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Transport  
for NSW

# Light Rail Stop Design Guideline



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## **Acknowledgments**

This guide has been prepared by Grimshaw Architects and Transport's Urban Design Team (Public Transport and Precincts) with contributions from across the transport cluster and design consultants from recent light rail projects.

Image Sources are noted are listed in the Appendix

April 2024

TfNSW 23.070 ISBN 978-1-922875-98-3

**Figure 1. Cover page** - Moore Park light rail stop (CSELR)

**Figure 2. Opposite page** - Customers crossing the tracks (IWLR)

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Dulwich Hill

Next service 1 min  
Star from 23:45 to 06

Tap on  
Tap off

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# Acknowledgement of Country

Transport for NSW acknowledges the traditional custodians of the land on which we work and live.

We pay our respects to Elders past and present and celebrate the diversity of Aboriginal people and their ongoing cultures and connections to the lands and waters of NSW.

Many of the transport routes we use today – from rail lines, to roads, to water crossings – follow the traditional Songlines, trade routes and ceremonial paths in Country that our nation’s First Peoples followed for tens of thousands of years.

Transport for NSW is committed to honouring Aboriginal peoples’ cultural and spiritual connections to the lands, waters and seas and their rich contribution to society.

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**Figure 3. Opposite page** - Indigenous artwork by Bronwyn Bancroft in stop shelter (IWLR, Glebe)



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# Glossary

AFFL	Above Finished Floor Level
AS	Australian Standards
BCA	Building Code of Australia
BIM	Building Information Modelling
BS	British Standards
CCTV	Closed Circuit Television
CSR	Combined Services Route
CSELR	Sydney CBD & South-East Light Rail project
DA	Development Application
DDA	Disability Discrimination Act
DKE	Dynamic Kinematic Envelope
DSAPT	Disability Standards for Accessible Public Transport
EMC	Electromagnetic Compatibility
ETS	Electronic Ticketing System
FFL	Finished Floor Level
FLR	Fixed Location Reader (Opal Tap On/Off)
IWLR	Inner West Light Rail Project
OCS	Overhead Catenary System
OHW	Over Head Wiring
NLR	Newcastle Light Rail
NZS	New Zealand Standards
PA	Public Address
PEHP	Passenger Emergency Help Point
PID	Passenger Information Display
PLR	Parramatta Light Rail
PLRC	Permanent Light Rail Corridor
SEPP	State Environmental Planning Policy
SPR	Scope and Performance Requirements
SSM	Single Service Machine
STA	State Transit Authority
TFNSW	Transport for New South Wales
TGSI	Tactile Ground Surface Indicator
UDPTP	Urban Design Public Transport and Precincts

**Figure 4. Opposite page** - Light rail stop in Randwick Town Centre (CSELR)



SYDNEY SURGICAL CENTRE

HIGH ST

NO RIGHT TURN

LEFT LANE MUST TURN LEFT AT BELMORE RD

66 - 168 Belmore Rd 166 - 6

DENTIST

NO ENTRY

ONE WAY



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# 1

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## Purpose of this Document

Transport for NSW is committed to high quality and site responsive light rail stops that make a positive contribution to successful places. This section provides an overview of the document and how to use it.

**Figure 5.** Honeysuckle Precinct in Newcastle (NLR)

## 1.1 Purpose

The purpose of the Light Rail Stop Design Requirements is to define key design principles and functional requirements for Light Rail stops.

This document does not detail the architectural appearance of stops, but rather gives guidance on key space-proofing, interface and coordination issues, design and implementation processes, and overarching architectural considerations to achieve best practice outcomes.

This document establishes a design quality benchmark and ensures the following outcomes are achieved:

- Well designed, future proof, compliant stop environments;
- Optimised planning, design and construction program;
- Lower design costs and avoidance of abortive documentation work;
- Interoperability with light rail systems and other modes;
- Standardised maintenance responsibilities;
- Delivery of consistent high standards of customer experience and brand identity;
- Consistent line identity for light rail as a transport mode; and
- Successful integration with the adjacent public realm

## 1.2 Intended Audience

This document is primarily intended for architects, landscape architects, planners and urban designers involved in the planning and design of light rail stops. Other professionals involved in the planning and delivery of light rail projects may also be using this guide, including but not limited to, engineers, project managers, contractors and operators and others involved in the planning, design and delivery of light rail station projects in NSW.

Providing designers with guidance of the standards, design performance objectives and template solutions enables designers to maximise contextual responses while meeting tight program deadlines. It enables projects to benefit from previous TfNSW knowledge and avoid 'reinventing the wheel' when delivering safe, reliable, cost-effective and customer oriented public transport infrastructure.

Stop designers should use the Light Rail Stop Design Guideline to develop specific architectural components for a Light Rail system, tailored to the specific site conditions while maintaining a uniform approach to customer experience, mode identity and brand. The stop designers should work with TfNSW to develop design options and select those that will meet the requirements for Light Rail stops.

This document is focused on stop planning and design. It does not cover the many other design aspects of light rail projects, particularly the urban design of the light rail corridor, roadways, public domain and landscaping, or the architecture of service infrastructure or depots. This document also assumes project teams identifying light rail corridors are using the Movement and Place Framework and its supporting tools and guidance, such as the Design of Roads and Streets or the Network Planning in Precincts guide

## 1.3 Lessons Learnt

All NSW Light Rail stops must comply with statutory regulations, standards and core transport policy. Synthesising all these requirements into a fully documented, verified, buildable solution for stops takes considerable time and resources.

Project teams on time pressured new projects may try to 'solve' integration problems by reducing customer requirements, ignoring warnings about the systems impacts or deferring coordination issues to on-site, ad-hoc solutions.

This document uses lessons learnt to describe the various architectural components of Light Rail design, establish baseline solutions, provide guidelines for design development and detailing, and describe consequences behind key design decisions.

Most light rail design requirements are set by technical standards, mode and brand consistency. There is no need for project teams to reinvent the wheel. Focus of design resources should be placed on tailoring to local contexts, detailed architectural design and materials selection, coordination and systems integration.

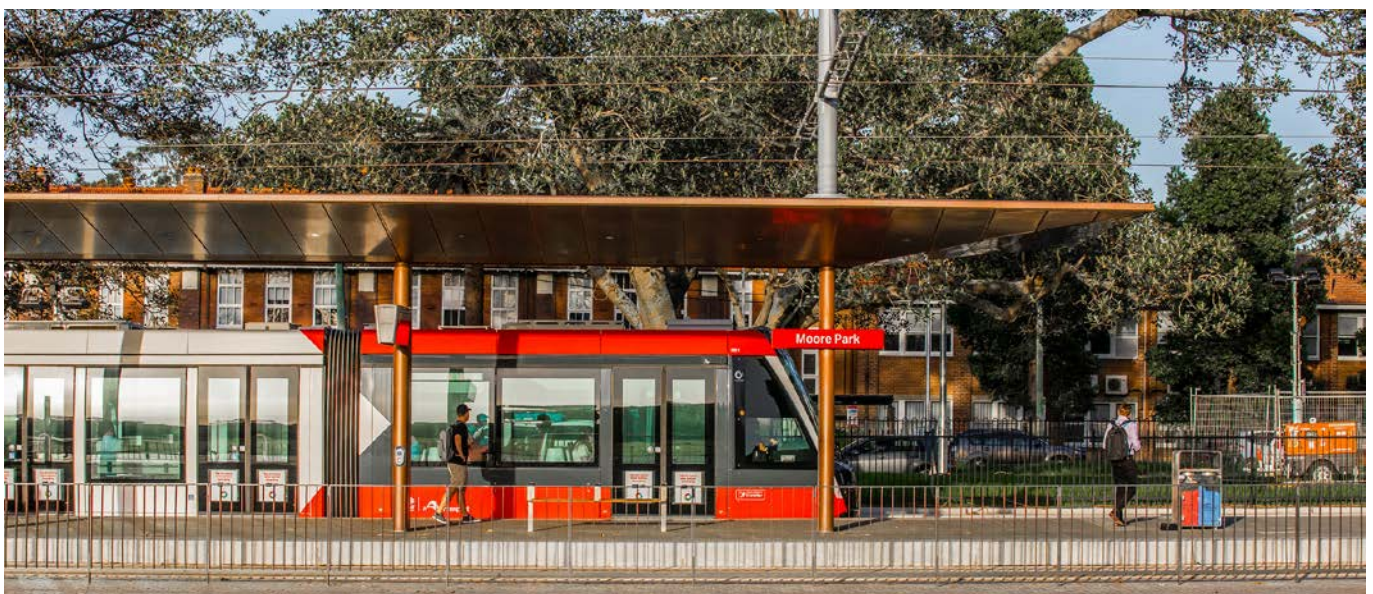
## 1.4 Design and Transport Infrastructure

Good design is NSW Government policy. One of the objects of the Environmental Planning & Assessment Act 1979 is to promote good design and the amenity of the built environment. TfNSW, as a key NSW Government agency building and operating infrastructure in the built environment, has an obligation to do so in a way that complies with NSW Government policy and legislation.

Transport for NSW has strategic goals to achieve successful place including building well-designed infrastructure that makes a positive contribution to the place it serves

TfNSW Urban Design uses the 'Designing with Place' approach to apply consistent design principles, guide contextual solutions and enable Transport projects to make a tangible improvement to places.

Beyond A to B is the headline document of a suite of TfNSW urban design guidance which includes a number of mode specific design guidance. The Light Rail Stop Design Guideline is part of this suite. Together, the TfNSW Beyond A to B Guidelines are instrumental in enabling TfNSW to ensure transport infrastructure is well-designed, delivering on TfNSW's obligation to abide by Government policy, while contributing to Successful Places for communities.



**Figure 6.** Lessons learnt from CSELR informed subsequent projects and this guideline (Moore Park)



**Figure 7.** CSELR created pocket parks and civic spaces as part of the project (Surry Hills)

## 1.5 Project Evolution

The Inner West Light Rail project opened in 1997. Since then, TfNSW has completed three other light rail projects in the CBD and South East Sydney, Newcastle and Parramatta.

With nearly 42km of track and 64 stops already constructed, TfNSW have gained a wealth of experience in delivering this mode of transport.

Even with a strong initial concept on the CSELR project, the design development process took an additional two years due to unforeseen complications, conflicts between requirements and integration that needed to be resolved. This was not only a costly process for the consultants, as the exercise also consumed significant resources across multiple teams in Transport to ensure the outcome balanced all customer, wayfinding, ticketing, asset management, accessibility, lighting, safety, architecture and urban design requirements.

In 2017 TfNSW commissioned a Light Rail Kit of Parts and Industrial Design Template which was a document intended to gather critical lessons learnt from CBD and South East Light Rail and apply them to the roll out of Newcastle and Parramatta Light Rail.

**Figure 8. Opposite page -** IWLR was the first modern light rail project in NSW (Lewisham West)

## 1.6 2023 Review

This document builds on the TfNSW Light Rail Stop and Industrial Design Template (interim issue), includes lessons learnt from Newcastle, Inner West and Parramatta Light Rail projects, consultations with operators and addresses:

- Successful places as a core goal for TfNSW as outlined in the Future Transport strategy;
- City shaping and precinct making, as government priorities for TfNSW;
- New guidance documents such as the Public Art in Transport Infrastructure Guideline;
- The Connecting with Country Framework and its increasing application to transport projects;
- A broader range of built transport projects that constitute best practice case studies; and
- New knowledge gained from experience applying these principles on real projects, including better explanation of how this guidance interfaces with project development and delivery processes to support good place and urban design outcomes.

The lessons learnt from built Light Rail projects has been used in this document to establish a consistent approach to architecture and urban design for future Light Rail projects. The guides in this document have been updated from the previous iteration to address challenges identified through the building process.



Platform 1  
Lewisham West

Lewisham West

Lewisham West

Platform 1

Platform 1

Platform 1



Newcastle Interchange

Towards Newcastle Beach

Plan your trip



Newcastle Interchange

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# 2

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## Technical Context

Designing and constructing Light Rail infrastructure comes with a number of considerations. This section outlines key aspects of working in NSW.

**Figure 9. Opposite page** - Newcastle Interchange illustrates integration with other transport modes (NLR)

## 2.1 What is Light Rail?

Light Rail is a high-capacity, high-frequency public transport mode. It is driver operated and runs on tracks within streets or corridors in shared, separated, or segregated lanes. Light Rail can be powered by electricity from overhead wires, third rail within the track way, batteries recharged at light rail stops or a combination of these. Light Rail stops are fully accessible and integrated into the urban environment. Light Rail offers a turn up and go service removing the need for timetables.

## 2.2 The Permanent Rail Corridor

The Permanent Light Rail Corridor (PLRC) is a legal and contractual zone, owned by TfNSW, and maintained by the Light Rail Operator. The PLRC typically follows the light rail alignment and contains all light rail infrastructure, including, but not limited to:

- Tracks and track slab;
- Power supply, including overhead wiring; and
- Stops and furniture.

However, it is not a contiguous zone. It includes items separated from the light rail alignment, such as substations or drivers facilities, and is also broken by the road surface at intersections. TfNSW requires ownership of the PLRC, so the light rail operator can safely and efficiently operate the light rail system.

TfNSW is responsible for design compliance (particularly accessibility) and maintenance of Light Rail stops as a permanent, new public transport facility.

## 2.3 The Light Rail Stop

The boundary of a Light Rail stop typically includes the full extents of the platform and access ramps at each end of the stop. This definition is particularly relevant to maintenance responsibilities, an interface between the scope of the operator and the local council or adjacent landowner. Note: this is a critical interface on side platforms which are integrated with adjoining footpaths. The Light Rail Stop also includes all associated architecture (canopies, equipment and furniture).

## 2.4 Essential Infrastructure

Signals, power, switchboard and UPS cabinets need to be fully lockable, durable and accessible 24/7 with consideration of working clearances and ergonomics. Ideas to simplify stops by locating infrastructure off stops into existing buildings are often challenged with legal, financial, construction and management issues. TfNSW does not pay commercial lease for infrastructure real estate, so locating elements such as ticketing machines or systems cabinets in nearby building frontages is highly unlikely.

Due to the commercial structure of Transport, even coordination with other operating entities is highly problematic. In addition, the exact number, performance and type of systems cabinets is likely to evolve during design development right up until final documentation phases, so a flexible solution in TfNSW's control is necessary.

A solution to use the customer circulation space and footpath space for service boxes is also typically not acceptable. The robust approach is to provide a dedicated space for services cabinets in a durable integrated service cabinet on the stops and use the external surface for customer information. External surfaces used for technical purposes must be both aesthetically and technically integrated.

TfNSW will not accept an uncoordinated systems approach; a lesson learned in the early phases of the Inner West Extension of the L1 Dulwich Hill line where a proliferation of single use cabinets, boxes, poles, panels and wayfinding signs were installed at stops.

## 2.5 Applicable Standards

An overview of standards relevant to a Light Rail project must be conducted prior to design implementation. In particular relevance of heavy rail, and other non-light rail infrastructure standards and their applicability to light rail are to be reviewed. For system critical areas where Light Rail standards have not yet been developed, TfNSW encourages reviewing solutions offered by countries where a well-established and world class light rail system can be demonstrated.

The primary classification for a public transport facility pursuant to the BCA is a Class 9b.

In cross-border locations such as Tweed Heads, design standards from different states need to be agreed and coordinated for a consistent system and line identity.

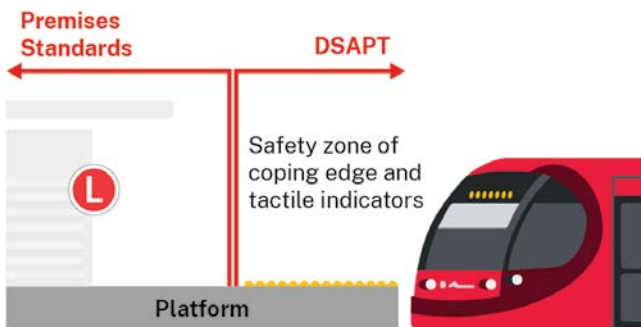
## 2.6 Accessibility

Light Rail stops must comply with the Disability Standards for Accessible Public Transport 2002 (DSAPT) and Premises Standards. The figure below, from TfNSW Transport Standards, shows the delineation between regulatory requirements

DSAPT prescribes national requirements that public transport service providers and facility operators must meet in order to comply with the legislation Disability Discrimination Act. Together, DSAPT, the Premises Standards, and DDA provides key dimensions, and establishes equivalent access and inclusion.

These equivalence standards strongly influence decisions and trade-offs possible in complex urban environments.

TfNSW aims to achieve a universally accessible and safe outcome for all customers beyond the minimal compliance regime of DSAPT. Opportunities to achieve universal accessibility and minimise injuries or falls through learnings from previous incidents should be a design priority.



**Figure 10.** Diagram illustrating delineation between standards extracted from TfNSW Transport Standard, 00045.1:1.0 Application of Disability Standards

## 2.7 Customer Requirements

Design plays a pivotal role in the success and satisfaction of customers using light rail systems. The TfNSW drivers of customer satisfaction are timeliness, information, safety and security, convenience, comfort, cleanliness, accessibility and customer service. First and foremost, an intuitive and thoughtful design enhances the overall customer experience, making it more accessible and user-friendly for a diverse range of passengers. Clear signage, well-planned station layouts, and comfortable seating contribute to a positive journey for customers, reducing stress and confusion commonly associated with public transportation. A well-designed light rail system fosters an efficient and welcoming environment, encouraging more people to choose public transit over private vehicles.

Moreover, design plays a crucial role in safety and security for light rail customers. Thoughtful architectural planning and lighting can contribute to the perception of safety, promoting a secure environment for passengers. Designing stops for the safety of vulnerable populations, such as children and older people, is particularly important, ensuring everyone can navigate and utilise the light rail system comfortably. Research with women and girls through the Safer Cities Program also highlights how design elements such as lighting, seating and technology affect perceptions of security in public transport environments.

In addition to functionality and safety, the aesthetic appeal of the light rail system can significantly impact the customer experience. A well-designed and aesthetically pleasing environment contributes to a positive atmosphere, making the journey more enjoyable for passengers. Incorporating local art, green spaces, and innovative architecture enhances the visual appeal and fosters a sense of community and pride in the transit system. Design that considers the cultural context and identity of the region can create a unique and memorable experience for customers, distinguishing the light rail system as a symbol of local identity.

## 2.8 Ticketing Machines And Opal

Where self service ticket machines are used in NSW, they are consistent for all transport modes. Currently the most commonly used machines offer both cash and card services, Opal top up and single trip tickets. Single trip tickets have historically been an important part of the revenue protection regime, and can only be purchased from a self service machine. Therefore, TfNSW typically requires at least one machine to be provided at each light rail stop. At side platform stops, the machine is typically located on the busiest boarding platform.

The number of ticket machines TfNSW require at a Light Rail stop will depend on demand and location. Site analysis can be done to demonstrate retail opportunities for Opal purchase and top up within the locality, noting opening times and accessible paths. At special event and interchange stops, or where people are unable to move between side platforms, TfNSW may use more machines

In the future, new technologies such as contact-less ticket systems may be introduced, however Opal tickets are and will likely remain a key customer interface requirement.

