For queries regarding this document
standards@transport.nsw.gov.au
www.asa.transport.nsw.gov.au

Technical Note - TN 078: 2016

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Subject: Principles, standards and high level design parameters for the development of light rail systems

This technical note has been issued as an update to TN 025: 2016, covering the same Subject that has been withdrawn. This covers an update to Section 2.2 *Technical standards* and minor typographical corrections have been made.

This technical note has been issued by the Asset Standards Authority (ASA) to describe the principles, high level design parameters and list the standards that are determined by Transport for NSW (TfNSW) as applicable to light rail systems delivered to TfNSW. Application of these principles, standards and high level design parameters in the development of light rail systems will provide whole of life economic benefits for all current and future TfNSW light rail networks.

This technical note specifically applies to staff within the TfNSW cluster involved in the early planning of TfNSW light rail networks. The design parameters included in this document shall be used as inputs in the early concept designs for the light rail systems to influence route selection. This technical note may be followed by other technical notes that cover additional aspects of planning and design of TfNSW light rail systems. These technical notes will be replaced by a suite of TfNSW light rail standards that will be progressively developed to cover all asset life cycle phases.

TfNSW mandates early engagement with the ASA during the development of light rail early concept designs and route selection. ASA acknowledges that the design parameters listed in this technical note are in the early stages of development.

Any deviations or suggestions for improvement that are required to achieve the desired and favourable asset and service outcomes shall be submitted to ASA for consideration via email at standards@transport.nsw.gov.au.

1. Principles and outcomes

The following principles shall be applied in the selection of routes and the development of future TfNSW light rail networks:

- Achieve efficiencies in procurement and asset management over the life cycle of any existing and new light rail assets.
- Maximise the safety, reliability and efficiency in maintenance, for the operation of service through design and in the route selection for the light rail network.
- Gain procurement efficiencies by considering the whole of life asset management of any existing and new light rail assets.
- Ensure that a range of future options remain available for future light rail vehicle procurement, that is, interchange of existing light rail vehicles on other (existing or new) light rail networks.
- Gain efficiencies in the procurement, on-going management and operation of high cost long lead time items, critical equipment (for example, sharing of specialty maintenance equipment such as wheel lathes) and spares (for example, substation transformers).
- Ensure that opportunities for future asset maintenance and renewal programs are not compromised by any short term procurement decisions.
- Achieve consistent passenger experiences across all light rail networks and between transport modes.
- Achieve consistency in the interfaces with and the expectations of other road users, including car drivers and vulnerable road users, across all current and future light rail networks within New South Wales (NSW). Where possible, ensure that the expectations are aligned with the experiences of other road users nationwide.
- Consider a range of emerging road vehicle and traffic control technologies that ensure synergy with other Transport initiatives.
- Ensure that a systems engineering approach is applied to light rail projects and programs across the system and asset life cycle.
- Where light rail alignment integrates with the road environment, ensure that road safety risks are appropriately addressed for all road users across all current and future light rail networks in NSW.

The application of the principles can be scalable depending on the size and complexity of the light rail network.

The following outcomes are expected as a result of applying the stated principles:

- A common light rail vehicle standard will be derived to ensure interchangeability and interoperability between current and future light rail networks. A common light rail vehicle standard will also drive standardisation of infrastructure elements.
- Consistent customer interface standards will be developed across light rail networks.
- Similar driver and operational interfaces across networks that deliver operational efficiencies will be achieved.
- High level governance, assurance, asset management and configuration control standards will be applied across future light rail networks that are common with other modes and deliver efficiencies in whole of life asset management practices.
- The most appropriate alignment will be selected for the proposed light rail route from a selection of segregated, separated or mixed routes. Segregation reduces the likelihood of incidents and transit times. The alignment options, in the order of preference, for route selection are as follows:

    1. Segregated - A dedicated corridor for light rail use only to which access for other road and rail traffic, and pedestrians are controlled.
    2. Separated - An alignment that is intended for exclusive use by light rail but integrated into the road space in such a way that occasional access by other traffic and pedestrians is possible.
    3. Mixed - An alignment fully integrated into the road space used by light rail, road traffic and pedestrians.

    Where light rail alignment integrates with the road space or creates interchanges that facilitate the movement of pedestrians between transport modes, or both, TfNSW mandates that the Transport planning teams engage the Centre for Road Safety for the implementation of road safety audits within light rail projects and programs, and agree on the staging of audits during the different stages of design and construction. This engagement shall include exploring the minimum vehicle safety requirements of construction vehicles used for current and future light rail networks, to manage the increased safety risks for other road users generated from construction activities.

