overnight facilities
- depot facilities for bulk storage of road repair materials; stabling for road build, renovate and repair vehicles; facilities for housing of spare signs, Intelligent Transport Systems (ITS) equipment and repair of same
- fleet assets, for example, passenger and freight rolling stock and maintenance vehicles, buses and ferries.

13.1 Existing asset and facility description

The OCD should describe existing operational assets and facilities as a starting baseline for the proposed network asset or service change, including, but not limited to, the following:

- fleet asset type
- transport modal interchanges
- control and communications
- fleet stabling facilities
- maintenance facilities
- freight terminal facilities
- security control and monitoring facilities.

Where the change involves introduction of a new facility, the detail should be provided in the future asset and facility description (see Section 13.2).

13.1.1 Fleet

The OCD should describe the existing baseline fleet.

Fleet may include, but is not limited to, the following:

- propulsion or traction type
- load type, such as passenger, freight, or bulk mineral
- fleet asset vehicle type, such as heavy rail commuter, light rail commuter, high speed intercity, freight, ferry, and buses
- fleet asset driver or operator training simulator facilities
- fleet maintenance, test and diagnostic facilities (this may be in the MCD).

13.1.2 Interchanges

The OCD should describe existing baseline transport interchange assets and facilities to support services.

Transport interchange assets may include, but are not limited to, the following:

- staff accommodation facilities
- control facilities
- vertical transportation systems, for example, stairs, ramps, lifts, and escalators
- Passenger information and public address systems
- Heating, ventilation and air conditioning services.

13.1.3 Control and communications

The OCD should describe existing baseline control and communications facilities to support the service.

Control and communications assets may include, but are not limited to, the following:

- fleet asset signalling control
- road, signals, signage, traffic management, supervision and control systems
- fleet asset management systems
- fixed and mobile communications systems
- passenger information displays and public address systems.

13.1.4 Fleet stabling facilities and minor maintenance facilities

The OCD should, if applicable, describe the following:

- staff accommodation facilities, such as yard or depot and crew or driver mess, ablutions, and rest areas
- washing, cleaning, vacuuming, litter and graffiti removal facilities
- yard or depot lighting arrangements, including for perimeter, stabling roads and walkways
- yard or depot drainage and water treatment arrangements
- mooring or stabling facilities.

13.1.5 Maintenance facilities

The OCD should, if applicable, describe existing baseline maintenance facilities to support the following services:

- fleet maintenance facilities
- infrastructure and systems maintenance depots
- maintenance staff accommodation, including ablutions, mess and rest facilities
- material and spares storage facilities
- provisioning and refuelling or recharging facilities.

13.1.6 Freight terminal facilities

The OCD should, if applicable, briefly describe existing baseline freight terminal facilities, including, but not limited to, the following:

- modal access by rail and other transport modes, such as other rail, road or ship
- freight sorting facilities
- freight terminal control facilities
- stacker and reclaimer equipment
- container stacking facilities.

13.1.7 Security control and monitoring facilities

The OCD should briefly describe existing baseline security facilities, including, but not limited to, the following:

- security operations centres
- security depots

- surveillance systems
- local security control points
- help phones.

13.2 Future asset and facility description

The OCD should describe the proposed new or altered operational assets and facilities.

However, at the concept phase in the Plan stage of the asset life cycle, the nature and configuration of future assets may not be fully defined. These may be reviewed and refined as the system progresses to the procure and design phases of the asset life cycle. The section titles used to describe existing assets and facilities (see Section 13.1) could be used as headings to describe the future assets and facilities.

14 Operational process scenarios

The identification of operational scenarios is the core of the OCD. A suite of operational scenarios that describe how the new system will work in specific situations should be appended to the OCD. These are often written in a style that brings together operational assets, operational roles, operational service levels, and operational modes in the integrated process description.

TS 01472 contains a requirement concerning operational process scenarios.

The OCD should describe how the transport system operators interact with each other, and with customers, external parties and the operational assets and facilities, to carry out or support transport services under various operational scenarios.

Depending on a particular project, an OCD selects those operational process scenarios that are relevant to the scope. For example, an OCD for a new fleet stabling yard project may select only stabling yard scenarios and some elements of train operations scenarios that are applicable to operating and moving trains into, within, and out of the stabling yard.

The following examples are focused on fleet assets, but the high-level structure and principles of TS 01472 and this guide facilitate expansion and application to other transport modes.

Appendix C contains examples of operational concept diagrams for a heavy rail network, buses and ferries.