In NSW, Light Rail customers must tap on before boarding vehicles and tap off after leaving vehicles. This system has faster boarding and disembarking times and reduces excuses for fare evasion. Fixed Location Readers (FLR) on stops are also more robust operationally, as any failures are localised to the affected stop and can be repaired without withdrawing vehicles from operation.

## 2.9 Benchmarks

Consideration must be given to the types of precedents used as benchmarks for new Light Rail systems. For example, Melbourne's tram system is exempt from the Office of the National Rail Safety Regulator that oversees all the new NSW Light Rail systems.

Light Rail projects in NSW are delivered through a State public transport agency, whereas many European systems are owned and administered by city councils. Different project delivery financing and contractual arrangements also compound this complexity, hence the need for a consistent stop solution across all networks. With this context in mind, precedents can be useful in non-spatial and safety topics such as public art and sustainability.

## 2.10 Policy Context

The Light Rail Stop Design Guideline is supported by policies, strategies and guidelines at the State government and agency levels, including:

- Future Transport Strategy, NSW Government;
- NSW Waste and Sustainable Materials Strategy 2041, NSW Government;
- NSW Resource Efficiency Policy 2019, NSW Government;
- NSW Circular Economy Statement 2019, NSW Government;
- Transport Sustainability Plan, NSW Government;
- Transport Environment and Sustainability Policy, TfNSW;
- Sustainable Design Guidelines, TfNSW;
- Beyond A to B, Urban Design Guidelines for Designing with Place in Transport Projects, TfNSW;
- TfNSW Stretch Reconciliation Action Plan (RAP) 2022-2025;
- Connecting with Country Framework, Government Architect NSW (GANSW);
- Better Placed, GANSW; and
- NSW Movement and Place Framework
- Public Art in Transport Infrastructure, Transport for NSW
- TfNSW Wayfinding Guidelines

As major public transport and precinct projects, light rail stops meet the principles of TfNSW's urban design guideline, Beyond A to B, as shown in figure 11. Well designed stops can encourage a shift towards public transport, and a more attractive and healthier urban environment. Design is not merely an aesthetic consideration, but fundamental to city shaping and precinct making responsibilities when building new transport infrastructure.

TfNSW is committed through its Stretch Reconciliation Action Plan (RAP) to genuine and sustainable contributions to reconciliation. The Stretch RAP commits to building and strengthening relationships with Aboriginal people, respecting and celebrating Aboriginal culture and creating opportunities for employment and career development for Aboriginal people. Connecting with Country on Light Rail projects is one way TfNSW will deliver on these commitments.

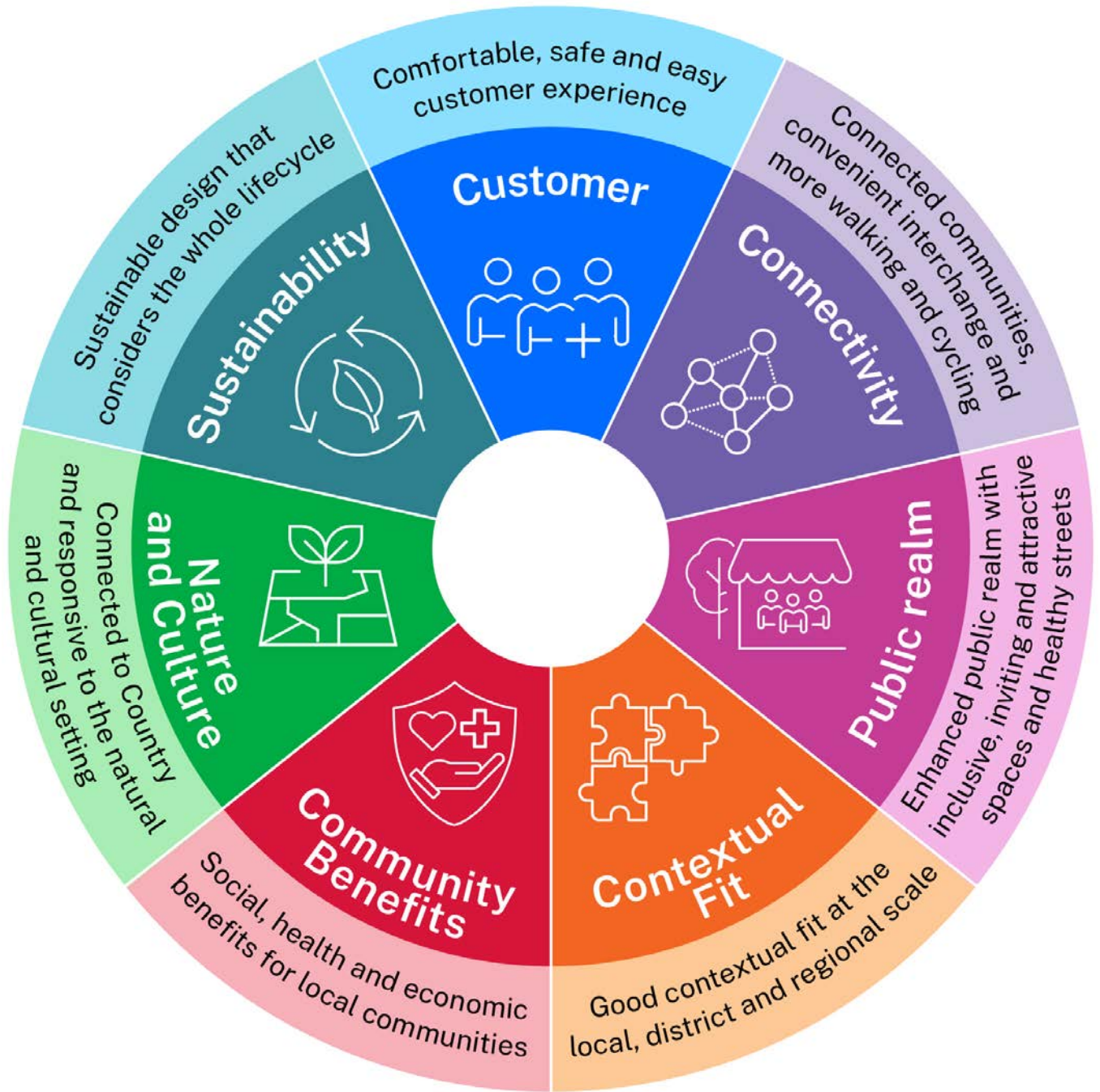


Figure 11. Urban Design principles from Transport Guideline Beyond A to B



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# 3

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## Project Management

The right design skills and processes in the internal and external teams from the earliest planning stages through to detail design ensures all aspects of the project are considered.

**Figure 12. Opposite page** - Central Station is one of the busiest Light Rail Stops on the network (IWLRL)

## 3.1 Design Process

### 3.1.1 Design Process and Phases

The design process continues from Concept Design (Gate 1 - pre Tender) through to AFC (Gate 5). The design team will change throughout however the design evolves with inputs from the TfNSW Design Review Panel (DRP), stakeholders and community consultation.

**Pre-Tender Design Phases** - Scoping, definition and reference designs assist the development of project scope and requirements to support business cases, investment decisions and planning approval processes. These designs are usually conceptual in nature (less than 30% design resolution) and can include a variety of options for consideration in multi-criteria assessment processes. It requires qualified urban designers and architects experienced in strategic design at the project planning, corridor, precinct and stop scales, preferably with delivery experience of previous light rail projects. Also design management skills in multi-disciplinary coordination at planning and planning consent stages, negotiation with stakeholders and highly developed communications and presenting skills to diverse audiences and governance bodies.

**Tender Phase** - At this point the design is at concept design level of resolution (approximately 30% design - depending on the specific project definition). TfNSW intends for this design to be further refined after contract award with the incorporation of any design commitments, planning conditions and with the ongoing, continuous involvement of TfNSW and key stakeholders. This requires similar qualified designers as pre-tender design phase.

**Concept Design (Preliminary Design Review - PDR)** - Key activities in this design stage include coordination work and stakeholder and Design Review Panel presentations. This stage is concluded by the production of a low fidelity prototype. 45% design resolution should be achieved at the end of this phase with key spatial parameters, massing, scale and materiality concepts agreed. Requires qualified urban designers, architects and landscape architects experienced in precinct and stop design, materiality, civil construction and systems co-ordination. Stop design requires industrial designer experienced with public domain structures and detailed elements, systems integration, prototyping and testing regimes. Also design management skills in multi-disciplinary co-ordination, stakeholder negotiations and presentations to design review panels.

**Detailed Design (Detailed Design Review - DDR)** - Key activities in this design stage include coordination work, stakeholder and Design Review Panel presentations, Community and Business Reference Group engagement. This stage is concluded by the production of a high fidelity prototype. 75% design resolution should be achieved at the end of this phase with greater design resolution and finalisation of spatial parameters and materiality. Requires similar qualified designers as PDR stage, with added skills of detailed documentation, prototyping and co-ordination across packages.

**Early Contractor Involvement** - The ECI process should ideally commence at the Detailed Design stage in order to provide valuable constructibility inputs including detailed resolution, fabrication methods. Materials availability, lead times and supply chain capacity. The main benefit of ECI is the lack of abortive design and documentation work. The ECI contractor should be responsible for the production of the high fidelity prototype. For models, samples and prototype requirements refer to [Chapter 3](#).

**Approved For Construction (AFC)** - Key activities in this design stage include finalisation of coordination work with all other disciplines, selection and integration of proprietary products, approvals. 100% design resolution should be achieved at the end of this phase with designs ready for construction. Documentation should reflect key findings from the prototype installation. Requires similar qualified designers as DDR phase. Also design skills in detailed design documentation, fabrication, certification and construction quality assurance.

Documentation submitted at each design stage will undergo a review and comment process by TfNSW and key project stakeholders. Comments should be closed out prior to advancement to the next design stage to avoid programme delays.

### 3.1.2 Operator Requirements

Operator input is critical in the development of the design. The Operator will have key operational and maintenance requirements which would typically be included in the project brief as 'User Requirements', with traceability of compliance required at each design stage.

### 3.1.3 Client and Business Requirements

In planning and development stages, Transport produces client and business requirements documents specifying all the functional, asset performance and service needs of the project. It is critical that Transport's architecture and urban design experts are involved in producing these requirements determining key design parameters such as stop location and siting, stop types and customer experience. Requirements for stop design processes and outcomes should refer to this document, and in particular detailed guidance on principles and considerations in chapter 4 Design Objectives.

### 3.1.4 Stakeholder Engagement

Active and open consultation with key project stakeholders can and should assist in determining design delivery solutions rather than merely responding to them.

A clear understanding of stakeholder requirements early in the design process will ensure that these are acknowledged throughout design development and reflected within documentation.

Ensuring stakeholder inputs are aligned with the Stage documentation requires skilful and timely engagement methods. Any community inputs required for local place integration or personal safety will be coordinated by the project engagement team. Specific stakeholder engagement processes such as the Accessible Transport Advisory Committee (ATAC) will occur throughout detailed design stages.

### 3.1.5 Independent Safety Assessment

Light Rail projects typically require the involvement of an Independent Safety Assessor who will estimate the risks associated with the insertion of the new transport system into the urban realm.

The focus of the Independent Safety Assessment may include but not be limited to junctions (the areas where the tramway crosses a road), running sections (parts of the line outside of the stop boundaries and junctions), and stops (including the vicinity of the stops).

The Independent Safety Assessment is typically performed in each of the design stages:

- Preliminary design: to act on the layout of the infrastructure (define the alignment in the most suitable way to minimise conflicts);
- Detailed design: to act on the environment (define the layout of the public space to make it understandable in the framework of the new transport system); and
- Installation, testing and commissioning: to act on the last modifications and testing.

The ISA will typically require the following inputs in order to carry out their assessment:

- Drawings (showing road signage and delineation, traffic lights, pavements, stops, street furniture, overhead line poles, local access points);
- Sections and elevations (showing kerb heights and widths for each public domain area); and
- Comments and observations will be collated and issued to the design team.

### 3.1.6 Road Safety Audits

In addition to the Independent Safety Assessment, TfNSW may also wish to conduct road safety audits through the design and construction processes. The light rail network, including stops, is assessed for crash and trauma potential for customers, the community and all road users. Through this process, ratings are assigned to each identified risk, allowing those with the highest safety risk to be prioritised for removal or mitigation as the design progresses. Inclusion of both an urban designer with built project experience, and an audit team member with operational experience is recommended to provide expertise on how people will use and interact with the system in its end state.

### 3.1.7 Assurance

#### What is a TAO?

The Technically Assured Organisation (TAO) Scheme recognises technical capability within the transport sector and allows entities to compete to provide self-assured services on Transport assets.

Entities that seek to provide self-assured engineering, architecture, urban design and asset services to Transport, or within the supply chain, are required to become a TAO.

Recognition as a TAO is gained through an evidence based assessment and is dependent on participation in the surveillance program.

#### Assurance

Assurance is a set of structured and planned activities conducted through the asset life cycle providing progressive justified confidence that objectives are being achieved and that the asset is or will be fit for purpose.

### 3.1.8 Reviewing and Verification

Documentation submitted at each design stage should undergo reviewing and verification by competent personnel who are independent to the design team. The specifics of the reviewing and verification process will be dependent on the TAO's internal processes, however certification may be required as evidence. Adequate time for reviewing and verification must be allowed for in the programme. Verification typically cannot commence until all reviewer comments have been addressed. Similarly the documentation cannot be issued until all verifier comments have been addressed and closed.

### 3.1.9 BIM and Digital Technology

Digital design tools are key to successfully realising intelligent engineering solutions for complex challenges. Digital design tools including Parametric Design and BIM should be embedded in the day-to-day work-flow, allowing design teams to incorporate environmental, material, acoustic, spatial, structural, and construction criteria into a Digital Building Prototype.

Projects should use appropriate digital engineering methods and tools to provide a digital representation of the design options, to test and validate the opportunities and constraints.

All design teams should work across a common digital platform such as BIM 360 that will be able to work live on a common model. This enables the project BIM leadership group to actively monitor the digital model development maintaining quality, precision, and de-risking output efficiencies of the team. The BIM360 platform also delivers the primary design coordination tool enabling detailed analysis and clash detection across all design disciplines.

A Digital Engineering Execution Plan (or similar) early in the detailed design process can de-risk the BIM/digital work-flow in detailed design phases.

Regular clash detection, reporting and review should be conducted using federated models to ensure interdisciplinary coordination.

A clear understanding of the digital engineering approach is critical, including objective and model uses for the project, in particular the scope of landscape or urban design assets must be agreed.

### 3.1.10 Independent Design Review

Independent design review is a best practice process for elevating design quality. Government Architect NSW (GANSW) sets out principles for design review which include the need for it to be independent, expert, multi-disciplinary, accountable, transparent, proportionate, timely, advisory, objective and accessible.

Design review panels (DRP) comprised of design professionals with expertise and industry experience in the type of project are a common format for design review. DRPs are best commenced early in the design process when the ability to make improvements or fix errors has the least impact on program and budget. The later design review is left, the more expensive changes become and the less likely are successful outcomes for places and customers. Design review panels are also a requirement of most sustainability rating processes TfNSW applies to projects, including the TfNSW Sustainable Design Guidelines and the Infrastructure Sustainability Council of Australia rating tool.

#### Project Development stages

In project planning and development stages, a design review panel provides advice and guidance to inform major project decisions, design directions and concept designs. The TfNSW Design Review Panel, managed by TfNSW Urban Design team (public transport & precincts) performs this advisory function in the early planning and design of projects. Once a preferred option has been identified, the design team will develop the concept to about 30% design resolution and a planning application will be made.

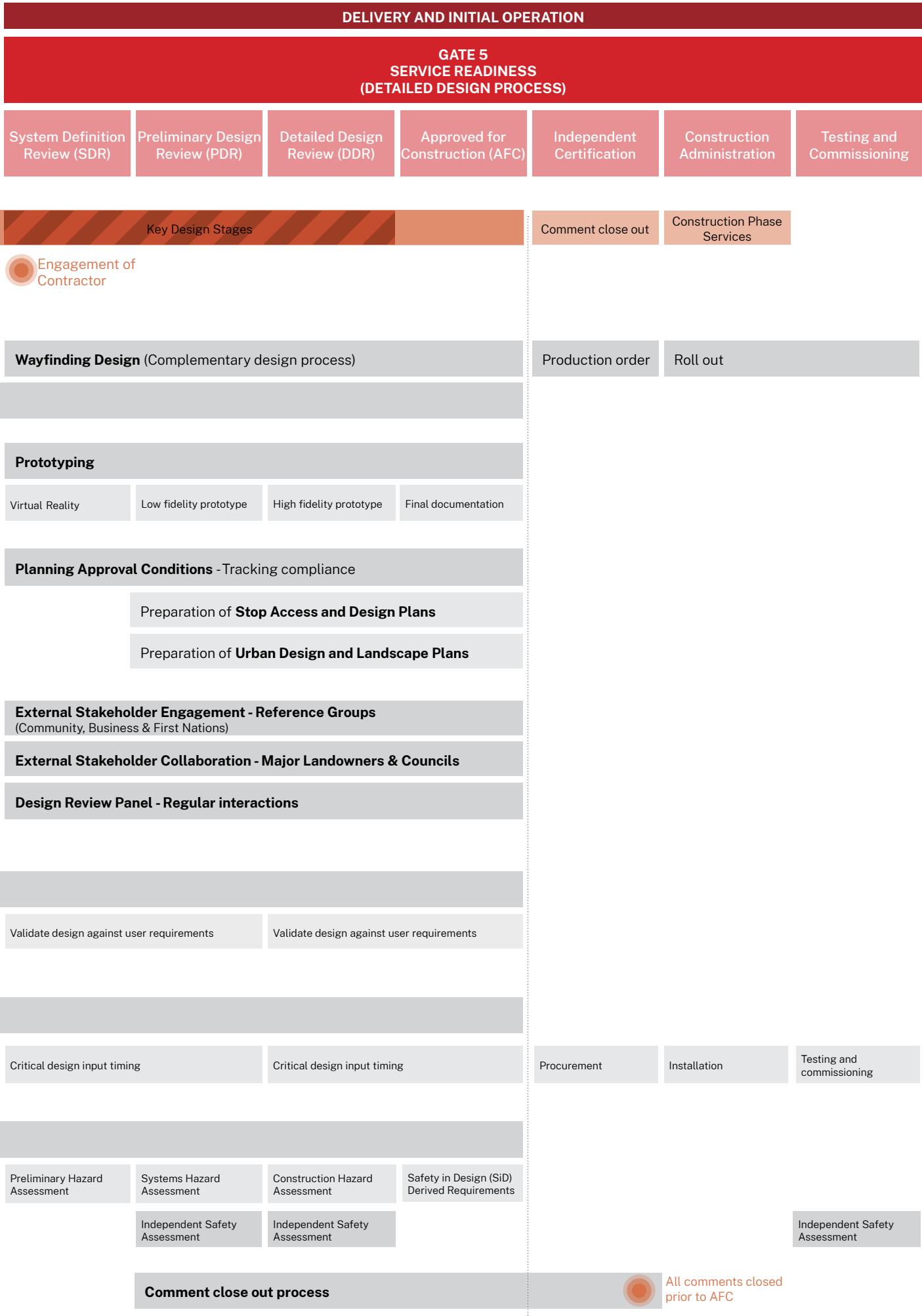
#### Planning Approval stages

Conditions of Approval usually include a requirement to conduct regular design review panel sessions as the design progresses through the stages of detailed design to construction. In the case of State Significant Infrastructure projects, such as a new light rail project, this design review will usually be performed by a project specific DRP in accordance with the conditions of approval.