    Speed zone reviews shall be conducted by Roads and Maritime Services (RMS) in consultation with the Centre for Road Safety for any light rail networks within the road environment.

2. TfNSW standards

Section 2.1 provides the overarching standards that apply across all modes of transport and are applicable to future light rail. Section 2.2 provides a list of technical standards that are deemed applicable for future TfNSW light rail projects and programs.

2.1. Overarching standards

TfNSW has nominated the overarching standards published under the following headings on the ASA website as applicable to future TfNSW light rail projects and programs:

- All disciplines
- Asset management
- Authorised Engineering Organisations
- CAD (including drawings lodgement criteria)
- Competency
    - Exclusion: T MU CY 04000 ST *Competency Pathways - Control Systems*
- Configuration control
    - Exclusion: TN 003: 2013 version 2 *Change Authorisation Process for Proposed Operating Diagrams*
- Environmental services
- Human factors
- Security standards
- Systems engineering

The latest published versions of the overarching standards at the time of establishing a project or contract shall apply.

TfNSW safety management standard 30-SD-492 *Safety Risk Tolerability and Targets* (and all relevant TfNSW safety management system requirements) shall also be applied to future light rail projects and programs. These documents are available to external parties on request by contacting the ASA via email at ASARisk@transport.nsw.gov.au.

In addition to the standards published on the ASA website, the Austroads publications and RMS publications applicable to road traffic and road construction shall be considered.

2.2. Technical standards

TfNSW has nominated the technical standards specified in Section 2.2.1 to Section 2.2.7 as applicable to light rail. Where a particular requirement is found not to be directly applicable to the light rail environment, the intent of the standard shall be considered applicable. Many of the standards listed below may only apply to segregated alignments. The Transport planners and designers shall assure and validate the standards that they adopt. TfNSW mandates early engagement with the ASA regarding the application of light rail standards.

2.2.1 Civil

T HR CI 12008 ST *Load Rating of Underbridges*

T HR CI 12030 ST *Overbridges and Footbridges*

T HR CI 12060 ST *Retaining Walls*

T HR CI 12065 ST *Station Platforms*

T HR CI 12070 ST *Miscellaneous Structures*

T HR CI 12075 *Airspace Developments*

T HR CI 12080 ST *External Developments*

T HR CI 12100 ST *Geotechnical Risk Assessment and Hazard Management*

T HR CI 12101 ST *Geotechnical Problem Management*

T HR CI 12130 MA *Track Drainage*

T HR CI 12130 ST *Track Drainage*

T HR CI 12160 ST *Boundary Fencing*

T HR CI 12190 ST *Service Installations within the Rail Corridor*

T HR CI 12200 ST *Access Roads*

ESC 340 *Tunnels*

ESC 520 *Level Crossings*

SPC 301 *Structures Construction*

2.2.2 Electrical

T HR EL 12002 GU *Electrolysis from Stray DC Current*

T HR EL 20003 ST *Underground Installation Configurations for High Voltage and 1500 V dc Cables*

SMS-06-GD-0268 *Working around Electrical Equipment*

2.2.3 Rolling stock

T HR RS 00117 ST *Electric Circuits & Equipment for Passenger Rolling Stock*

T HR RS 00126 ST *Electronic Equipment Supplied for Passenger Rolling Stock*

T HR RS 00164 ST *Cable for Passenger Rolling Stock*

T MU RS 01000 ST *Structural Integrity and Crashworthiness of Passenger Rolling Stock*

T MU RS 17001 ST *Environmental Conditions for Rolling Stock*

T MU RS 17002 ST *Prohibited and Restricted Materials*

2.2.4 Security

T MU SY 10001 ST *Public Transport Closed Circuit Television (CCTV) Functional Requirements*

2.2.5 Stations and stops

T MU SS 70001 ST *Foundations and Tie-Downs for Portable Buildings*

T MU SS 90001 ST *Safe Pedestrian Surfaces*

T MU SS 90002 ST *Shelter at Railway Stations and Interchanges*

T MU SS 90007 ST *Bicycle Facilities.*

2.2.6 Telecommunications

T HR TE 01001 ST *Communication Outdoor Cabling*

T HR TE 01002 ST *Signalling Bungalow Communications Cabling*

T MU TE 21001 ST *Equipment Rooms and Cubicles*

T HR TE 21002 ST *Communications Earthing and Surge Suppression*

T HR TE 21003 ST *Telecommunications for Traction Substations and Sections Hut*

T HR TE 41001 ST *Packet Switched Networks Wired - Local, Metropolitan, and Wide Area Networks*