Operational process scenarios that are described in the OCD may include, but are not limited to, the following:

- network management operations including the following:
    - early warning of network service perturbations

  - managing service prediction
  - managing service regulation
- line and route management operations including the following:
  - modifying the current fleet asset service plan as required
  - managing timetable perturbation and recovery
  - managing network incidents
- signal, traffic, and area control operations including the following:
  - controlling traffic signals, signs, and intelligent transport devices
  - managing imposition and lifting of temporary speed restrictions
  - managing headways
- stabling yard or facility operations including the following:
  - managing fleet asset acceptance operations (into yard)
  - managing fleet asset despatch operations (out of yard)
  - managing fleet asset stabling movements (within yard)
- fleet depot or facility operations including the following:
  - managing fleet asset inspection and condition monitoring operations
  - fleet asset vacuuming, presentation, and graffiti removal operations
  - managing fleet asset depot security operations
- vehicle or vessel operations including the following:
  - booking on with the duty manager at the start of a service shift
  - booking off with the duty manager at the end of a service shift
  - entering fleet asset and safely starting up services on an asset at a stabling yard at start of shift
- station or transport interchange operations including the following:
  - opening station or interchange to passengers (initial conditions, process, communications, facilities, actions)
  - closing station or interchange to passengers (initial conditions, process, communications, facilities, actions)
  - responding to a major station or interchange incident

- freight terminal operations including the following:
    - managing road freight or bulk material transport into and out of the terminal
    - managing maritime freight vessels into and out of the port terminal
    - handling and transfer of freight or bulk material from one transport mode to another
- security operations including the following:
    - remote security monitoring of stations, interchanges and facilities
    - remote security monitoring of the rail or road corridor
    - remote security monitoring of fleet assets.

Geographic operations are defined into specific transport routes, services and operations. Examples include the following:

- NSW heavy rail network map
- Newcastle metropolitan diagram
- Outer Sydney metropolitan network diagram.

Figure 1 describes a layered view of operations within the TfNSW transport network centred on rail assets. The layers are as follows:

- the outer layer identifies all modes of transport
- the second layer indicates the fleet asset network operations and operational interfaces with other transport modes
- the third layer identifies all services in terms of routes that comprise the fleet asset network collection of operations
- the core layer identifies the main operational process areas that apply to fleet assets, for example, area operations, interchange operations, depot operations, fleet stabling operations and finally all these operations coordinated by fleet asset operations.

Likewise, Figure 2 describes a layered view of TfNSW transport network centred on bus assets and Figure 3 describes a layered view of TfNSW transport network centred on ferry assets.