Project teams must budget resources and program accordingly to fulfil this requirement. The project design team is required to prepare and present material regularly to the DRP in structured sessions. Written advice in the form of statements of support for aspects of the design and/or recommendations for improvement are provided to TfNSW and the Project Team. Conditions for Approval usually require the DRP advice to be tracked and project design team responses recorded. The DRP will also be responsible for considering and endorsing documents required by the Conditions for Approval, such as the Urban Design and Landscape Plan, at set points in the design development program.

Once project delivery commences, the DRP reviews and provides advice on elements of the detail design and any proposed changes to ensure the original design intent and commitments are achieved.

PLANNING AND DEVELOPMENT				PROCUREMENT	
GATE 1 STRATEGIC OPTIONS		GATE 2 BUSINESS CASE		GATE 3 MARKET READINESS (PREPARING TENDER)	GATE 4 TENDER EVALUATION
Concept Design (CD)	Strategic Business Case (SBC)	Reference Design (RD)	Final Business Case (FBC)	Preparing Tender Documentation	
Key Design Stages		Key Design Stages		Design Process	
Define <b>sustainability objectives and targets</b> for the project				Define and agree <b>Design Commitments</b>	
<b>Wayfinding</b> - Define requirements					
<b>Customer Centred Design process</b>					
				Define prototype requirements	
<b>EIS Process</b>					
<b>External Stakeholder Engagement - Connecting with Country (CwC)</b>				Define CwC requirements	
<b>External Stakeholder Engagement - Major Landowners &amp; Councils</b>				Third party agreements	
<b>Design Review Panel - Regular interactions</b>				<b>Design Review Panel - Regular interactions</b>	
<b>Shadow Operator Engagement</b>				<b>Operator Engagement</b>	
				Formulate user requirements	Agree user requirements (To be included in contract)
Define <b>Electrification</b> Options				<b>Train Systems Integration</b>	
				Understand design implications	
<b>Safety in Design activities</b>					



## 3.2 Interface

### 3.2.1 Interface Management

A light rail stop has an extraordinary number of interfaces –it is where all disciplines come together, so it is imperative to reduce coordination risk.

Technical coordination across the design team is of paramount importance in developing a robust response to the project requirements.

The interfaces and coordination between different disciplines is a key risk which must be mitigated through strong leadership, clear scope split, considered allocation of responsibilities and effective team management.

Interface management on Light Rail is highly complex and consideration must be given to the timing whereby information (such as critical design inputs) is made available to avoid developing the design on too many design assumptions, dependencies and constraints.

Key interfaces and risks:

- Rolling stock - the rolling stock selection will determine platform dimensions and in particular the platform length with potentially significant urban design integration consequences. The rolling stock impacts on the set out of the coping edge and its door positions may inform equipment placement on the platform. Rolling stock can also affect the vertical and horizontal gap between coping edge and the tram;
- Systems such as communications and signalling play a critical role in the stop design and public domain integration. This information is often confirmed late in the design process meaning early stages of design are based on spatial assumptions and later validated. This approach carries risk and timings should be aligned closer to the stop design programme;
- Opal integration including ticketing and card readers plays a significant role in the Light Rail stop design. The provision of ticket machines on platforms is the most impactful decision on the placement and dimensions of the integrated services cabinets. The quantity of Opal card readers also impacts the number of racks within the cabinet and must be carefully considered;
- Public domain design and stop design integration is critical. The two work streams cannot happen in isolation in order to avoid issues at critical interfaces. Examples include coordination with existing and proposed trees and the necessary offset from track-form and overhead wiring, stop access points, and many more;

- Wayfinding design integration and documentation should not be underestimated. It can be expected that stop name confirmation will come later in the design process than is ideal. The approval process & consultation should start as early as possible and be aware that this confirmation will be reliant on a number of factors outside of TfNSW control. Consult with TfNSW Wayfinding team early, meet frequently and understand fully the TfNSW Wayfinding guidelines;
- Civil works - responsibility for correctly modelling the back of the platform on side platforms; and
- Overhead wiring - exclusion zones to stop infrastructure.

### 3.2.2 Specific Project Team Expertise

#### Industrial Design

Light rail stops typically consist of a number of industrial design elements which are closer in scale to street furniture rather than buildings. Services and equipment integration requirements bring with them a need for high levels of technical resolution and coordination. Throughout all design stages the project team must therefore include a suitably qualified industrial designer.

#### Signage and Wayfinding

TfNSW require the implementation of an established TfNSW wayfinding system, not a redesign. Due to the specific design and documentation requirements for signage and wayfinding, the project team must include a qualified wayfinding designer familiar with transport assets of a similar scale and complexity.

#### Connecting with Country

A First Nations Engagement Specialist must be appointed to co-develop a response to the Connecting with Country Framework. A First Nations Designer should also be appointed to embed a First Nations perspective within the design process and outcome.

#### Accessibility

Specialists in demonstrating compliance with disability standards assists design development and certification.

#### Urban Designer

Stop siting and integration with the urban context, existing and new public domain, stakeholder inputs and corridor design activities requires the interface design and management expertise of a qualified urban designer.

### 3.3 Resourcing

#### 3.3.1 Resourcing Levels

The following information is provided to inform project management and resourcing. A key point is designers have multiple responsibilities throughout all stages in the systems engineering process of light rail delivery.

##### Team Size

Project teams must ensure all design stages are adequately resourced from the outset. An analysis of the CSELR resourcing of the architectural team across Design Stages 1 through to 3 (concept design to AFC) showed that the project core team size (FTE) remained largely unchanged.

##### Compliance

Sufficient time and resourcing must be allocated to compliance related activities. Project teams must track and demonstrate compliance with scope and performance requirements, user requirements, third party requirements and planning conditions. This is a onerous and time consuming process which must happen as a key activity at each design stage.

An Independent Certifier will typically review the documentation for compliance with the above.

##### Assurance

Assurance activities related to the Technically Assured Organisation/ Authorised Engineering Organisation obligations must be allowed for in the programme. Checking and verification of each design package prior to submission at each design stage will be required.

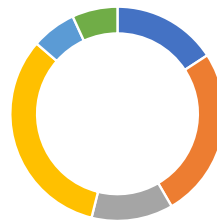
##### Review Comments

Projects of such complexity as Light Rail will typically involve a review process carried out by key internal and well as external stakeholders, TfNSW and the Independent Certifier. All comments must be closed prior to the commencement of construction and ideally prior to commencement of the subsequent design stage to prevent delays at the end of detailed design.

##### Design Effort

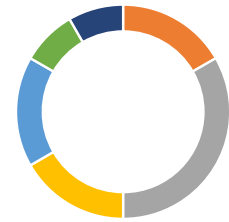
The diagrams adjacent illustrate the total relative hours spent on CSELR per design element.

Analysis of hours per design stage:



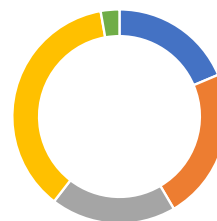
- Stage 1 (Concept Design)
- Stage 2 (Detailed Design)
- Stage 3 (Construction Documentation)
- Stage 3 to AFC (CSELR Specific)
- Variations
- Construction Phase Services

Analysis of activities (Design Stage 2 - Detailed Design) example:



- Design
- Coordination
- Presentations
- Documentation
- Assurance
- Comment close out

Analysis of Full Time Equivalent per design stage:



- Stage 1 (Concept Design)
- Stage 2 (Detailed Design)
- Stage 3 (Construction Documentation)
- Stage 3 to AFC (CSELR Specific)
- Construction Phase Services

**Figure 13.** Total relative hours spent on CSELR per design element

Prototypes play a vital role in the successful delivery of a high quality light rail product. Prototypes benefit TfNSW as they give quality certainty but they also benefit the delivery consortium and the contractor by enabling testing of details, assemblies and constructibility.

## 3.4 Prototypes, Testing and Quality Control

### 3.4.1 Value

The purpose of this chapter is to define the design process requirements and scope relating to the production and review of models, samples and prototypes.

Prototypes in particular play a vital role in the successful delivery of a high quality light rail product. It is important to note that the entire design and delivery team can benefit from prototyping, as outlined below:

#### Design Team Benefits:

- Ability to test the scale and proportions of designed elements; and
- Ability to test assemblies through 1:1 models.

#### TfNSW Benefits:

- Increased certainty of delivery;
- Stakeholder review and endorsement tool; and
- Stakeholder review, customer testing and endorsement tool.

#### Contractor Benefits:

- Increased constructibility certainty compliance and cost certainties;
- Approvals (user testing and TfNSW review);
- Agreeing quality benchmarks;
- Testing of access and maintenance provisions early and inform design changes; and
- Improved safety through testing of installation methodologies, maintenance activities, etc.

#### Operator Benefits:

- Access and maintenance testing;
- Materials and product selection review and testing (maintenance, part replacement, door hardware testing); and
- Improved safety through testing of maintenance activities;

Typically the head contractor will be required to provide a Plan at the outset of the design process, which should outline as a minimum the prototyping programme, scope, intended location, testing requirements and intended outcomes to be derived.

### 3.4.2 Terminology

**Sample** - finishes, fixtures and equipment examples to support selection and demonstrate desired quality and finish.

**Benchmark** - existing, (ideally) local example of a desired finish, structural assembly, etc.

**Quality Benchmark** - an element identified as a quality benchmark for the remainder of the fabrication/ construction works - may be the prototype or completed elements of the works approved and agreed to become a benchmark.

**Low Fidelity Prototype** - a full scale model utilising materials support framing appropriate to describe design intent, spatial configurations, etc.

**High Fidelity Prototype** - a full scale assembly utilising actual selected materials and finishes, equipment, lighting, moving parts, support framing.



**Figure 14.** CSELR stop element prototypes

### 3.4.3 Physical Models

**Purpose:**

The production of working models at various scales should be integral to the design method.

Working models used for testing of scale and proportions of elements.

These are not display models.

**Scope:**

- Design through testing of 3D models is encouraged. The scope has not been defined and is subject to design development and agreement with TfNSW;
- CSELR utilised 1:20 models of the trackway and platforms to inform early user testing and customers with vision impairments; and
- 1:50 to 1:1 as suitable

**Timing:**

Throughout the concept design and detailed design stages.

### 3.4.4 Virtual Reality

**Purpose:**

Fully integrated design and visualisation tools enable real time development of design iteration and options, helping the client and stakeholders understand the project before it gets built.

The CBD and South East Light Rail and Parramatta Light Rail utilised a virtual reality model that was reviewed by internal and external stakeholders. Customer testing using virtual reality can inform design development through the eyes of customers.

**Scope:**

- VR should accurately reflect the correct colours and materials proposed at the stops; and
- Testing should consider alternative methods for people that cannot participate in VR (due to vision impairment for example)

**Timing:**

Concept Design stage



Figure 15. Virtual reality testing

### 3.4.5 Low Fidelity Prototypes

#### Purpose:

- TfNSW review and Stakeholder consultation;
- Testing of spatial design decisions such as mounting heights of signage and wayfinding, placement of stop furniture, FLRs, testing with peak loads, etc; and
- User testing

#### Scope (minimum assuming project has both island and side platform types, amend as necessary):

- Island platform including access ramps, canopy, cabinet and totems;
- Two side platforms including access ramps, canopies, cabinets and totems; and
- Track zone

The low fidelity prototype can be fabricated out of plywood or another acceptable alternative material (to be agreed with TfNSW). Ideally a prototype can be capable of being changed and re-tested as a dynamic design tool. Consideration should be given to the reuse or recyclability of the prototype elements once the review has been completed.

#### Timing:

- The low fidelity prototype should be fabricated based on the finalised SDR documentation.



**Figure 16.** Parramatta Light Rail low fidelity prototype

### 3.4.6 High Fidelity Prototypes

#### Purpose

- Demonstrating and testing final design solutions;
- Testing details for constructibility; and
- Final materials and colour selections applied to the stop prototype for TfNSW sign off.

#### Scope (minimum):

- Free standing totem;
- Canopy totem;
- Canopy typical bay;
- Canopy end bay;
- Balustrade;
- Street furniture such as benches and bins;
- Wind break screen;
- Cabinet module typical;
- Cabinet module PEHP; and
- Signage (including Mode ID, Stop ID, cabinet mounted signage including poster cases, totem mounted signage)

The high fidelity prototype must as a minimum include all finishes modules, louvres, doors, signage, lighting, equipment (CCTV, PA) and any other significant elements that will form part of the visual character of the finished stop.

#### Timing

- The high fidelity prototype should be fabricated based on the finalised detailed design documentation; and
- Outcomes of the prototyping process should be captured in the final construction documentation

### 3.4.7 Quality Benchmarks

#### Purpose

- To demonstrate the detailed design resolution, quality of fabrication and installation and architectural character; and
- NOTE: This is more likely to be required when there is no high fidelity prototype or in the event the high fidelity prototype is constructed by a different contractor to the one carrying out the works.

#### Scope:

- Key stop components - as agreed with TfNSW.

#### Timing:

- Upon completion of the first segment of works (of its kind) and prior to roll out of other such segments.

### 3.4.8 Samples

#### Purpose:

- To review and confirm suitability of selected materials and finishes, their appearance, durability and other functional requirements.

#### Scope:

- All specified materials and finishes or as agreed with TfNSW.

#### Timing:

- Acquired and reviewed throughout the design process; and
- Provided by the relevant contractor for review and approval prior to construction;

### 3.4.9 Testing

#### Purpose

- User testing
  - A user testing plan should be reviewed with TfNSW prior to recruitment to agree purpose of each specific test, methodology, user sample, and questions;
  - Braille and tactile elements need to be tested by a vision impaired person in the context of where the sign will be placed. Spatial and environmental context is important to the translation;
  - Contrast requirements for stop furniture and equipment should be tested;
  - Help Point testing for usability and compliance (if not standard product); and
  - User testing of the high fidelity prototype in night conditions particularly with women, girls and older people will help inform the design.
- Third party testing typically required:
  - Tactile paving luminance contrast testing;
  - Materials and finishes luminance contrast testing;
  - Wind break manifestation band luminance testing; and
  - Site test preferred in natural not artificial lighting conditions preferred;
- Constructibility; and
- Access and maintenance.



Figure 17. CSELR testing with customer groups

Figure 18. Opposite page - Customers approaching the tram at Dulwich Hill stop (IWLR)



Central

16

NOVA SERVICE 1 MIN  
SEE PLATFORM AT NOVA

NOVA



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# 4

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## Design Objectives

Light Rail is a transformative urban project. The corridor, individual stop, and precinct design builds a legacy of high-quality experiences and places that put people first.

**Figure 19. Opposite page** - End of the line treatment can provide opportunity for landscaping (CSELR, Randwick)

## 4.1 Strategy

### 4.1.1 Urban Design

Light Rail is a catalyst project that builds connections between communities, transforms existing urban centres through improved public and active transport and high quality public domain, and works with stakeholders to realise community aspirations.

As major public investments, light rail projects have both functional and strategic aims. Light rail stops need to be functional and meet the specific needs of passengers. Light rail stops should also create safe and attractive environments that attract visitors, workers and investment to places. Good place outcomes in and around light rail stops can improve public perceptions of security, increase the appeal of public transport and provide respite from urban heat.

Light rail stops, successfully integrated with the community, can create precincts that are attractive places for economic activity, social interaction and walking and cycling.

The siting and planning of a light rail stop should maximise easy and safe physical connections to places of interest such as civic or recreation destinations, education and retail environments. Siting and design also seeks to maximise integration with other transport modes to enable quick and easy interchange.

The stop layout and architecture of the canopy is largely fixed for technical requirements and line wide identity. The major opportunity for contextual integration is associated with public domain treatments such as paving, landscape, street furniture, heritage interpretation, bicycle parking and, public art.



**Figure 20.** CSELR canopy in urban road environment (UNSW Anzac Parade)

### 4.1.2 Connecting with Country

The Government Architect NSW has developed a Connecting with Country Framework that articulates how an understanding of Country can inform the planning, design and delivery of built environment projects in NSW. The Framework sets out three long-term strategic goals which include:

- Aboriginal co-lead design and development;
- Reduced impacts of natural events through sustainable land and water management; and
- Ensuring Country is cared for appropriately and sensitive sites are protected.

As a major government project within the built environment, any future Light Rail projects will need to be aligned with the Connecting with Country Framework.

The Framework contains detailed guidance on new practices for a Country-centred approach at each project stage. These practices include establishing relationship-based, respectful processes, knowledge-sharing and design collaboration, intellectual property protection and community engagement protocols. Major projects like

light rail will have First Nations specialists or reference group members to advise and lead on these matters. Transport's Aboriginal Engagement Team will also be a source of advice and leadership.

All members of the team will need to undertake Cultural Awareness Training relevant to the Country the project is built upon as a basis of Cultural awareness that will be built throughout the project life-cycle.

Throughout the planning and design process, spatial and non-spatial opportunities to connect with Country through placemaking strategies should be explored such as:

- Heritage Interpretation within the built form of the stop and associated landscape;
- Wayfinding as an opportunity for story telling, education, place naming;
- Public Art integration;
- Sustainability and promoting ecology, biophilia and traditional water management practices through contemporary sustainability and regenerative design strategies); and
- First Nations stewardship, employment and education.

**"The design of new places, objects and systems can be a purposeful extension of Country and imbue meaning and story into them, so that as we engage with them over time, multiple narratives are strengthened. If the stories are rooted in cultural values that reinforce our relationship to nature and compel us to care for it, then this will ultimately become our collective and cultural identity."**

Alison Page

Design: Building on Country

### 4.1.3 Heritage

Heritage interpretation may be required at some stops as part of the planning approval process. The analysis undertaken early in the scoping process as part of a Heritage Interpretation Strategy will identify heritage items and heritage themes relevant to the place.

Heritage fabric contributes to the distinctive social and cultural identity of a place. The design of stops should support rather than conflict with heritage values, and will consider how the stop interfaces with nearby heritage items.

Retaining existing significant trees is also a major opportunity to contribute to local heritage, as well as other benefits such as shade and community support

A sensitive approach to heritage may include maintaining significant views and vistas to and from items and places of significance and minimising visual clutter caused by light rail stops and infrastructure. Stops should also respond to the prevailing geometry of the heritage built form and public domain items.

Consideration should be given to integrating heritage interpretation with the design of the stop, either as standalone elements or can include the use of public art as a means of interpreting heritage. This will be a process undertaken during detailed design, in consultation with a suitably qualified heritage consultant.

Public art and heritage interpretation are to be integrated into the design of the stop, but to be budgeted and managed separately from the architectural scope.