T HR TE 41002 ST *Wireless Data Communication in LIPD Class Licensed Bands*

T MU TE 41003 ST *Radiocommunication in LIPD Class Licensed Bands*

T MU TE 41004 ST *Packet Switched Networks – Wireless Local Area Networks*

T MU TE 61005 ST *Customer Information Systems for Public Transport Buildings and Conveyances*

T HR TE 81001 ST *Telecommunication Equipment – Physical Interfaces and Environmental Conditions*

T HR TE 81002 ST *Telecommunication Equipment – Network Management*

T MU TE 81003 ST *Test Processes and Documentation for Programmable Electronic Systems and Software*

The standards that are currently under development and which can apply to light rail are as follows:

- T MU TE 61006 ST *Help Points Technical Requirements*
- T MU TE 61007 ST *Clock Synchronisation of Networked Systems*

2.2.7 Track

T HR TR 00111 ST *Rail Lubrication*

T HR TR 00192 ST *Ballast*

T HR TR 13000 ST *Railway Surveying*

ESC 200 *Track System*

ESC 210 T*rack Geometry and Stability*

ESC 215 *Transit Space*

ESC 220 *Rail and Rail Joints*

ESC 230 *Sleepers and Track Support*

ESC 250 *Turnouts and Special Trackwork*

SPC 206 *Track Construction*

SPC 207 *Track Monitoring Requirements for Undertrack Excavation*

SPC 213 *Trackside Signs*

SPC 221 *Insulated Joint Assemblies*

SPC 232 *Concrete Sleepers*

SPC 233 *Concrete Turnout Bearers*

SPC 234 *Resilient Fastenings*

SPC 235 *Resilient Baseplates*

SPC 251 *Turnouts and Special Trackwork Components*

TMC 221 *Rail Installation and Repair*

TMC 222 *Rail Welding*

TMC 223 *Rail Adjustment*

TMC 224 *Rail Defects and Testing*

TMC 225 *Rail Grinding*

TMC 226 *Rail Defects Handbook*

TMC 227 *Surface Defects in Rails*

3. High level design parameters

The principle of interchangeability of rolling stock defines the light rail infrastructure design parameters. Table 1 includes the critical design requirements that shall be used as inputs to the light rail system early concept designs and influence route selection. Application of these parameters will support the asset management principles and outcomes described in Section 1.

Table 1 – Design parameters and values

Design parameters	Value
Nominal voltage	750 V dc
Traction substation spacing	1500 m typical
Traction substation size	80 sq m typical
Electrical clearance (static)	100 mm
Nominal contact wire height	5500 mm
Conductor system	Contact only or simple catenary
Conductor tensioning	Auto-tensioning using balance weights
Civil structures - design	In accordance with AS 5100 *Bridge Design* Design live load - TBA
Civil structures - construction	In accordance with SPC 301 *Structures Construction*
Track gauge	Standard gauge of 1435 mm
Horizontal alignment – minimum curve radius	Straight through stops Other than stops: preferred minimum 25 m
Vertical alignment – maximum track grade	No more than 2.5% through stops Other than stops: preferred maximum 3.5% Other than stops: absolute maximum 7%
Nominal track centres (not including clearances to overhead wiring poles)	Desirable 3650 mm Minimum 3450 mm To be tailored to specific location during later stages of design
Vehicle developed kinematic envelope (DKE) width	To suit light rail vehicles chosen for system Nominally 3200 mm
Stop platform length	To suit light rail vehicles chosen for system
Stop accessibility	Stops and stop access paths shall comply with the *Disability Discrimination Act 1992* and the *Disability Standards for Accessible Public Transport 2002* Stop access shall be through a signalised pedestrian crossing where people are required to cross a road traffic lane to access a stop
Light rail vehicle axle load	12.5t maximum
Signalling	Line of sight system, supplemented by signals to regulate potential conflicts between light rail vehicles (LRVs), road vehicles and pedestrians at road intersections and between LRVs at track junctions
Speed limits	Common speed limits in pedestrian and road areas across different light rail networks

Authorisation:

	Technical content prepared by	Checked and approved by	Interdisciplinary coordination checked by	Authorised for release
Signature				
Date				
Name	Robert Bennett	Toby Horstead	Peter McGregor	Graham Bradshaw
Position	Manager Asset Management Framework	Principal Manager Network and Asset Strategy	A/Chief Engineer	Director Network Standards and Services