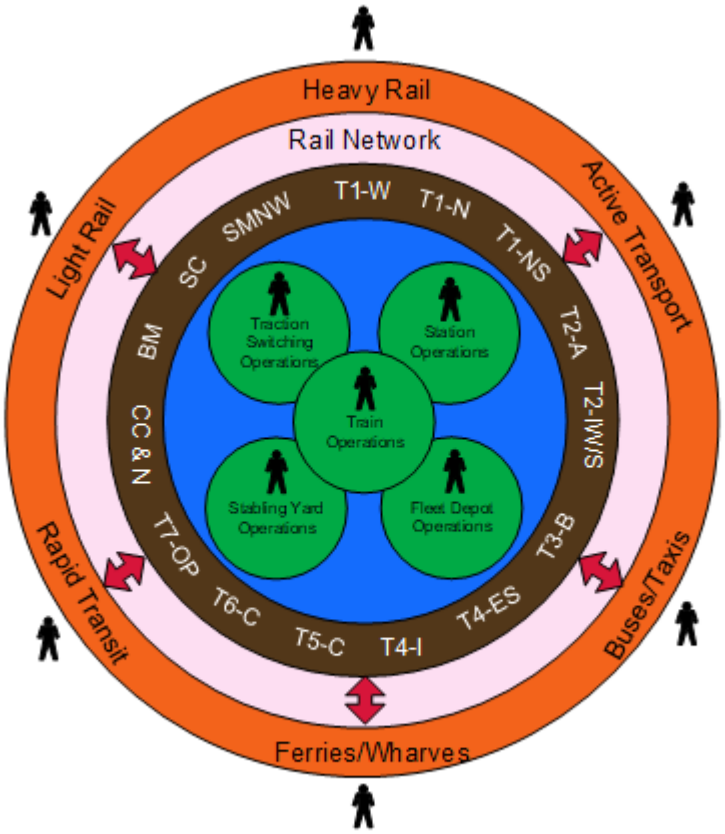

Figure 1 – Passenger rail operational layers and context

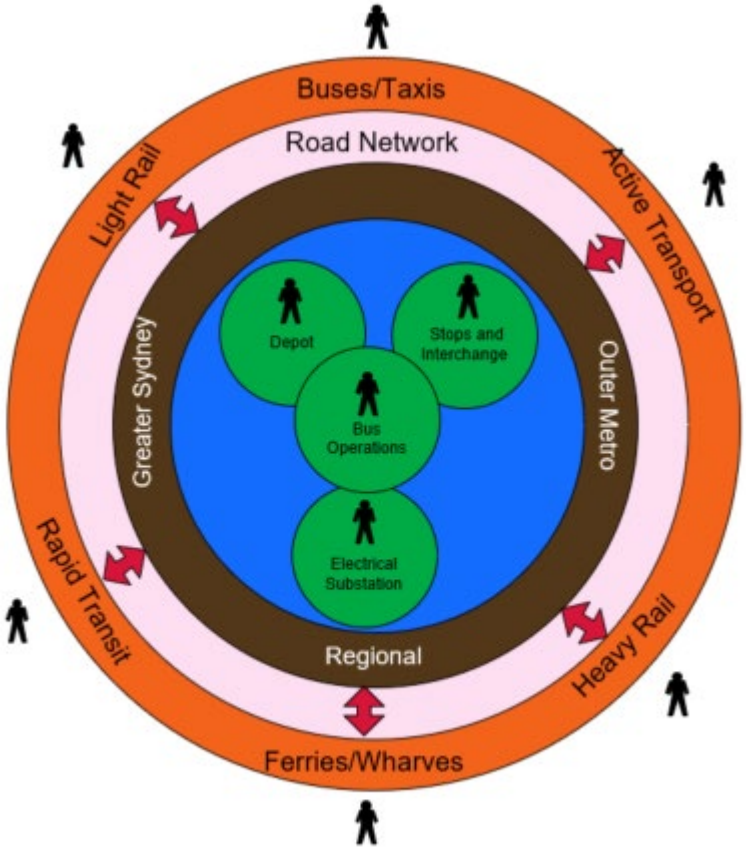

Figure 2 – Bus operational layers and context

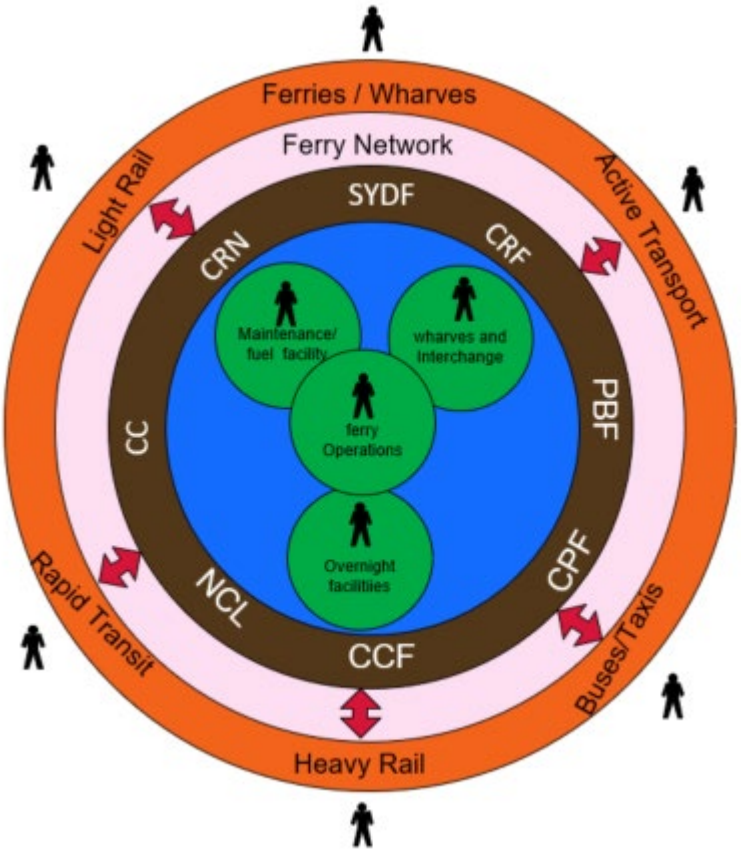

Figure 3 – Ferry operational layers and context

15 Operational user types and other actors

In developing the OCD, the roles and associated responsibilities of operational users, including operators, maintainers, passengers, and the public and external parties such as emergency services should be identified.

TS 01472 contains a requirement concerning the identification of operational users.