CSELR lesson learned:

- Heritage interpretation initiatives were considered late in the project and could have been better integrated into the stop design;
- Side platforms on CSELR stops have cabinets with inactive facades. These could have been an opportunity for heritage interpretation or public art integration; and
- Consider integrated services cabinet facades and wind break screens as suitable canvases for heritage interpretation and public art.

### 4.1.4 Public Art

Incorporating art within the public domain contributes to the identity of places, and is a key element of good urban design. It is increasingly a feature of transport systems, elevating customer experience, supporting place-making, wayfinding and identity. Public art contributes to the creation of environments that make people feel safe and valued and can promote a sense of belonging which encourages positive behaviour. Public art can delight all ages or be a playful element for children.

Future Light Rail projects should ensure key partners, stakeholders and the community are engaged to integrate opportunities for public art into infrastructure design. The team should engage with TfNSW Urban Design and key stakeholders to develop a plan for how public art will be delivered drawing on the guidance outlined in Public Art in Transport Infrastructure, TfNSW.

Public art and heritage interpretation are to be integrated into the stop architecture and should be part of a holistic consideration embedded into the design from the early stages of the design process. If left to the end it will risk becoming a retrofit solution.

Public art by Aboriginal artists is one pathway to connect with Country on the project, but should not be seen as the only response to goals of the Framework. Public art can also be a means of revealing or celebrating non-Indigenous cultural or heritage values associated with the place.

Public art should be specific to its site or context, drawing from and telling a story about the community, its culture or the experience of travel.

Public art should be responsive to its context in scale and considerate to its impact on local amenity and use. It should be high quality, durable and fit for purpose in a public domain environment.

### 4.1.5 Advertising

To assist with TfNSW's financial sustainability requirements, future light rail projects should be adaptable to the integration of advertising material at light rail stops. The revenues raised from these assets provide a customer benefit in terms of reinvestment back into the TfNSW networks to improve customer services whilst reducing our impact on NSW tax payer funds. Further, the digital assets are also used by TfNSW Brand & Marketing for TfNSW content.

Commercial advertising at light rail stops can successfully co-exist with customer and operational assets/information. Each site and placement of an advertising screen is considered on its own merits. Locations need to consider customer amenity, spatial effects, significant views, heritage, wayfinding, sightlines to oncoming light rail vehicles, road safety or near pedestrian crossings whilst acknowledging existing advertising asset placement at other existing stops.

Any advertising boards should be designed or selected to complement the light rail canopy, equipment and totem designs.

Revenue management placement strategies will seek to optimize the commercial benefit to TfNSW by considering key drivers of value, e.g. location, placement, size, viewing angle and format type (e.g. digital, static, domination, sampling & experiential, etc).

### 4.1.6 Smart City

Smart technology integrated into any future Light Rail network should be inclusive, equitable and customer centred.

Transport will ensure transparency through the use of public technology communication standards. TfNSW must ensure users understand the governance framework and data policies of the smart technology deployed, and ensure data is securely and ethically captured and published. For example, refer to the NSW government trial 'Digital Trust in Places and Routines'.

Through the integration of smart technology, TfNSW has the opportunity to improve service efficiency, customer safety and sustainability across any future Light Rail network.

Smart technology could contribute to service efficiency through:

- Wifi across the network to improve social connectedness and navigation;
- Congestion data that could help TfNSW understand the spread and activity of people during different times of the day and special events. Data could be used to inform strategies that reduce congestion, and improve crowd management and reduce queue times. For example, notifications that inform commuters of congested routes and direct them to better alternatives could be generated when data collection indicates a service is at capacity;
- Sharing data with emergency services, state government agencies, utilities and other stakeholders responsible for critical infrastructure and services to enable integrated planning, preparedness and responsiveness to emergency scenarios;
- Self-monitoring and reporting connected infrastructure such as smart lighting and amenities servicing; and
- Wayfinding for all customers, and particularly vision impaired users, such as audio based apps for advice on services or best tram door for priority seating.

Smart technology could contribute to customer safety in a 24hr city through:

- Smart lighting, smart CCTV and smart transportation.

Smart technology could contribute to sustainability through:

- Circular economy initiatives such as a Material Passport or Digital Twin, to enable more efficient parts replacement and maintenance;
- Temperature monitoring that could help inform actions that reduce the impacts of extreme heatwaves and wet weather events. Predictive analytics can be applied to anticipate and plan for future disruptions, shocks and stresses. For example, a smart storm-water system could determine cleaning and maintenance schedules and identify flooding risks, or smart irrigation to help manage water use; and
- Shared infrastructure provided by Light rail stops, together with enabling digital and power infrastructure along the corridor, providing the foundational infrastructure for connectivity uplift and smart technologies. The demand for 5G small cells in urban areas, combined with increasing cost of traditional telco infrastructure and declining margins, is increasing demand for Shared Infrastructure.

## 4.2 Design Principles

### 4.2.1 Design Principles

This guideline is part of a suite of documents informing the design of public transport infrastructure. TfNSW Urban Design uses the 'Designing with Place' approach to apply a universal set of design objectives and principles for a consistent application across all public transport projects. Design teams should refer to the overarching design guideline for TfNSW public transport *Beyond A to B*

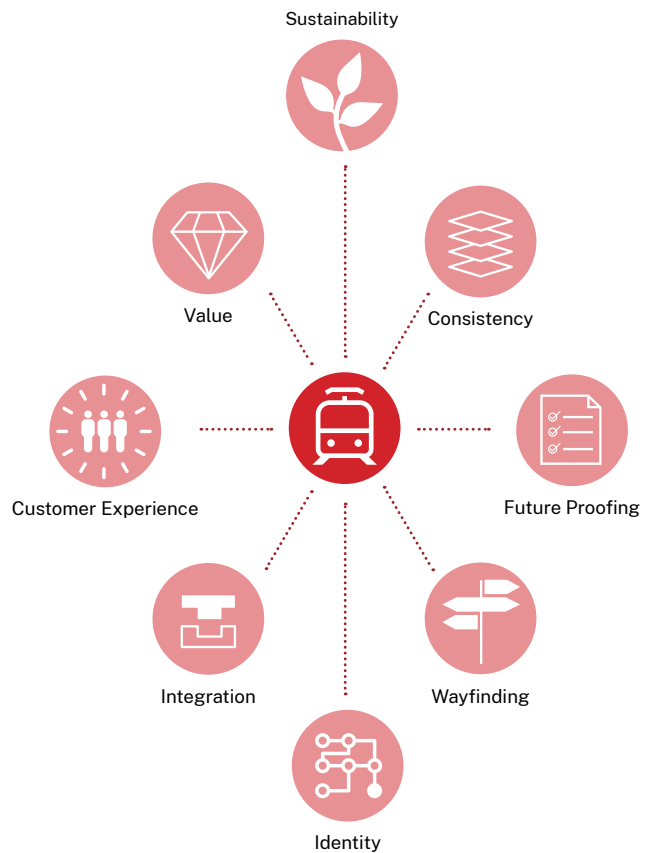
For light rail stop design, a specific set of design parameters are:

- Provide a seamless, safe, easy to use and high quality transport experience that maximises a positive customer experience and easy interchange;
- Contribute to the making of Successful Places through well-designed transport infrastructure that makes a tangible improvement to place;
- Maximise the benefits of economies of scale through the standardisation of geometries and components that can be adapted and extended over time;
- Maximise the life of products through clear separation of long life elements (e.g.. canopy) and shorter life elements (e.g.. ticketing equipment, signage);
- Use commonality and consistency across the materials, finishes, furniture and wayfinding, and employ a common approach to the stop designs, a consistent use of grids, materials and a family of components;

Architecture plays a vital role in delivering a high quality light rail system that enhances the public transport customer experience. Architectural designs must be developed based on principles of timeless, elegant and functional design.

- Employ a concealed and integrated approach to services and associated containment, with flexibility for future proofing of technology;
- Keep environments simple and intuitive to use and navigate;
- Ensure architectural stop components are based on the utilisation of a common palette of materials to create a line wide identity; and
- Ensure architectural components are clean, simple and modular, and integrate stop equipment into cabinets and poles housing multiple functions (signage, lighting, public address, information, CCTV, etc.) in order to maximise space and reduce the number of elements on platforms.

These design principles will ensure a consistent identity for NSW Light Rail projects that delivers value, reliability, ease of maintenance and buildability.



**Figure 21.** Light Rail Design Principles

## 4.3 Customer Requirements

### 4.3.1 TfNSW Stop Requirements

Detailed customer requirements will be itemised in project documents such as the Customer Requirements Definition, Business Requirement Specification or contract documentation. There are many customer requirement topics covering comfort, ease of use, equity and information. Safety and perceptions of safety is a key requirement, not only waiting, boarding and exiting the tram but also getting to and from the stop.

There are a number of non-negotiable, core Customer/DSAPT requirements for each platform. These can include:

- Provision of canopies for weather protection;
- Provision of public address systems (Note: project specific requirements and planning consent conditions will determine whether these systems are to be used for emergency announcements only or to include public announcements)
- Provision of hearing augmentation loops for people with hearing aids;
- Provision of customer seating (proportional to demand) including dedicated wheelchair waiting spaces and priority seating;
- Provision of wayfinding signage (that complies with the TfNSW Light Rail Wayfinding Kit of Parts and Planning Guide);
- Advertising as required subject to stop location and conditions of planning consent;
- Accessible paths of travel on/off the stop platform and to/from safe crossing points with TGSIs and high contrast markings;
- Lighting for operational safety and customer comfort and security; and
- Passenger Information Displays (PID) are screens showing next service/s information in real time and other customer information as necessary.

Customer interfacing elements are ideally co-located and should include:

- Passenger Emergency Help Points (PEHP) on each platform including Information Help Point for on demand, audio equivalent of visual information;
- Opal self service machine/s;

- Opal card readers known as a Fixed Location Reader (FLR); and
- Information signage.

A single point of service provides customers with a convenient and intuitive central place for information, tickets and help.

Additional elements that may be required, depending on the stop context (to be agreed with TfNSW) and can include:

- Rubbish bins (depending on Council agreements and operator maintenance contracts);
- Wayfinding directional signage (depending on Council agreements); and
- Advertising screens

### 4.3.2 Modal Identity and Consistency

Light rail stops should adopt a single consistent mode identity across the line. The modal identity can be represented by a consistent design for canopies and other stop elements. Stop canopy, equipment and furniture layouts are to be consistently located on stops, with the opportunity to tailor to significant, site specific influences such as heritage context.

### 4.3.3 Integration

Light rail stop equipment and services are to be fully integrated into the stop design. Multiple uses for one element are preferred to avoid unnecessary clutter. Integration of equipment must allow for easy access for maintenance and repair. Removal of integrated elements should not require the removal of surrounding cladding panels.

### 4.3.4 Comfort

Resilience to weather and climate should be considered when planning and designing Light Rail stops. Weather protection is to be provided on all stops.

Appropriate climate analysis should be included within the planning and design of light rail stations to inform appropriate facility orientation, shelter design and location suitability.

Sustainability forms an integral part of TfNSW’s vision for design of future Light Rail networks. Given the potential size and scale of the works, TfNSW recognises the ability to influence industry, and set new benchmarks and standards in environmental and socio-economic spheres.

## 4.4 Sustainability

### 4.4.1 Background

Transport is governed by a number of key sustainability drivers at an international, national and state level, including the TfNSW Environment and Sustainability Policy. The primary internal sustainability driver is the Transport Sustainability Plan 2021. The plan outlines eight key focus areas and associated goals which address a number of key sustainability aspects associated with our activities. The eight sustainability focus areas are:

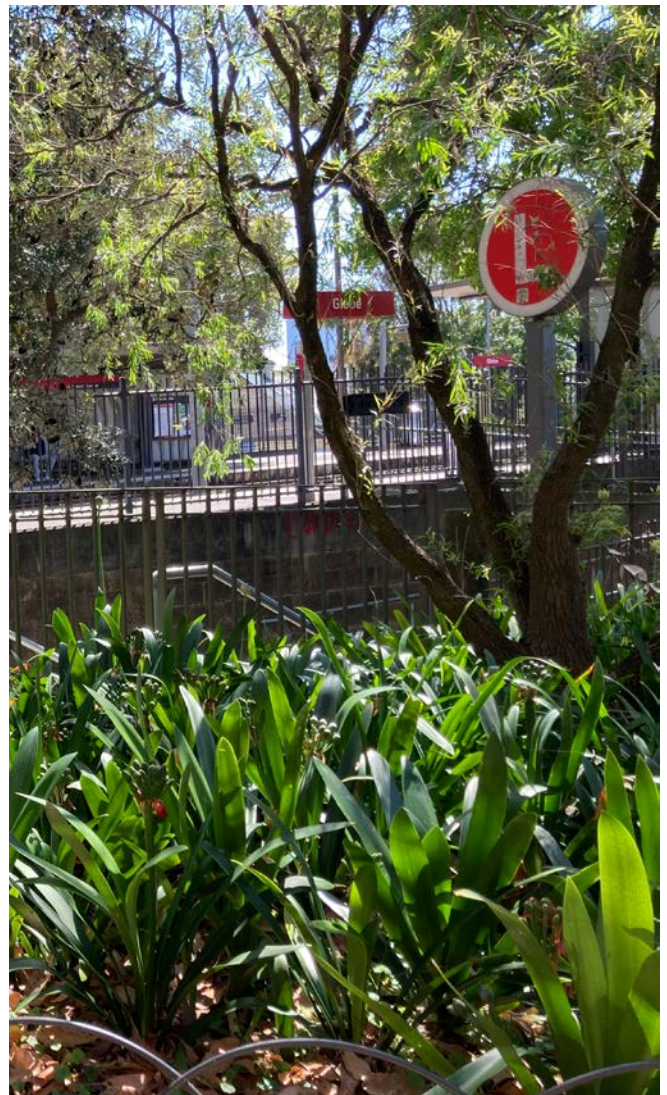
- Respond to climate change;
- Protect and enhance biodiversity;
- Improve environmental outcomes;
- Procure responsibly;
- Partner with communities;
- Respect culture and heritage;
- Align spend and impact; and
- Empower customers to make sustainable choices.

Future Transport embeds sustainability outcomes in its strategic directions. Under the Successful Places for communities outcome, strategic directions include a transition to net zero emissions; transport minimises environmental impacts; and is resilient and adaptable to shocks and stresses, including climate change impacts.

Design, delivery and operations of major projects like Light Rail will be subject to sustainability processes, frameworks and certifications. Architecture and design play a key role in fulfilling sustainability requirements in particular under themes such as embodied carbon, material selection and social outcomes.

The multi-disciplinary design team including architects must play an active role in determining and meeting the project’s sustainability objectives.

Sustainability guidance at project level will be detailed in contracts and may be informed by frameworks such as the TfNSW Sustainable Design Guidelines or those from the Infrastructure Sustainability Council. Consultation with the TfNSW Sustainability team is needed to determine which framework is applicable to a particular light rail project.



**Figure 22.** Green landscaping around stops is attractive and cooling (IWLR, Glebe)

#### 4.4.2 An Enduring and Sustainable Legacy

Infrastructure has a significant, lasting impact on Australia's greenhouse gas emissions. Infrastructure assets built today will still be operating in 2050 when countries like Australia have committed to reach net zero emissions under the Paris Climate Agreement and the NSW Government emissions targets. Design and delivery of any future Light Rail projects must focus on sustainability through:

- Design that is fit for purpose now and into the future, and adaptable to change;
- Commitment to a low environmental footprint and whole-of-life approach through all design, construction and maintenance activities.
- Social outcomes - Assess community benefit opportunities and integrate them into the architecture and urban design;
- Drive no net loss biodiversity outcomes - Biodiversity should be left in a better state than pre-development;
- Incorporate water sensitive urban design (WSUD) principles and minimise irrigation and ongoing maintenance requirements; and
- Connecting with Country - Integration of Country centred design.

#### 4.4.3 Appropriateness

Proposed solutions must be appropriate to scale and context. For example TfNSW currently does not consider photovoltaic cells on stop canopies due to the lack of power generation relative to the embodied carbon associated with their manufacture and installation. Depot roofs are a far more appropriate location however. We acknowledge that technologies evolve and welcome investigations in this space. Microbiotic coatings and other innovative solutions can be considered.

#### 4.4.4 Certification

It is important to recognise that Light Rail stops typically sit outside of the conventional building typologies for which the industry has well established standards and targets.

There are a number of widely used standards, guidelines, practices, and protocols with general focus on the built environment such as Green Star, BASIX or NABERS. The Infrastructure Sustainability Council (ISC) supports the incorporation of an Infrastructure Sustainability (IS) rating scheme for planning, design, construction and operations of infrastructure assets.

Tool kits are broadening the industries attitude and responsibilities towards the progression of environmental design and governance in the built environment. Some examples include Green Star Communities which focuses on precincts, and the Living Building Challenge which utilises regenerative design solutions to create 'living buildings' that have a net-positive impact on local environment.



**Figure 23.** The green tracks assist contextual integration, water permeability and treatment of stormwater runoff (PLR, Cumberland Hospital Precinct)

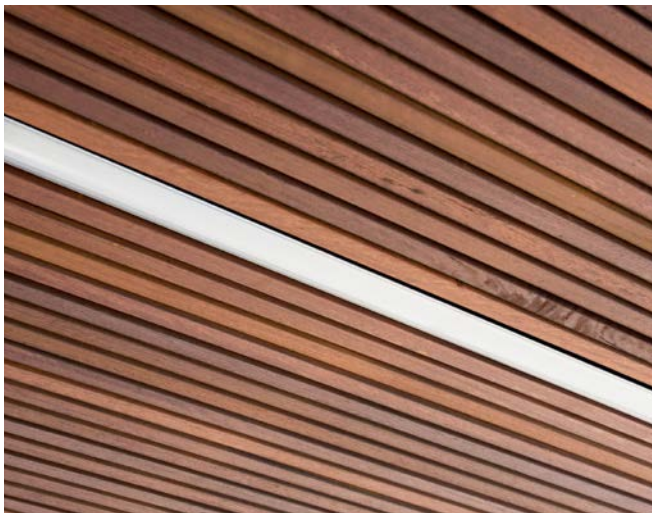
#### 4.4.5 Circular Economy

With reference to the NSW Circular Design Guidelines for the Built Environment, the following principles should be applied to light rail infrastructure design:

- Minimise the use of resources (products, components and materials) and source ethically;
- Keep resources in use for as long as possible; and
- Recover and regenerate resources at the end of life.

Circular economy methodologies which applicable to Light rail stop design are:

- Designing 'in layers' (separating long design life elements from short design life elements for ease of repair and replacement);
- Standardising design (creating efficiencies in design and construction);
- Designing for Manufacture and Assembly (considering how elements can be fabricated off-site, fully utilising benefits of design technology and BIM for minimised construction waste, improved safety and programme);
- Designing for flexibility and modularity (allowing for future extensions and reconfigurations as well as future proofing);
- Designing for disassembly (ensuring components are utilised at their highest value for the longest possible time and designing in a matter that will enable disassembly and reuse at the end of the intended design life); and
- Dematerialisation (looking for opportunities to 'do more with less').



**Figure 24.** Wooden slats were used in the ceiling of IWL R canopies as a sustainable material

#### 4.4.6 Materials Selection

Materials selection on future light rail project should consider the following:

- Materials sourcing (looking for opportunities for locally sourced products and materials);
- Stretched durability (consideration of characteristics that enable products to serve their originally intended functions longer);
- Maintenance (selection of self finished, durable and high quality materials requiring little to no maintenance);
- Utilising the TfNSW banned/hazardous materials and chemicals lists alongside the International Living Future Institute (ILFI) Living Building Challenge Red List (list of materials, chemicals, and elements known to pose serious risks to human health and the greater ecosystem that are prevalent in the building products industry);
- Promoting the specification of products and materials which have Environmental Product Declarations (EPD); and
- Utilising other product certifications and schemes such as the Good Environmental Choice Australia (GECA) and Green Tag.



**Figure 25.** Copper finishes were used on CSEL R for its durability and low maintenance

#### 4.4.7 Landscaping At Stops

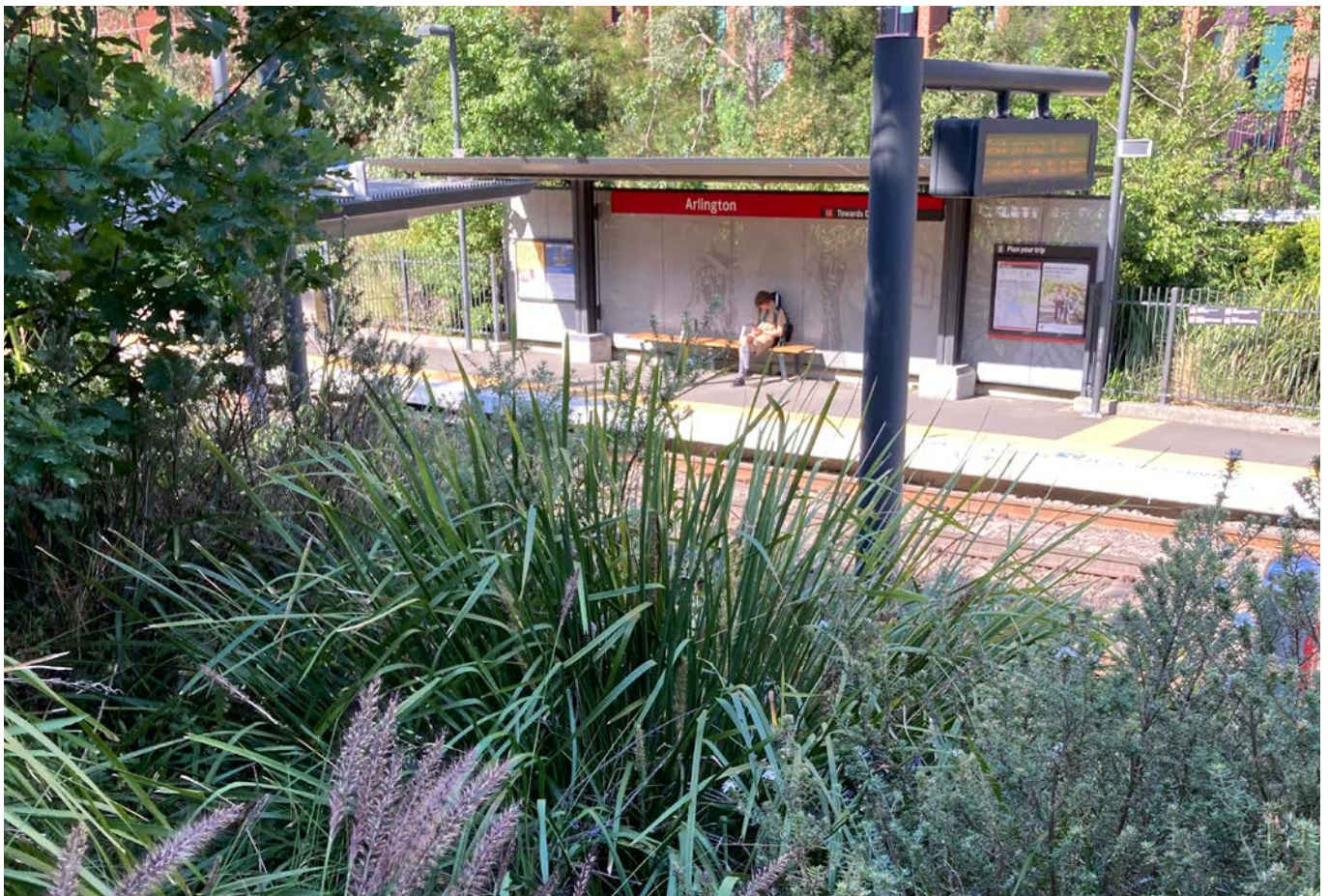
As heat waves become more frequent in New South Wales, the need to combat them and provide respite for light rail customers will become more important. Opportunities to mitigate Urban Heat Island Effect (UHIE) should be integrated into design responses for each stop wherever possible. Such opportunities may include:

- Canopy and paving material selection to improve sunlight reflection and cool the light rail stop;
- Additional shade or shelter devices to provide protection from sunlight; and
- Increased landscaping including ground coverage; improved canopy coverage near the stop or trees along the stop itself to provide shade and amenity for customers.

In addition to combating UHIE, the landscaping should enhance the existing natural environment, place and character. The following requirements should be considered when selecting species and designing the public domain of the stop precinct::

- Endemic to the area or region to increase biodiversity and habitat for local wildlife;
- Drought resistant or tolerant to reduce the need for additional irrigation and maintenance;
- Minimal shedding of leaves to reduce drop onto stop surfaces that could increase the risk of trips, slips and falls
- Retention of existing trees close to the stop for day one shading and attractiveness.

Another opportunity to mitigate UHIE and contribute to an integrated approach to landscape is through the use of green track. Green tracks have many benefits and have been used on numerous international and Australian light rail networks, including Parramatta, Melbourne and Adelaide.



**Figure 26.** Low maintenance landscaping around stops (IWLRL, Arlington)

### 4.4.8 Examples of landscaping at stops



**Figure 27.** Low planting can be used to separate pedestrian paths from non-pedestrian zones (PLR, Ngara)



**Figure 28.** Kangaroos Paws planting provides colour and interest (PLR, Ngara)



**Figure 29.** Mature trees provide shade and amenity in the stop precinct (IWLR, Hawthorne)



**Figure 30.** Landscaping provides pleasant views from the stop and its surrounds (IWLR, Jubilee Park)



**Figure 31.** Mature trees shading paths (IWLR, Waratah Mills)



**Figure 32.** Low maintenance planting minimises ongoing costs (CSELR, Wansey Road)



Figure 33. Landscaping with street furniture in the stop precinct (ICLR, Arlington)



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# 5

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## Stop Planning

This chapter considers the early stage planning and design of new light rail stops. This is important where light rail stops can act as a catalyst for urban development, are in highly urbanised environments or rely on walking catchments and convenient interchange.

**Figure 34. Opposite page** - The light rail corridor along George Street, Sydney (CSELR)

## 5.1 Early Stage Considerations

TfNSW in consultation with the local government, will typically determine the rail alignment and the most appropriate spacing and location of light rail stops. This should take into account current and future integrated transport network requirements, customer needs, patronage and maximising service coverage and urban context.

The size of the catchment area of a Light Rail stop is generally influenced by:

- Site constraints;
- Customer appeal of the service dependent on frequency, reliability and journey times.
- Proximity of connecting modal interchange opportunities;
- Urban structure of the district and street network;
- Urban form, densities and land uses;
- Precinct typology (retail, parkland, arterial road setting, etc.);
- How light rail supports/is supported by connected modes (for example, greater spaced light rail stations may require more bus feeder services to maximise coverage); and
- Proximity of activity precincts, key destinations, major institutions and trip generators.

### 5.1.1 Strategic Design and Network Planning Teams

Urban design plays a key role in determining route options, stop locations, siting, planning and design integration into local areas. From the earliest phases of a project, Country and place considerations need to inform these strategic decisions which have a direct effect on connectivity, amenity and functionality.

Including urban design expertise when working at the conceptual macro-scale in the early phases will ensure the project makes a positive contribution to Successful Places at the local scale. This is because urban designers work in a multi-scale manner, refining the design in one scale by testing it in another.

This approach ensures the regional solution, usually the transport network priority, will also work at the local scale in future detailed design and delivery stages. This is less risky than an approach which defers these considerations to later in the project life cycle.

Considerations such as site slope, road reserve dimensions, boundary conditions and likely desire lines to stops are fixed constraints for stop design that can not be changed later. This approach also provides more certainty and graphic information for Councils, landowners and the community, for whom the local scale is their primary concern.

The team involved in the network planning stage making important early decisions about the route and stop locations should include urban designers knowledgeable and experienced about stop siting and spatial design at the street scale to foresee opportunities and constraints.

### 5.1.2 Working at Multiple Scales

Planning and designing iteratively at multiple scales during each stage avoids locking in early decisions based only on large scale maps without understanding the local implications. The multi-scale planning and design method improves on the conventional top-down approach when investigations and decision occur sequentially in successive project stages from the large to the small scale.

By planning and designing at multiple scales, transport infrastructure:

- Has a progressive development towards well-designed, context-specific assets starting in the planning phase with a clear line of sight to potential design solutions;
- Can be delivered with more certainty to project scoping, budgets, programs, engagement and approvals;

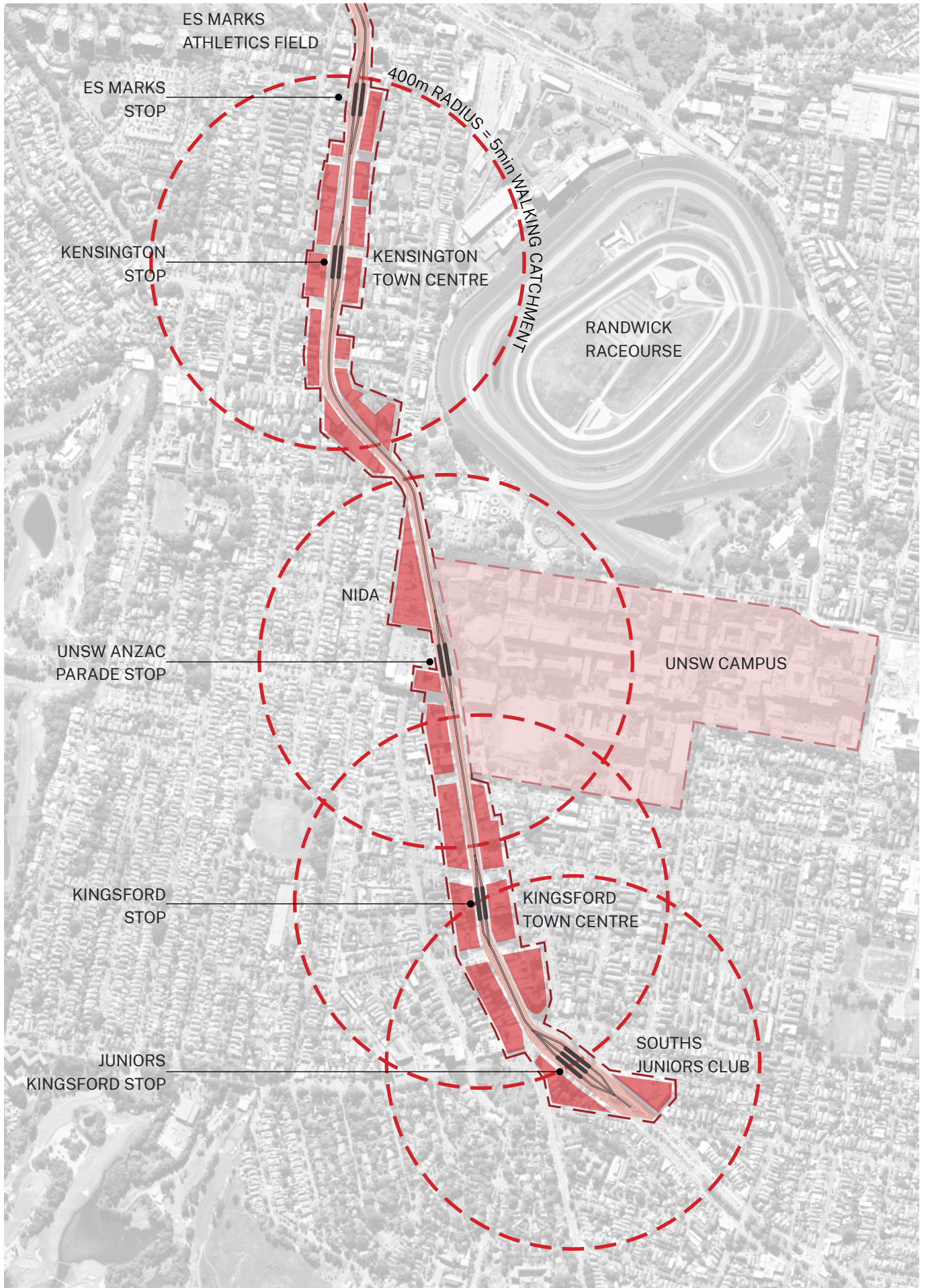
- Is an efficient investment in not only providing mobility or services but also supports the Future Transport strategy outcome 'Successful places for communities' of making positive built contributions to centres, precincts or neighbourhoods throughout New South Wales; and
- Multi-disciplinary problem solving and encourages addressing both place and movement aspects

The approach is universal for any road, street or infrastructure project and suggests various design techniques and deliverables. For example, urban designers can inform network or district scale planning by conceptual design at a local scale or typology methods to test and communicate an indicative end-state.

Refer to the Movement and Place website under Working at Multiple Scales for techniques and methods.



Figure 35. Working at multiple scales strengthens multi-disciplinary problem solving

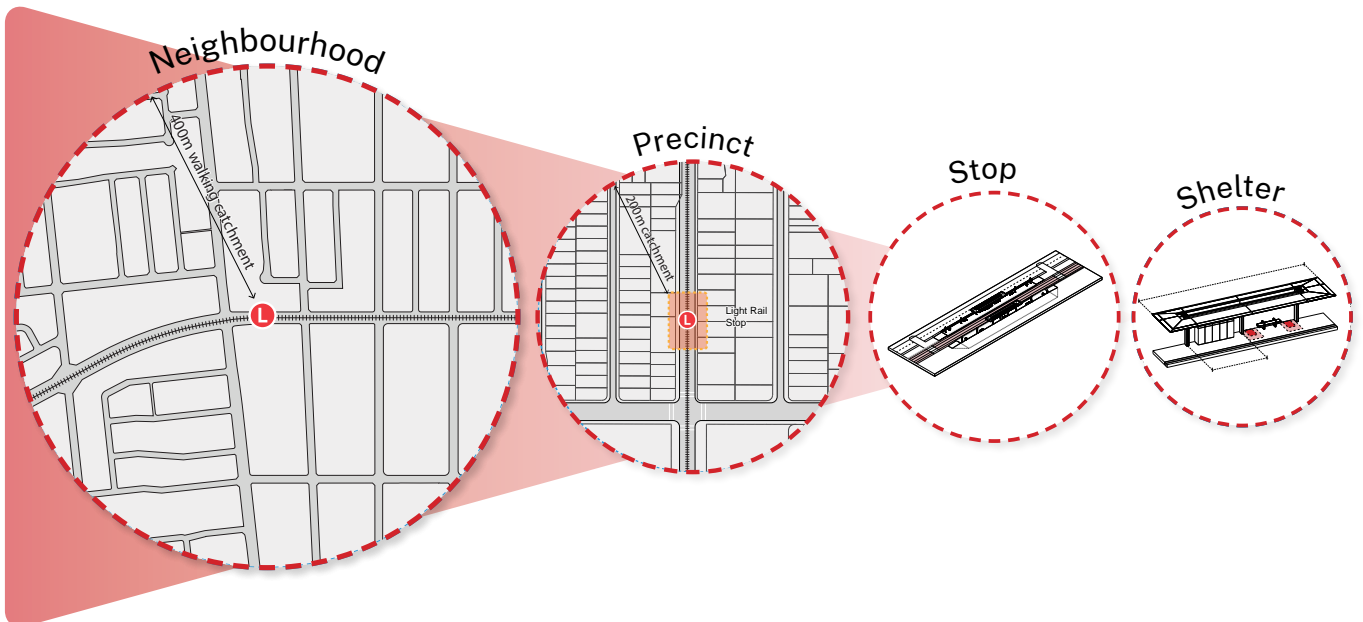


**Figure 36.** Stop locations in context of the corridor, major destinations and adjacent high street activities. (CSELR, Kensington District)

### 5.1.3 Stop Locations and Siting

The positioning and spacing of light rail stops will typically be based on the following considerations:

- A balance between journey time and the frequency of stops;
  - Catchment area and proximity to significant attractors;
  - Connectivity and interchange;
  - Planned future development proposals or land use changes;
  - A service design preference for the same stop types (island or side platforms) along a route so customers alight or board consistently on one side of the tram; and
  - Stop configurations:
    - Minimum overall corridor dimensions and associated constraints;
    - Stop typology considerations (side platforms versus island platforms)
    - Access provisions (sites must have the available space for sufficient footpath area so pedestrians can safely walk past the stop).
- Interfaces with roads, crossings and traffic phasing;
  - Topography and geometry (in particular in relation to accessibility and flooding and vertical alignment of light rail and platform gradient);
  - Consideration of the urban context, heritage and built form;
  - Sightline requirements that apply for light rail operators, waiting passengers, other pedestrians and road vehicle; and
  - How the stop is connected to and impacts existing and planned active transport networks.



**Figure 37.** The positioning and planning of stop locations is vital for its success and integration into the urban environment at all scales

A key activity will be a comprehensive site analysis which must be carried out to determine:

- The opportunity to successfully integrate a stop into its urban context giving consideration to topography, landscape & built form context, social and cultural context;
- Potential heritage and view corridor impacts;
- Pedestrian desire lines and walk up catchments; and
- Potential proximity to utilities and any underground structures; and
- Future cycling demand and space for potentially significant bicycle parking.

Terminus stops should be located and designed so that light rail can be extended in the future.

In planning, the stop must be considered and scoped for public domain works as a precinct not just the platform and canopy. This scales ensures the project design can achieve a seamless integration with the surrounding elements and maximise customer convenience.

The stop typology will be dependent upon several factors including:

- The proposed light rail alignment;
- Intended function (for example: interchange, terminus and event);
- Forecast stop patronage and the capacity and length of the chosen Light Rail vehicle;
- Maintaining a level of safety for traveling and non-traveling customers and road corridor users;
- Street corridor dimensional constraints such as lane widths and presence of underground utilities
- Level of pedestrian activity;
- Pedestrian desire lines and ensuring island stops can be accessed from both ends;
- Context of the stop within adjacent infrastructure and surrounding land uses and precincts;
- Adjacent road traffic volumes and intersection spacing; and
- Topography.