Operational users to be identified in an OCD may include, but are not limited to, the following:

- transport network management operators (for example in the Transport Management Centre)
- line, route or corridor management operators
- signal or area control operators (for example in the Rail Operations Centre or distributed signal boxes)
- fleet asset maintenance operators
- fleet depots facility operators, including yard master, yard operations staff, yard security staff and presentation staff

- fleet maintenance facility operators, including fleet facility manager, fleet facility operations staff and fleet facility security staff
- freight terminal operators
- asset operators, including third party operators and asset owners, including duty manager, drivers, crew
- transport interchange operators such as manager, staff, and security staff
- maintainers for the following disciplines:
    - civil and structures
    - asset infrastructure
    - electrical
    - signalling
    - communications
    - fleet
- site managers and staff for pavement; traffic signals; signs; intelligent transport devices, and asset infrastructure delivery projects
- fare-paying passengers, non-fare customers using facilities in and around the station and interchange and freight customers
- emergency services personnel such as fire brigade, ambulance and police
- security control personnel, monitoring and contract guard operators
- utility owners and operators, for example, for electricity, water and gas.

TS 01472 contains a requirement concerning operational users' responsibilities, accountabilities and informing in relation to operational process scenarios.

The OCD may use a RACI (Responsible, Accountable, Consult, Inform) matrix to summarise responsibilities, accountabilities, consulting and informing of operational users against the operational process scenarios.

TS 01472 contains a requirement concerning operational user skills, training or retraining that result from asset changes.

Changes in operations from existing operational arrangements may require a skills assessment or reassessment to determine if current operational staff competencies match the tasks to be performed under new operational arrangements. For example, the introduction of driver only operation (DOO) may create additional tasks in terms of managing the stopping place vehicle interface.

Identification of operational users and their interaction with operational assets and processes should consider human factors as explained in TS 04976.

16 Operations migration

TS 01472 specifies requirements concerning operations migration.

Due to the complex nature of integrated fleet asset operations, and the need to maintain services safely while introducing new or altered systems to meet a new operational need, making a full change in a single step is generally impractical. For example, the road network is still required to be available to people safely while improvements or changes in configuration are being completed.

The normal approach is to plan and execute the migration from existing to future operations as a series of intermediate configurations, while supporting interim timetables and services.

16.1 Existing operations

The OCD should describe the baseline existing operations against which the introduction of the new or altered assets and associated operations will take place.

16.2 Future operations – interim

The implementation of a highly complex new or altered system onto the transport network is unlikely to occur in a single stage of work.

New or altered systems may be introduced in a series of interim stages. The OCD should describe the operational migration arrangements associated with these interim stages.

16.3 Future operations – final

Once all interim stages are completed, the OCD should describe the future final proposed change for new or altered systems and the associated operations involved.

16.4 Migration arrangements

TS 01472 contains a requirement concerning migration arrangements.

The operational migration arrangements associated with introducing new or altered transport systems should be clearly identified to ensure that the integrity of existing transport network assets and associated operational availability and safety is maintained, so far as is reasonably practicable.

Migration arrangements may include, but are not limited to, the following:

- safety – how existing operational safety will be maintained or improved
- efficiency – how operational efficiency will be maintained or improved
- contingency – fall back and business continuity arrangements during the migration
- rules – any minor or major changes to operational rules to accommodate the migration
- processes – interim changes to operational processes to accommodate the migration
- assets – interim changes to existing operational assets to accommodate the migration; in software-based systems, this could involve hardware or software changes
- people – interim organisational changes, including changes in responsibility and accountability, as well as interim skills changes.

17 Operational interfaces

TS 01472 contains requirements concerning operational interfaces within the operation itself and with other organisations.

An OCD should include operational interfaces that involve changes in technology or operational philosophy or responsibility.

Consideration should be given while identifying and defining operational interfaces when developing an OCD.

Examples of what may be considered include the following:

- internal or external operational interfaces
- operational roles (identification of communicating parties)
- means of communication (voice, data, video, visual/audio)
- what is communicated (decisions, information sharing, actions)
- communications protocol and process (direction, acknowledgement, allocation of responsibility).

All operational interfaces should be recorded centrally so that they can be independently reviewed by multiple operational stakeholders, in line with agreed performance measures, timetable and other operational measures.

Changes to operational interfaces should be under configuration control.

17.1 Internal operational interfaces

Networks have many internal operational interfaces, and the OCD should describe the way these operational interfaces work. These internal operational interfaces may include, but are not limited to, the following:

- network management, including line control and infrastructure control
- signal and area control
- stations and interchanges
- fleet assets
- fleet depots, stabling yards and maintenance depots.

17.2 External operational interfaces

The transport networks have external operational interfaces to other transport modes. The OCD should describe the way these operational interfaces work.

Other external interfaces may include, but are not limited to, the following:

- police, fire and ambulance services
- state emergency services
- transport accident investigators
- regulators and statutory corporations
- bridge owners.

18 Operational states and modes

TS 01472 contains a requirement concerning operational modes.

The nature of complex systems such as the transport system is that they can completely fail or partially fail. In order to address this issue, the following states should be identified:

- how the system may fail
- to what extent it may fail
- the arrangements needed to be in place to ensure some suitable level of business continuity until full functionality and performance are restored.

Operating modes may include the following:

- normal mode
- interim or abnormal mode, for example, special sporting events

- degraded mode (includes fault mode where failure has occurred and operation is limited)
- emergency mode, for example, incident recovery, security, backup control
- maintenance or possession mode.

18.1 Normal mode

Normal operations are the default and should be described in operational process scenarios.

18.2 Interim or abnormal mode

The OCD should identify and describe how interim or abnormal operations are conducted.

Interim or abnormal modes do not necessarily imply degraded operations but relate to special events where deviations from normal operations may be required.

18.3 Degraded mode

Degraded operations cover situations where full operational capability, including functionality or performance, is not achievable due to degraded physical asset or human performance.

The OCD should identify degraded operations and how they are managed.

18.4 Emergency mode

Emergency mode covers situations where full operational capability, including functional and performance capability, is severely degraded or completely lost due to a catastrophic system event, including physical asset or human failure.

The OCD should identify emergency operations and how they should be managed.

18.5 Maintenance or possession mode

The OCD should identify maintenance or possession mode (or service or road closure) operations, for example, service arrangements around weekend or night-time track work. The management of maintenance or possession mode operations should also be identified.

18.6 Response and recovery to normal mode

TS 01472 contains a requirement detailing response and recovery to normal mode.

The aim of the incident management and control organisation and processes is to safeguard customers, employees and assets during incidents, and to facilitate return of services to normal. There can be more than one normal mode. For example, lane control and tidal flow systems can have one normal mode for ‘most of the day’ and one for a small part of the day. These are often called ‘am peak’ and ‘other times’, rarely there is a third for pm peak.

The OCD should describe the incident management and control organisation and operating modes other than normal mode, where the organisation is required to implement special command and control processes.

Appendix A Fleet asset information

Table 1 outlines the fleet assets relevant to this guide.

Table 1 – Fleet asset categories and details

Fleet asset	Fleet type or vehicle categories	Detail
Rail	Heavy rail, Light rail, Metro rail	Locomotive, carriage, rail car, rail motor, light rail vehicle, train, tram, metro, light inspection vehicle, self-propelled infrastructure maintenance vehicle, trolley, wagon or monorail vehicle, but does not include a vehicle designed to operate both on and off a railway when the vehicle is not operating on a railway; (*Rail Safety National Law (NSW)*)
Bus	MD – Light omnibus	An omnibus with a Gross Vehicle Mass not exceeding 5.0 tonnes.
Ferry	Passenger	Ferry
Ferry	Car ferry	Car ferry, cable ferry
Ferry	Maintenance	Punt, pontoons, work boat (powered) and boat (unpowered).

Appendix B Compliance to ISO/IEC/IEEE 29148:2018

Table 2 shows the alignment of information contained in this guide with ISO/IEC/IEEE 29148:2018.

Table 2 – TS 01463 alignment with ISO/IEC/IEEE 29148:2018

ISO/IEC/IEEE 29148:2018 section	TS 01463 (this guide) section
A.2 Operational concept document (OpsCon)	7 Operational concept definition development
A.2.2.2 Identification	7.5 Operational Concept Definition process
A.2.2.4 System overview	13 Operational assets and facilities
A.2.4 Current system or situation	13 Operational assets and facilities
A.2.4.2 Background, objectives and scope	7.7. Resources and tools for developing an operational concept definition 8.1 Transport objectives 13.1 Existing asset and facility description 16.1 Existing operations
A.2.4.3 Operational policies and constraints	9 Assumptions, dependencies and constraints
A.2.4.4 Description of the current system or situation	13 Operational assets and facilities
A.2.4.5 Modes of operation for the current system or situation	18 Operational states and modes
A.2.4.6 User classes and other involved personnel	15 Operational user types and other actors
A.2.4.6.1 Organizational structure	15 Operational user types and other actors
A.2.4.6.2 Profiles of user classes	15 Operational user types and other actors
A.2.4.6.3 Interactions among user classes	17 Operational interfaces
A.2.4.6.4 Other involved personnel	17.2 External operational interfaces
A.2.4.7 Support environment	8.1.8 Maintenance depot capability
A.2.5 Justification for and nature of changes	8.2 Rationale for operational change
A.2.5.2 Justification for changes	8.2 Rationale for operational change
A.2.5.3 Description of desired changes	8.1 Transport objectives
A.2.5.4 Priorities among changes	8.2 Rationale for operational change
A.2.5.5 Changes considered but not included	8.1 Transport objectives
A.2.5.6 Assumptions and constraints	9 Assumptions, dependencies and constraints
A.2.6 Concepts for the proposed system	8.1 Transport objectives
A.2.6.2 Background, objectives and scope	13.2 Future asset and facility description 16.2 Future operations – interim 16.3 Future operations – final
A.2.6.3 Operational policies and constraints	9 Assumptions, dependencies and constraints