**Figure 38.** Public domain improvements at the interface with the stop enhance access to Prince Alfred Square (PLR, Prince Alfred Square)

### 5.1.4 Examples of Precinct Integration



**Figure 39.** Direct connection from the hospital precinct to the light rail stop (CSELR, Randwick)



**Figure 40.** Complementing existing public pathways (NLR, Queens Wharf)



**Figure 41.** Integration with the walkways in Eddie Ward Park (CSELR, Surry Hills)



**Figure 42.** Stop locations complement high street activity (CSELR, Kingsford)



**Figure 43.** Stop precincts can be integrated with new developments (IWLR, Lewisham West)



**Figure 44.** Pathways provided through the Moore Park precinct on desire lines to the stop (CSELR, Moore Park)

## 5.2 Stop Typologies

There are two main platform typologies – Island and Side. The selected configuration may be driven by urban context, spatial constraints and the track alignment. The typology will have far reaching consequences, determining track alignment, operations, public domain and customer experience.

Generally, side platforms provide a more permeable stop precinct with easier access arrangements.

### 5.2.1 Island Platforms

An Island Platform is positioned in between two tracks and may be located within a road median. Island Platforms will always require passengers to cross the tracks while accessing or exiting the stop.

There are several factors to consider when designing an Island Platform, including:

- Efficiency of the track layout (side platforms with straight track alignments are more space efficient overall than island platforms);
- Ability to provide access at both platform ends (single access island platforms are not recommended). On main streets, pedestrian crossings at both ends of an island platform may need to be signalised, impacting road movements. Single access island platforms are not recommended;
- Customer safety and safe movements on and off the stop (preventing desire lines and uncontrolled crossings over the tracks and roadway);

- Ability to provide signalised track and road crossings required to access the platform given minimum distance standards between signals;
- Traffic light phasing on larger crossings (phasing must provide sufficient time to cross, or a mid point must be provided on the crossing for customer safety);
- Forecast patronage numbers for space-proofing of the stop itself, the stop approach and the pedestrian crossings;
- Safety concerns relating to wrong side door opening. Doors opening incorrectly on the wrong side at an island platform may expose passengers to road traffic.;
- Opportunity to integrate OHW poles with stop functional lighting (ownership of power supply within stop power supply); and
- Integrated services cabinets, that can service all customers on the platform; and
- Separation between tram corridor and road traffic lanes to discourage or prevent general traffic moving into the DKE.

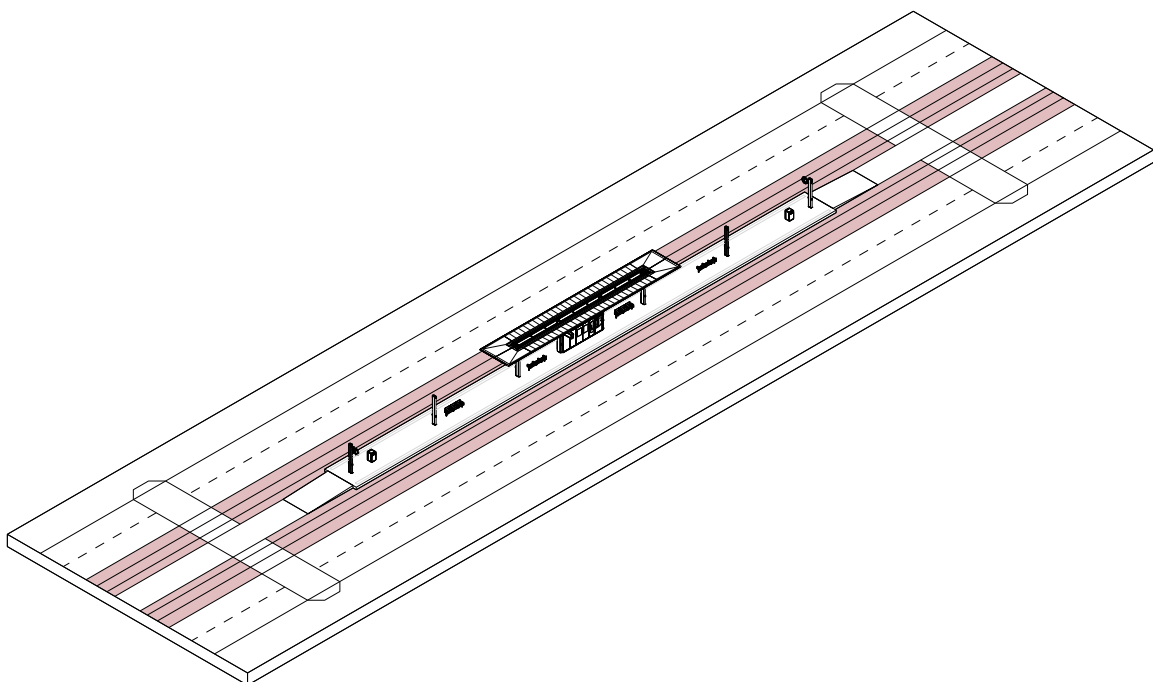


Figure 45. Typical island platform

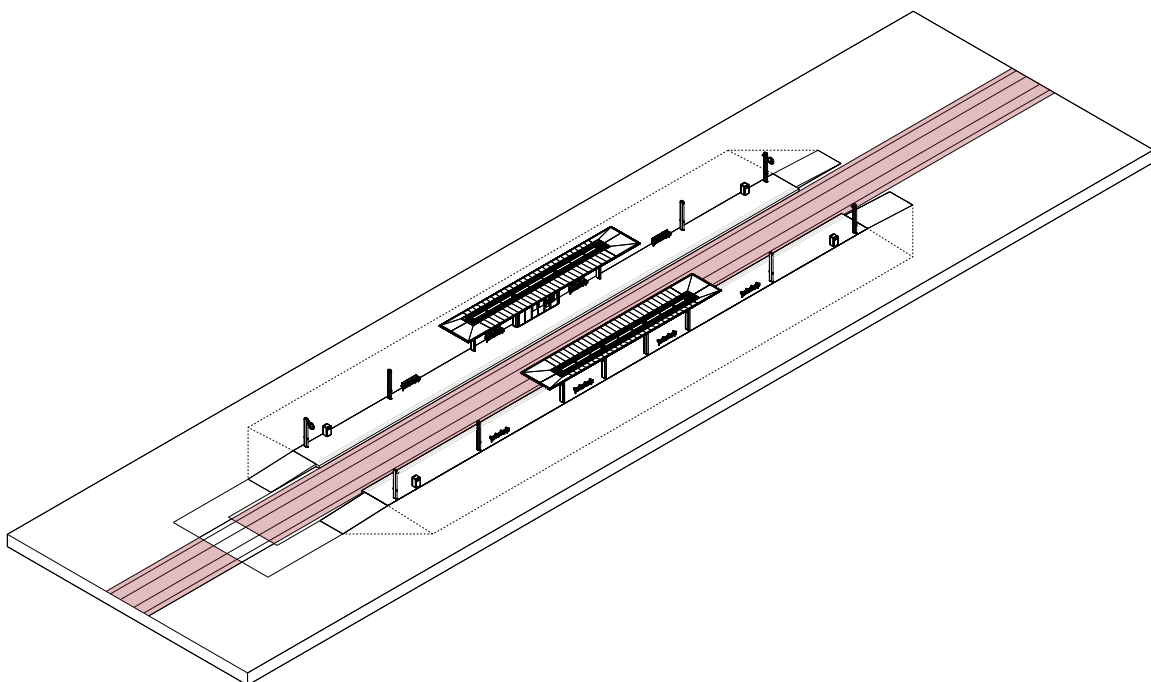
### 5.2.2 Side Platforms (integrated with the public domain)

Side Platforms allow the tracks to run in between two facing stops. Side platforms are usually integrated with footpaths and require fewer people to cross the tracks to access or exit a stop. However, this spatial arrangement can impact a wide area of the public domain as it requires greater footprint to accommodate two platforms.

A Side Platform configuration allows for the platform to be integrated seamlessly with the surrounding public domain but this can be challenging at times as platforms are typically raised above the surrounding ground level requiring regrading.

There are several factors to consider when designing a Side Platform, including:

- Efficiency of the track layout (straight track alignment is more efficient than split track alignment/ Island Platforms);
- Opportunity of adding stops/ platforms in the future without modifying the track alignment;
- Direct access from adjoining street or precinct, with opportunity for at-grade access
- Easier configuration for crowd management (compared with Island Platforms);
- If whole corridor has side platform stops, predictability of door opening always on a constant side;
- Placement of OHW poles is possible on the platform. However, the alignment must be considered in relation to any existing poles and infrastructure;
- Location of integrated services cabinet on one of the side platforms (usually the platform with higher boarding demand); and
- Side platforms require two separate canopies in the streetscape, positioned closer to adjacent buildings.



**Figure 46.** Typical side platform with integrated public domain

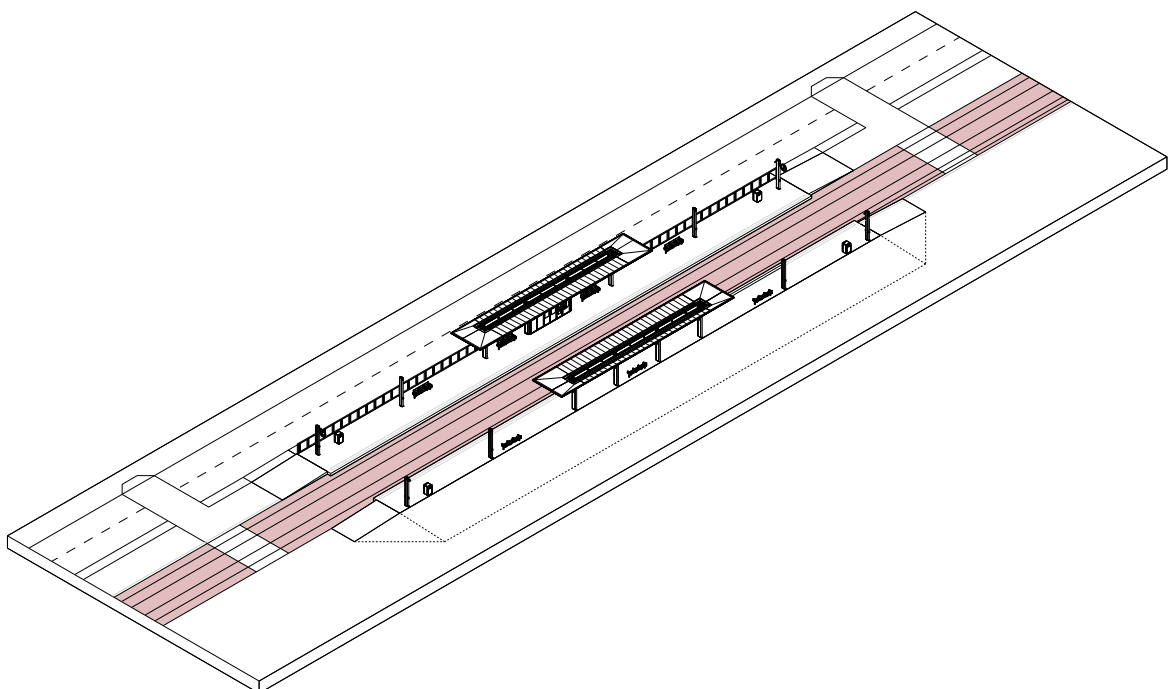
### 5.2.3 Side Platforms (with a road behind)

In this configuration, some type of barrier such as a balustrade or seating wall will typically be provided along the length of the platform to prevent uncontrolled crossings onto the roadway.

Consideration must also be given to the protection of the platform and associated infrastructure from vehicle impacts, especially when the roadway behind the platform can be accessed by buses. In this scenario bus operator clearances apply.

There are several factors to consider when designing a Side Platform with a road behind, including:

- Passenger protection and uncontrolled road crossing prevention through the use of balustrades along the back platform edge;
- Vehicle impact protection through the use of some type of safety barrier, such as balustrades, along the back platform edge;
- Consideration to access and maintenance requirements of equipment placed on platforms relative to an active roadway; and
- Bus operator clearances to stop and stop infrastructure (if applicable).



**Figure 47.** Typical side platform with road behind

### 5.2.4 Interchange Platform or Shared Bus/ LRV Zone

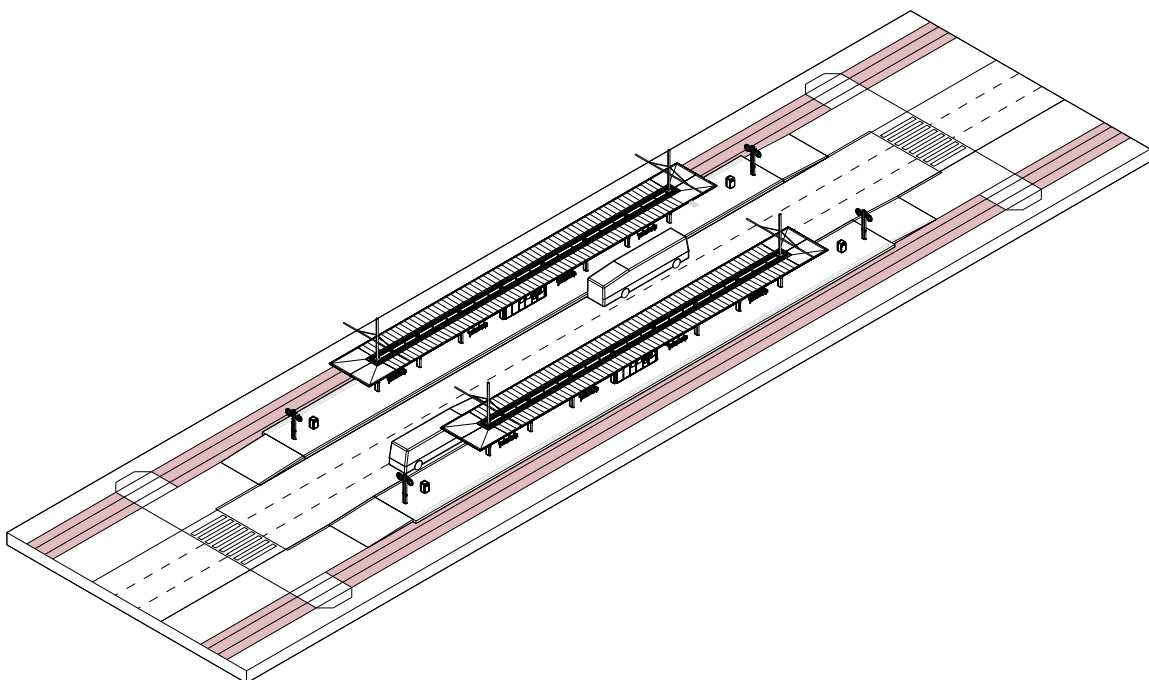
Interchange platforms are typically island platforms which allow one side to be accessed by bus. In this configuration the platform edge is typically 150mm above the road level. DDA requirements for platform delineation differ from a typical island platform, and specific bus movements must be considered when determining the position of bus signage and passenger information displays.

Note that at interchange platforms bus operator clearances apply.

In some instances, the track zone running parallel to the stop may be shared with buses. Shared corridors, like interchange platforms must take into consideration specific bus operator clearances and offsets to elements of stop infrastructure. Consideration must also be given to measures preventing incidental collisions of buses with stop infrastructure (platforms, ramps).

There are several factors to consider when designing an interchange platform:

- Potential advantage of direct interchange between modes;
- Bus operator clearances to stop infrastructure impact on the minimum height and extent of canopies, which has consequences with regards to weather protection;
- Specific bus infrastructure set-out and location (bus timetables, passenger information displays);
- Head of stop delineation (for bus movements)
- No platform edge tactile surface indicators required on bus side;
- TfNSW bus mode integration. (Integration of light rail and bus mode identity on one platform);
- Digital passenger information for bus services;
- Liaison with TfNSW bus planning for the latest approach to unifying technology, data collection and amenities; and
- Directing customers safely to controlled crossing points and discouraging movements across the bus lanes between platforms.



**Figure 48.** Typical interchange platform

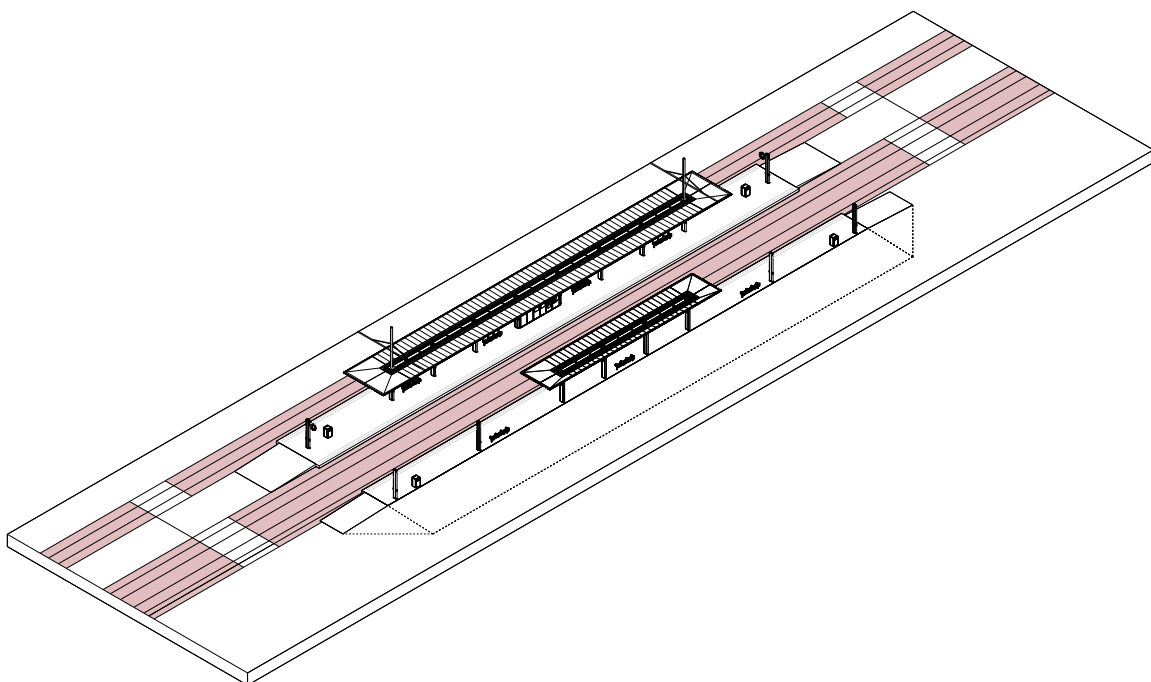
### 5.2.5 Event Mode / Multiple Platforms

Terminus stops and high patronage stops may require additional platforms to deal with surges in capacity and to enable efficient movement of Light Rail vehicles.

A typical event mode arrangement may consist of an island platform and a side platform which enable flexibility in vehicular shunting movements to service daily peak and event use.