ISO/IEC/IEEE 29148:2018 section	TS 01463 (this guide) section
A.2.6.4 Description of the proposed system	13.2 Future asset and facility description
A.2.6.5 Modes of operation	18 Operational states and modes
A.2.6.6 User classes and other involved personnel	15 Operational user types and other actors
A.2.6.6.2 Organizational structure	15 Operational user types and other actors
A.2.6.6.3 Profiles of user classes	15 Operational user types and other actors
A.2.6.6.4 Interactions among user classes	15 Operational user types and other actors 17 Operational interfaces
A.2.6.6.5 Other involved personnel	15 Operational user types and other actors
A.2.6.7 Support environment	13.2 Future asset and facility description
A.2.7 Operational scenarios	14 Operational process scenarios
A.2.8 Summary of impacts	16 Operations migration
A.2.8.2 Operational impacts	10 Operational risks 11 Operational impacts
A.2.8.3 Organizational impacts	16 Operations migration
A.2.8.4 Impacts during development	16 Operations migration
A.2.9 Analysis of the proposed system	8.1 Transport objectives
A.2.9.2 Benefits	8.2 Rationale for operational change
A.2.9.3 Disadvantages and limitations	8.2 Rationale for operational change
A.2.9.4 Alternatives considered	8.2 Rationale for operational change

Appendix C Operational concept graphics

Figure 4 illustrates how a heavy rail network system may be applied as an operational concept, showing a selection of various operational assets, facilities, stakeholders, users and operational interfaces.