There are several factors to consider when designing an event mode platform:

- Platform numbering and associated signage to assist with operations and customer announcements;
- Good visibility of PIDs (two PIDs should be visible at the same time);
- Consideration of customer announcements;
- Ensuring adequate platform widths to deal with surges in patronage;
- Managed pedestrian track crossings for maximised safety during event mode operations;
- Additional locations for event mode signage; and
- Additional Opal card readers placed within the public domain to deal with high passenger numbers during events



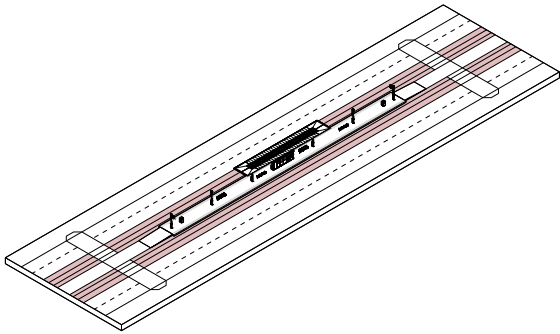
**Figure 49.** Typical event mode platform



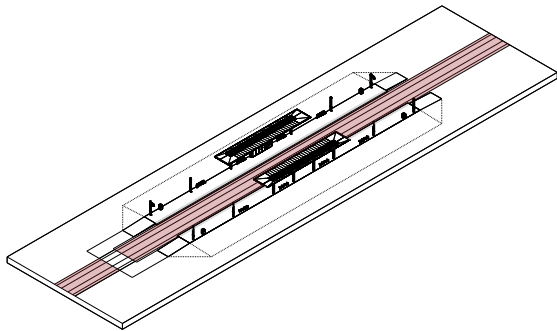
**Figure 50.** Circular Quay is a multi platform terminus stop with direct level access to the surrounding precinct (CSELR)



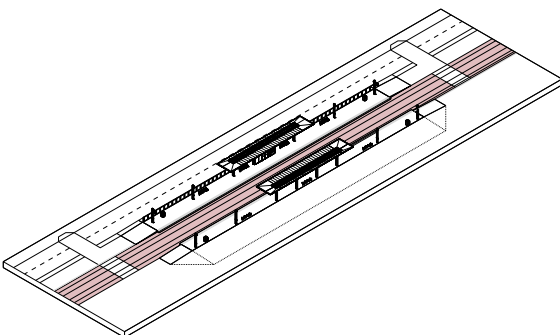
**Figure 51.** Central Chalmers Street is a major interchange between other modes of transport as well as a terminus stop for some special event services (CSELR)



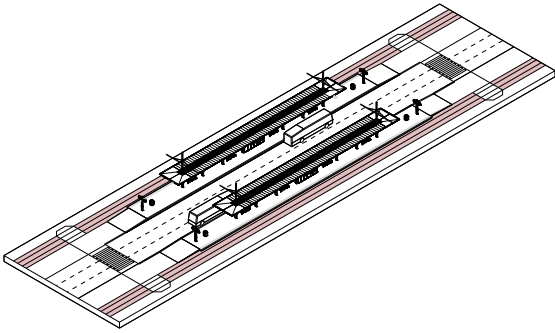
**Figure 52.** Typical Island Platform (NLR, Queens Wharf)



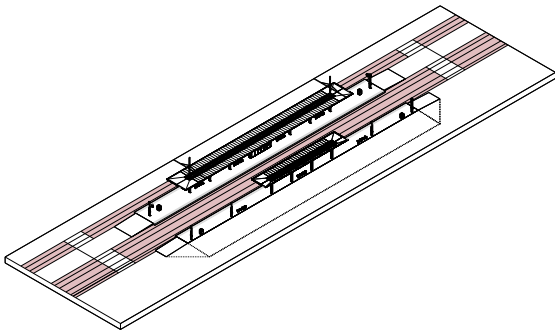
**Figure 53.** Typical Side Platform with integrated public domain (CSELR, Town Hall)



**Figure 54.** Typical Side Platform with Road behind (CSELR, UNSW High Street)



**Figure 55.** Typical interchange platform (CSELR, Juniors Kingsford)



**Figure 56.** Typical event mode platform (CSELR, Moore Park)

## 5.3 Road Integration

### 5.3.1 Road and Traffic Integration

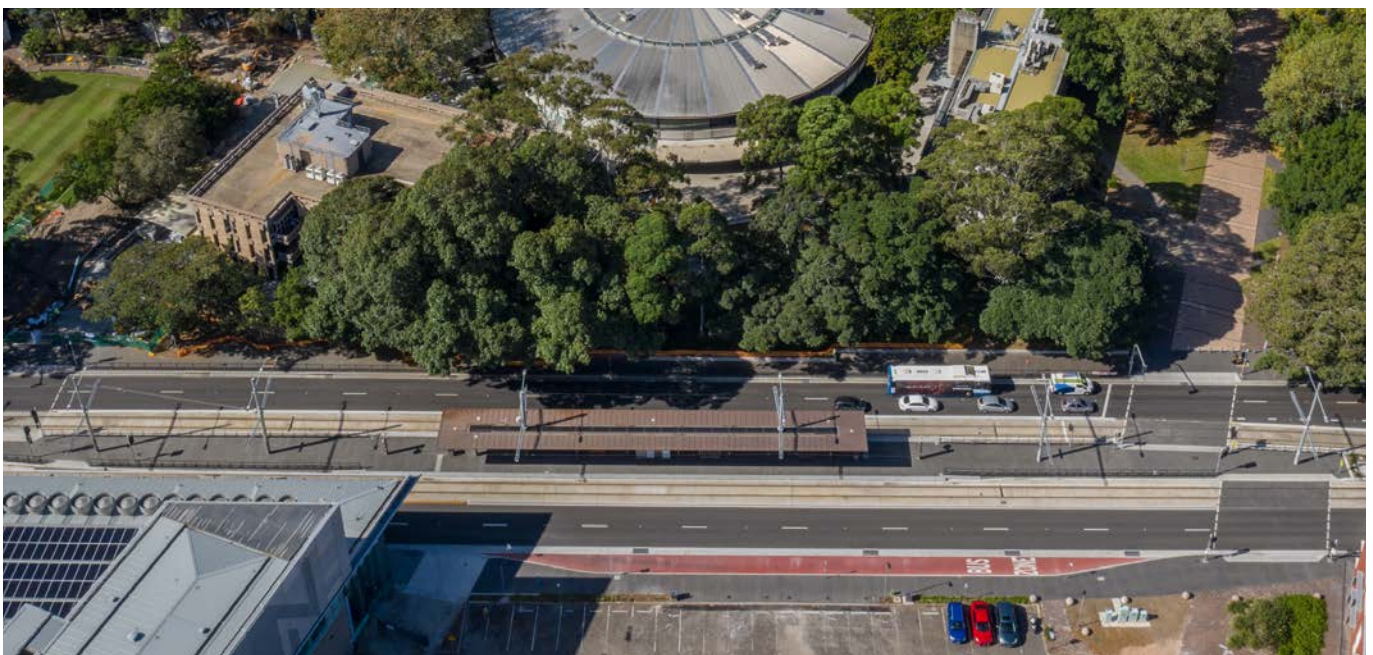
For street running light rail, the placement of stops must carefully consider how the stop and its access points interface with the road system and all road users. Road changes for new light rail stops can improve connections across corridors for the wider community.

Customer desire lines to light rail stops are very strong. Island stops in major roads need to be accessed from both ends. Evidence from previous NSW light rail projects show that customers do not walk long detours to get to island stops accessed from only one end. Road safety for pedestrians is a key design determinant and compliance factor.

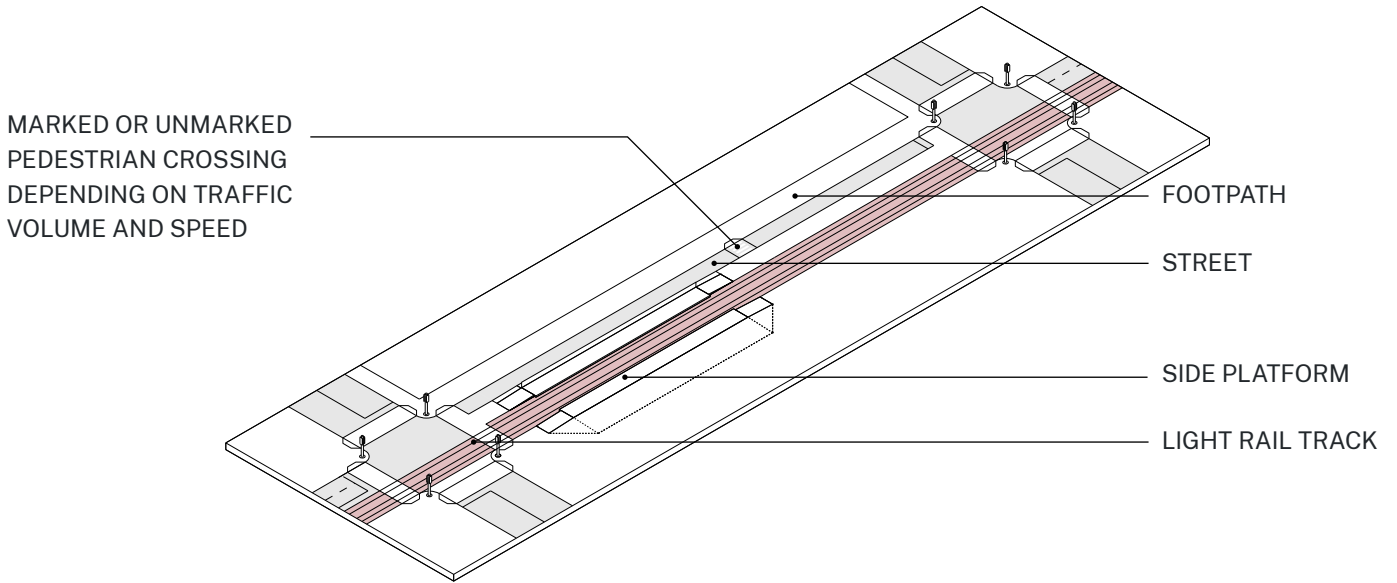
There are some aspects that contribute to the decision making regarding stop placement within a roadway (as illustrated in the diagrams):

- Signalised versus unsignalised pedestrian access to the stop. Pedestrian crossings to light rail stops must be signalised when there are 2 or more traffic lanes adjacent to the stop. This definition of '2 travel lanes' includes the situation of a single traffic lane immediately adjoining the light rail track. When traffic conditions allow it or when there is one adjacent traffic lane in each direction marked or unmarked pedestrian crossings can be deployed. (See Figure 58)

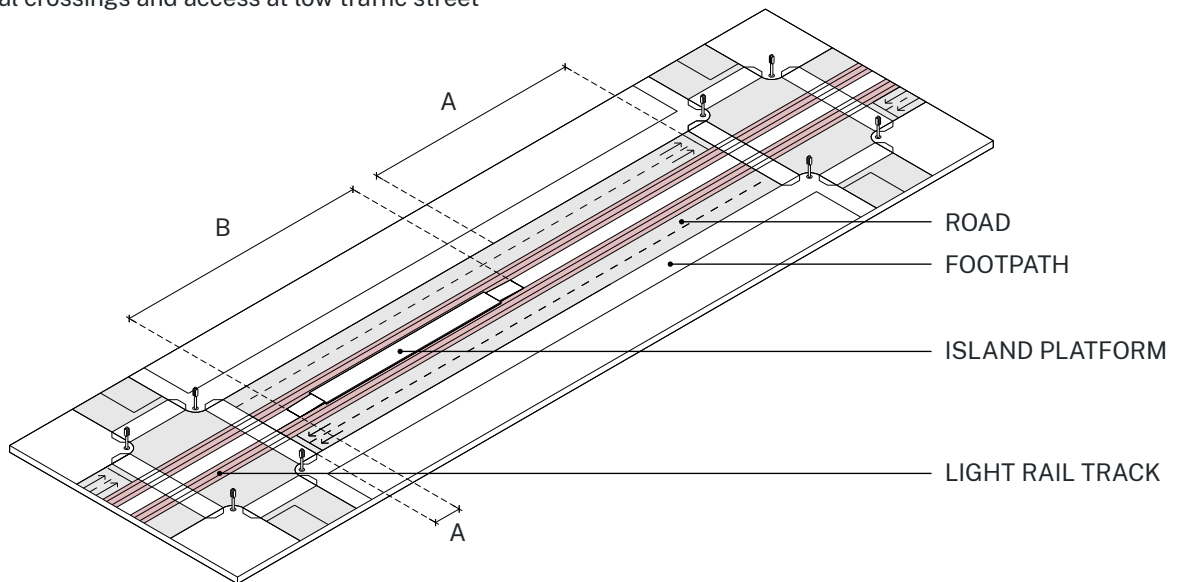
- (A) The appropriate minimum/maximum travel distance within a median from the platform to the nearest pedestrian crossing. Note that the longer the distance the more likely people are to make uncontrolled crossings which in turn necessitates the inclusion of barriers. (See Figure 59)
- (B) The length of the stop in relation to the urban grid and proximity to existing junctions and planned junctions. Note the longer the stop the more challenging the interface may become.
- (C) The minimum allowable distance between crossing points when providing dedicated signalised access to the stop. Planned stop crossings that are too close to signalised junctions may not be approved in later stages. By this stage, it will be too late to change the stop location resulting in sub-standard access and undesirable mitigation measures like pedestrian barriers will be difficult to avoid. This is why early consultation with the Road Authority, TfNSW's Safety team and design expertise in early planning stages is essential. Single sided entry stops are not preferred due to the increased likelihood of people carrying out uncontrolled crossings over the trackway and adjoining roadway. (See Figure 60)



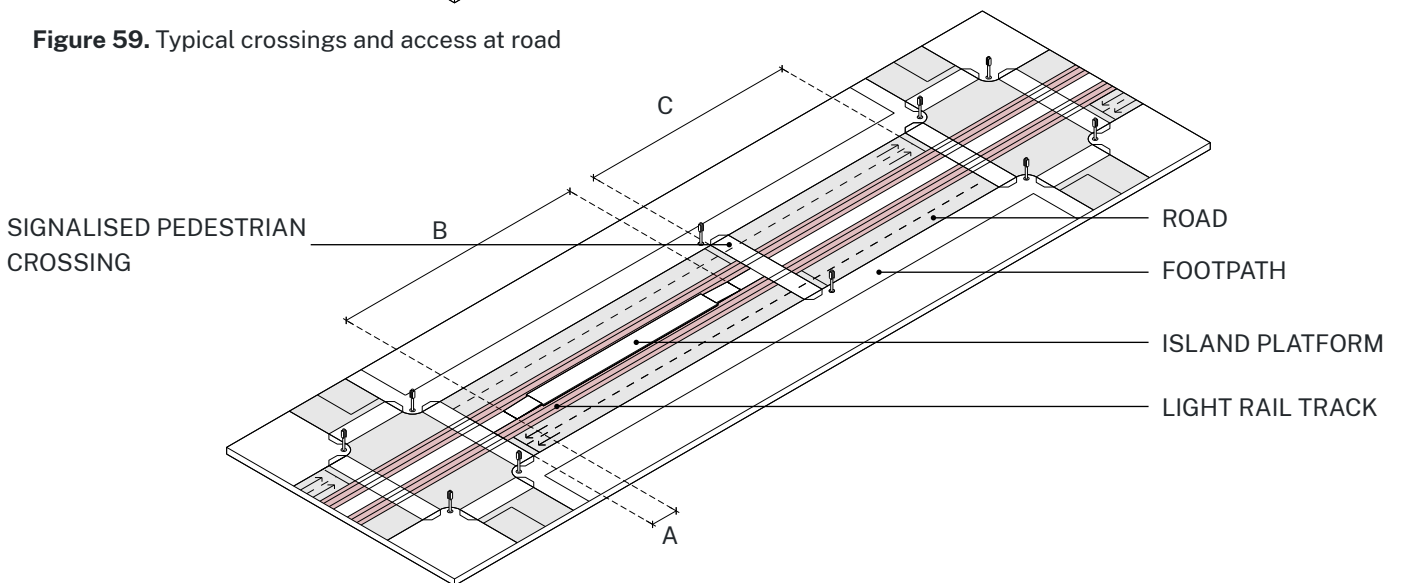
**Figure 57.** Light rail stop in a median at UNSW Anzac Parade Stop with crossings on either end (CSELR)



**Figure 58.** Typical crossings and access at low traffic street



**Figure 59.** Typical crossings and access at road



**Figure 60.** Typical crossings and access at road with mid-block signalised crossing

### 5.3.2 Examples of Road Crossings at stops



**Figure 61.** Signalised crossing across a single travel lane with balustrade dog-leg (PLR, Benaud Oval)



**Figure 62.** Non-signalised crossing across a single travel lane with balustrade dog-leg (PLR, Westmead Hospital)



**Figure 63.** Non-signalised crossing across single travel lane (PLR, Benaud Oval)



**Figure 64.** Non-signalised, pedestrian crossing over single travel lane (CSELR, Surry Hills)



**Figure 65.** Signalised crossing across the full road reserve (PLR, Fennell Street)



**Figure 66.** Signalised crossing across multiple travel lanes (IWLR, Convention)

### 5.3.3 Examples of Track Crossing at Stops



**Figure 67.** Single track crossing (CSELR, Wansey Road)



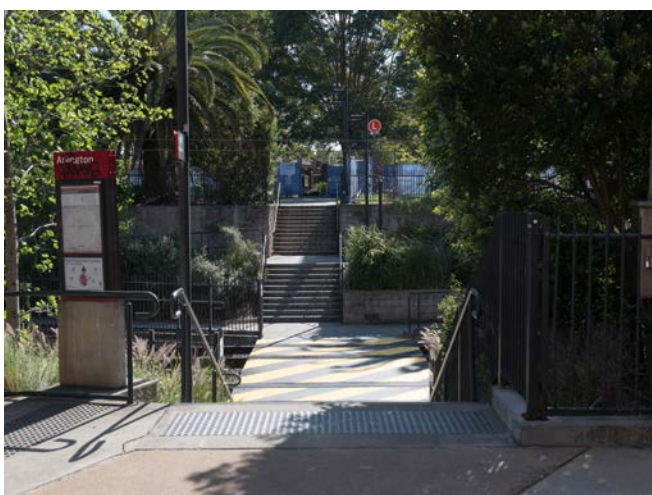
**Figure 68.** Crossing over ballasted track between side platforms (IWL, Hawthorne)



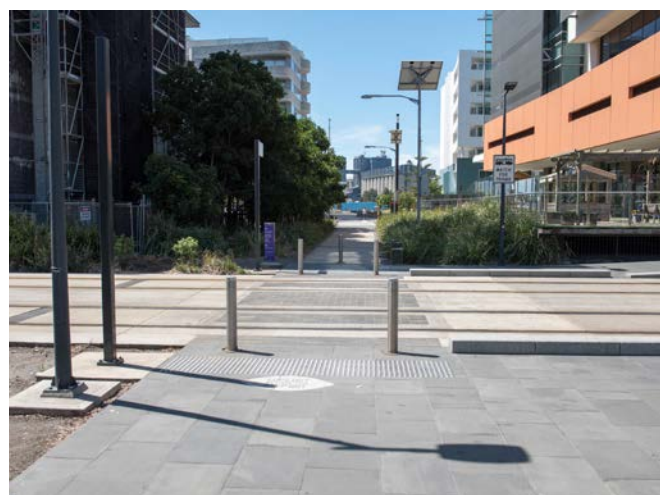
**Figure 69.** Crossing over ballasted track between side platforms (IWL, Waratah Mills)



**Figure 70.** Double track crossing (CSELR, Royal Randwick)



**Figure 71.** Track crossing aligned with pedestrian paths and steps (IWL, Arlington)



**Figure 72.** Double track crossing aligned with pedestrian paths (NLR, Honeysuckle)

## 5.4 Urban Integration

### Principles

New light rail stops must become a part of the wider precinct. Stops cannot impact existing building entries and associated footpath levels. Integration and design detailing seeks to minimise the risk of slips, trips and falls from people not anticipating the change in grades around stops and the trackway. Furthermore the design solutions must where possible avoid steps, fencing and balustrades in the streetscape.