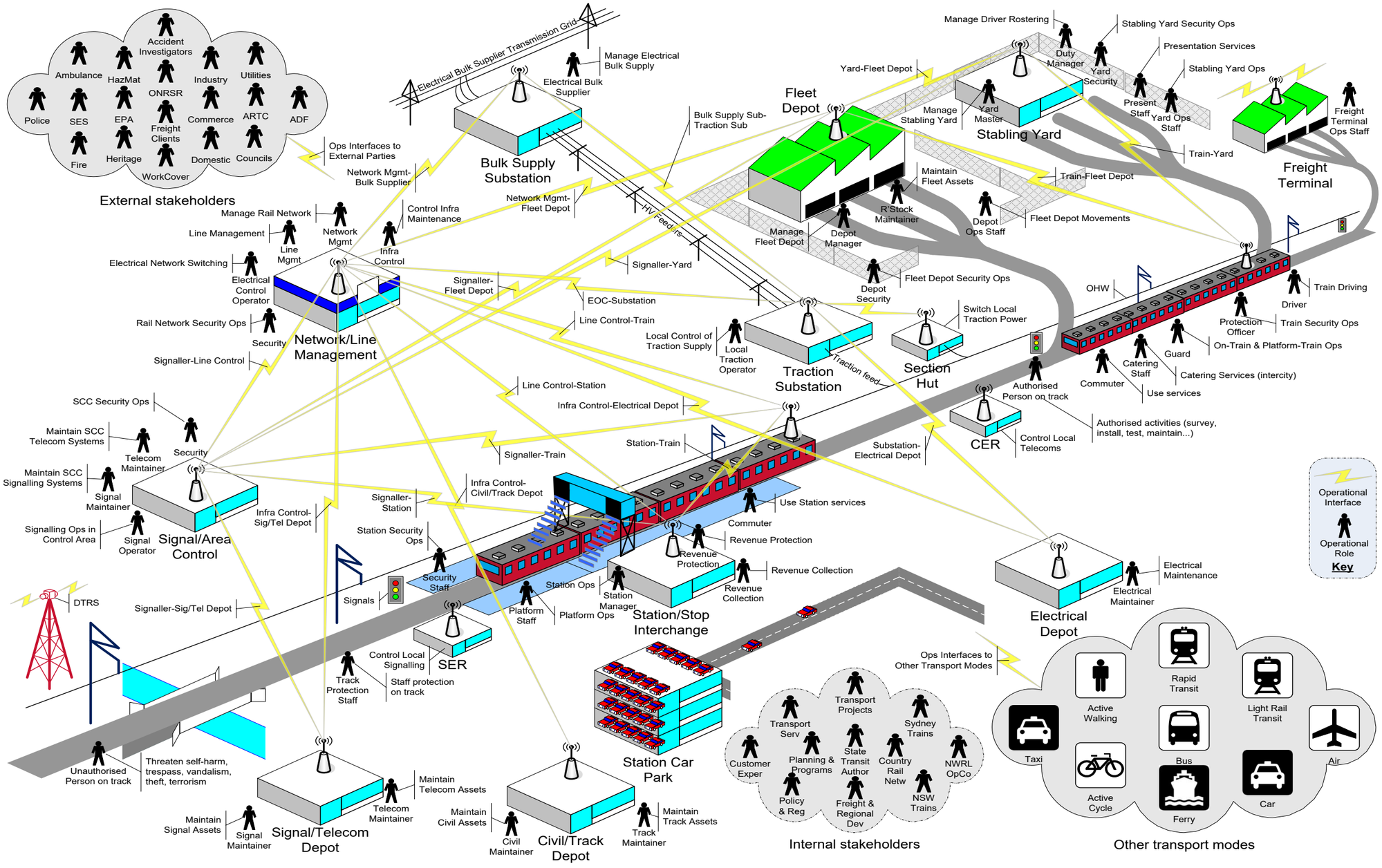

Figure 4 – Heavy rail network operational concept

Figure 5 illustrates how a bus network system may be applied as an operational concept.

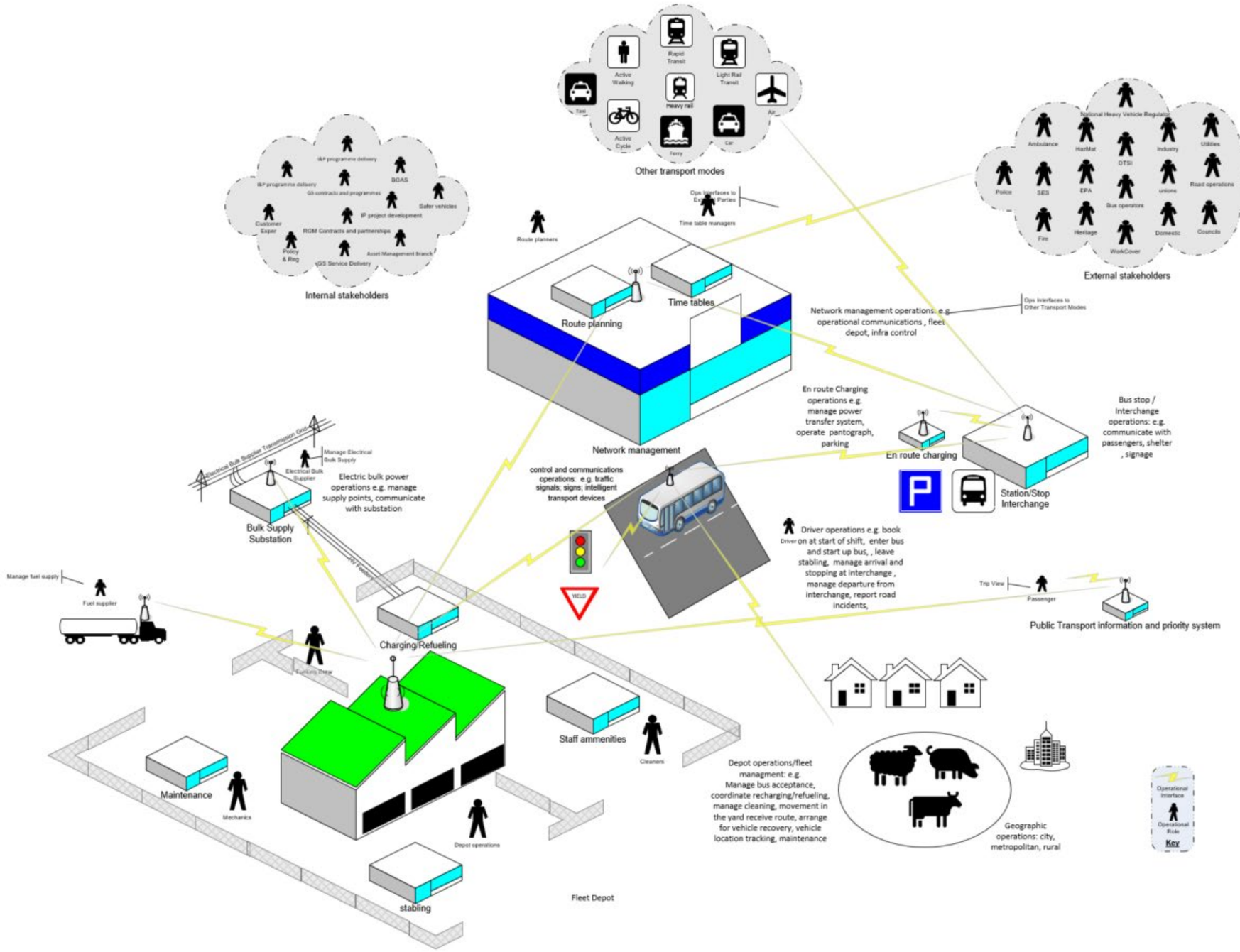

Figure 5 – Bus network operational concept

Figure 6 illustrates how a ferry network system may be applied as an operational concept.

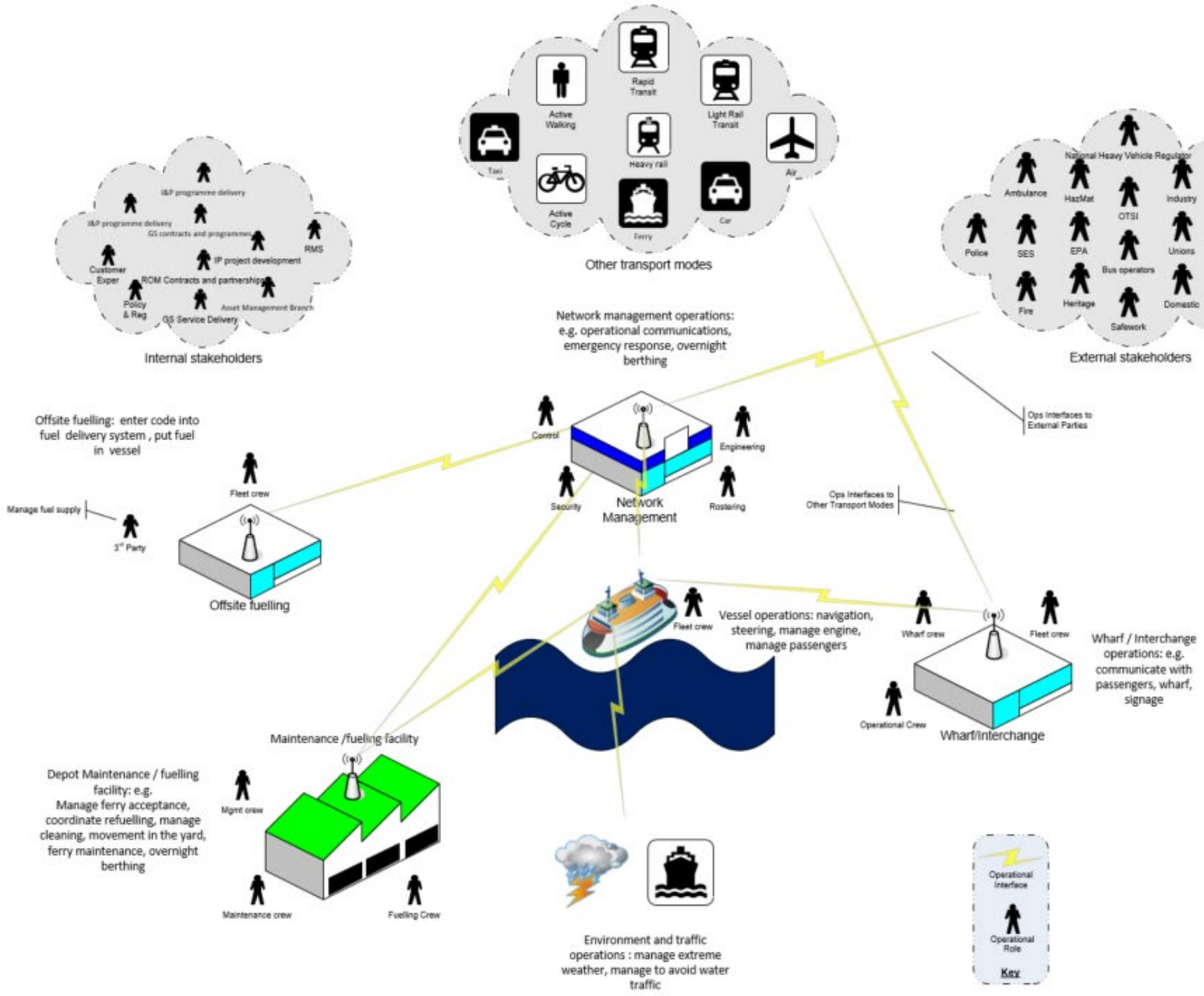

Figure 6 – Ferry network operational concept