Most projects will require the platform to be in the order of 300mm higher than the track zone in order to provide step free access to the light rail vehicles.

There are a number of ways in which to integrate side platforms with the surrounding public domain. The selected option will have far reaching consequences relating to general accessibility, property line impacts as well as drainage and flooding.

### Requirements

- The design is to consider the extent of regrading towards the building line;
- The design is to ensure that regraded footpaths are DDA compliant;
- The design is to ensure that accessible paths, that is footpath widths, are provided between the building line and the back of the stop; and
- The design is to assess any potential flooding impacts to adjacent properties and the trackway;

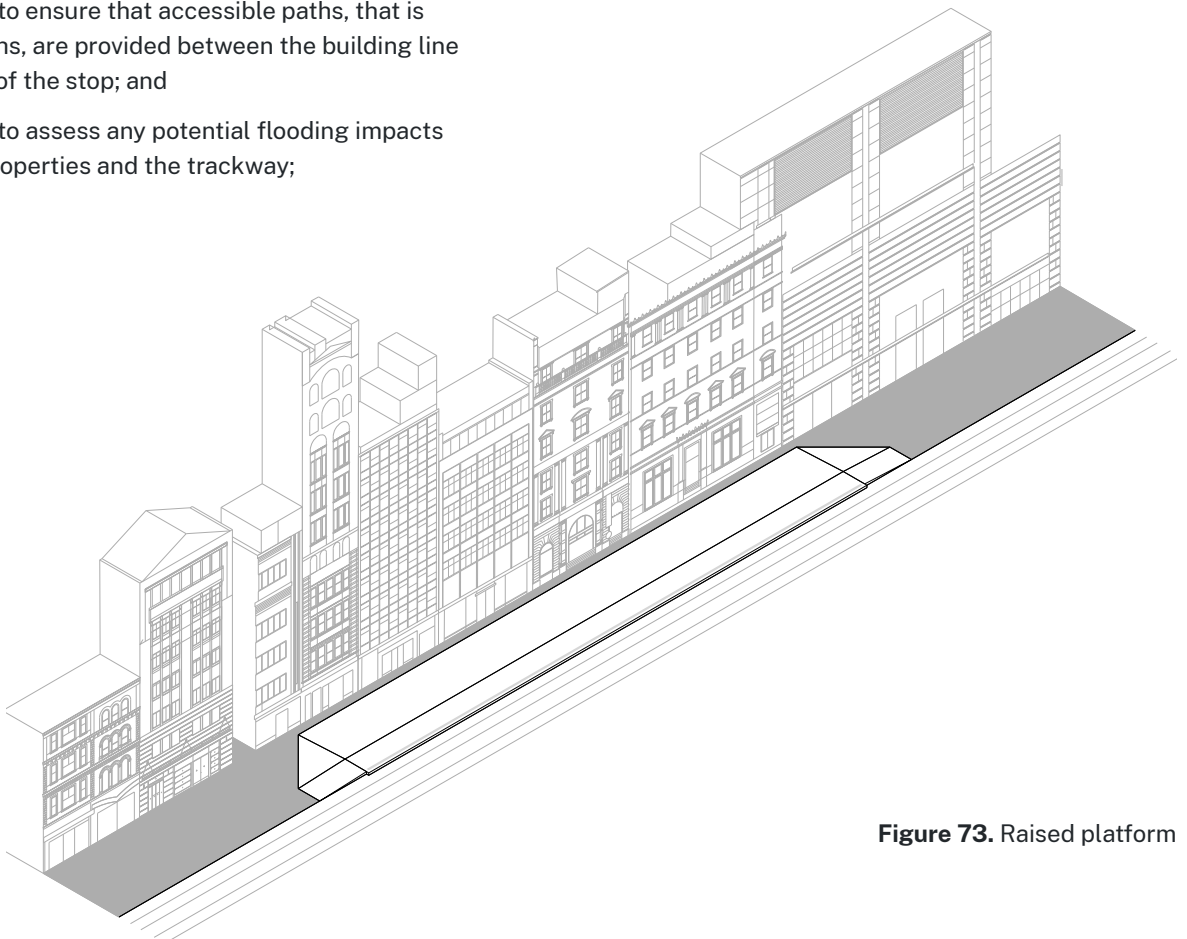
### Option 01 - Raised platform

In this option the track level is flush with the footpath and the platform is raised to provide access to LRV. In this scenario consideration must be given to the regrading of the adjoining public domain. Maximum cross falls for DDA compliance must be observed which determines the extent of regrading.

Consider extent of regrading to back of platform. Existing ground levels at property boundary should be maintained and no flooding impacts created.

Often sites may not have sufficient area within the project permanent site boundary to be able to accommodate this and stairs or kerbs may be needed at the back of the platform.

The benefits of this solution relate to the limited extent of the stop and track crossings located in the immediate vicinity of the platform ends (base of ramps) resulting in maximised DDA accessibility across the track zone.



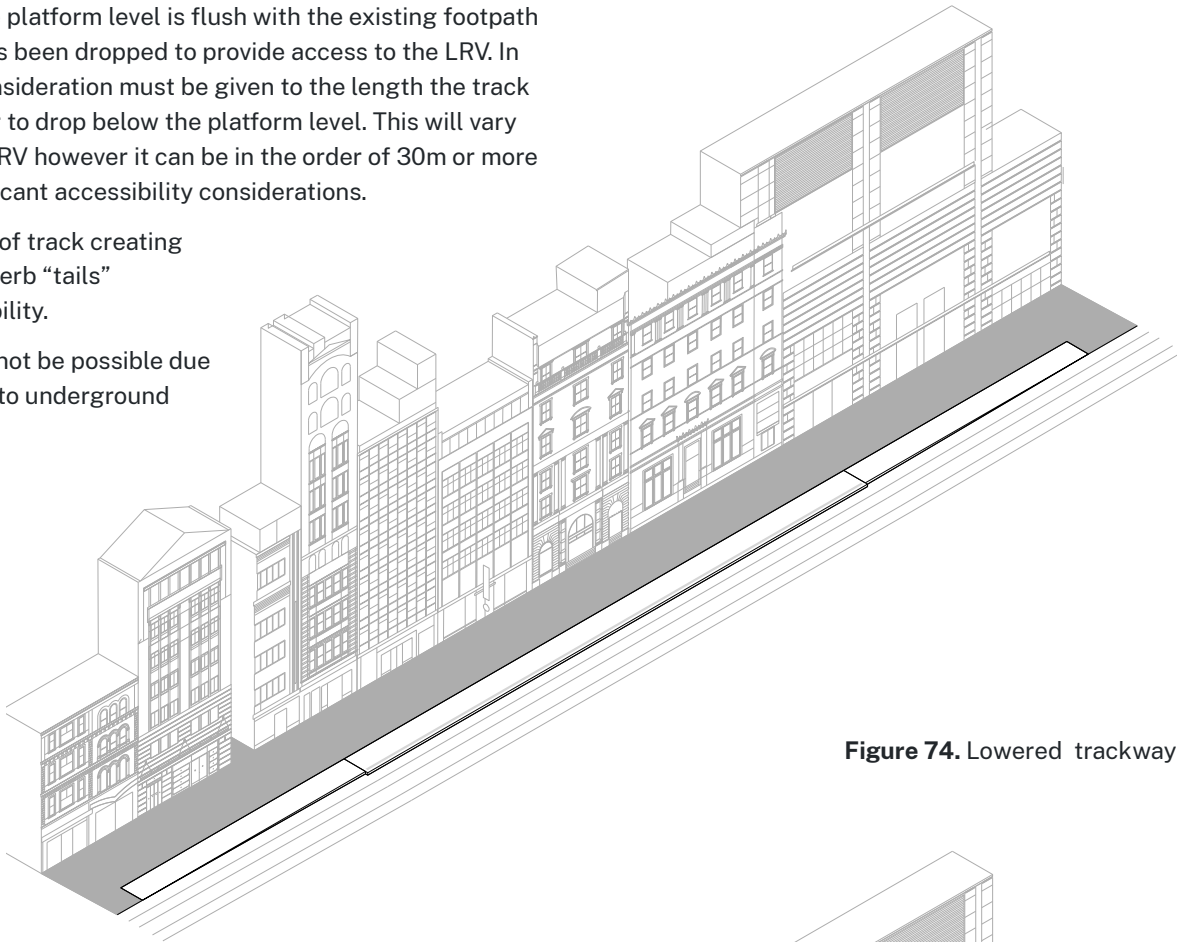
**Figure 73.** Raised platform

**Option 02 - Lowered trackway**

In this option the platform level is flush with the existing footpath and the track has been dropped to provide access to the LRV. In this scenario consideration must be given to the length the track required in order to drop below the platform level. This will vary depending the LRV however it can be in the order of 30m or more which has significant accessibility considerations.

Consider length of track creating long triangular kerb “tails” limiting accessibility.

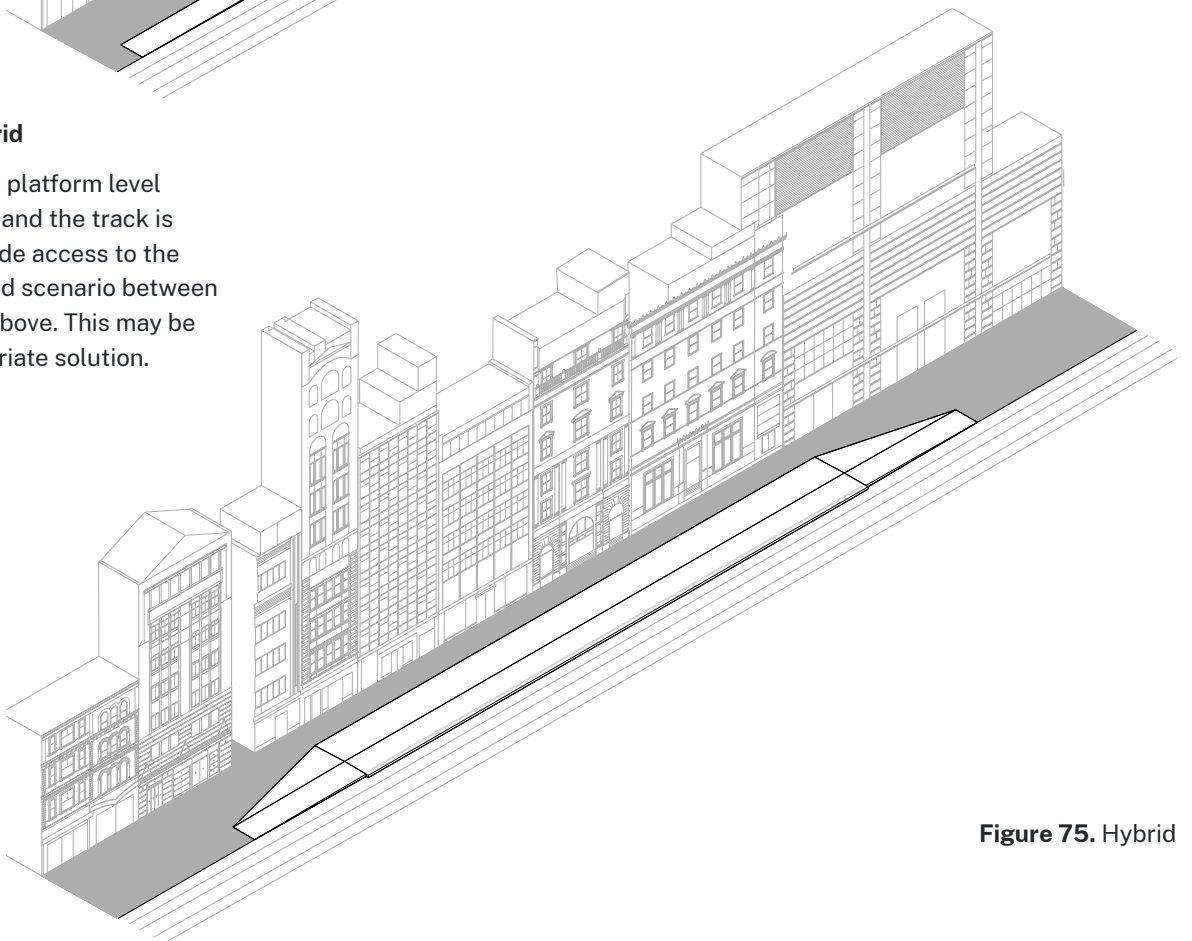
This option may not be possible due to the proximity to underground utilities.



**Figure 74.** Lowered trackway

**Option 03 - Hybrid**

In this option the platform level is slightly raised and the track is dropped to provide access to the LRV. This is hybrid scenario between options 1 and 2 above. This may be the most appropriate solution.



**Figure 75.** Hybrid

### 5.4.1 Flush Platforms

When integrating side platforms with adjoining footpaths the extent of regrading must be considered. The footpaths at the back of the platform must be DDA compliant, which means they cannot have cross falls greater than 1:40. This becomes a significant constraint.

#### Platform Cross Section 01

The maximum cross fall on a light rail platform cannot be greater than 1:40 in order to achieve DDA compliance. This applies to the adjoining footpath also.

A drainage line must be established which allows water to be collected without draining onto surrounding properties.

#### Platform Cross Section 02

In constrained areas there may not be sufficient area for the extent of regrading required. Existing utilities or underground structures may also prevent the track zone being dropped. In these circumstances steps to the back of the platform may be considered in order to provide access to the stop.

The width between the platform and building line should be checked against the TfNSW Walking Space Guide to ensure the whole-of-street outcome fits the context.

Ensure a minimum of 1800mm between the building line and the edge of the PLRC can be achieved for DDA compliant footpath widths.

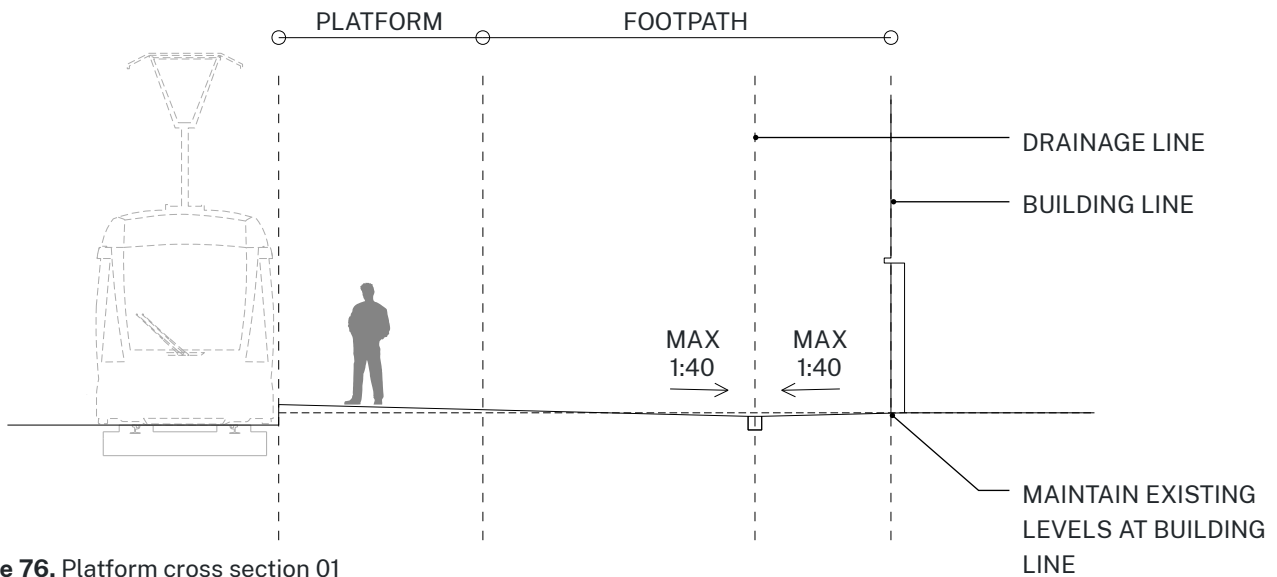


Figure 76. Platform cross section 01

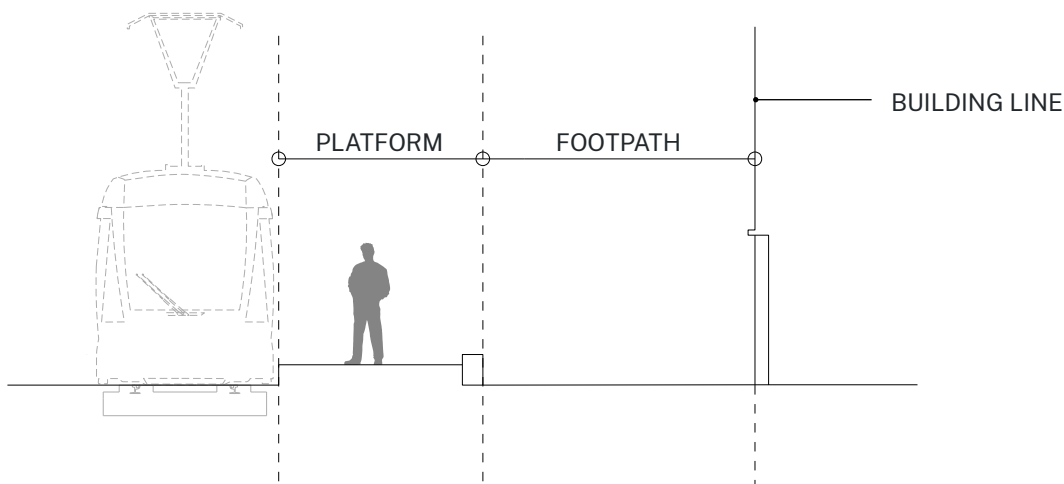


Figure 77. Platform cross section 02

### 5.4.2 Stair Access

When proposing stairs to the back of the platform consider the positioning of tactile surface indicators for DDA compliance. Consider how these integrate with the platform paving.

Platforms are not often completely flat longitudinally. Note that one step is unlikely deemed accessibility compliant and two steps may need to be provided as a minimum.

Avoid balustrades at the back of the platforms. Rather, investigate kerbed solutions for an improved streetscape design. If a compliant step solution can not be provided, the level difference between footpath and platform could be used for incidental seating opportunities in the street rather than balustrades.

If a fully flush back of transition cannot be achieved, maximise access along the back of the platform and eliminate balustrades for visual and physical permeability.

Longitudinal falls to the back of the platform and integration of stairs will require review by the project team accessibility consultant.

One design solution for tidy step integration with the public domain is to maintain at least one, consistent 150mm riser (top of stair) and establish the length of the stair based on the diminishing riser (bottom of stair). This enables a single, continuous line of tactiles along the top and bottom of the stair, as illustrated below.

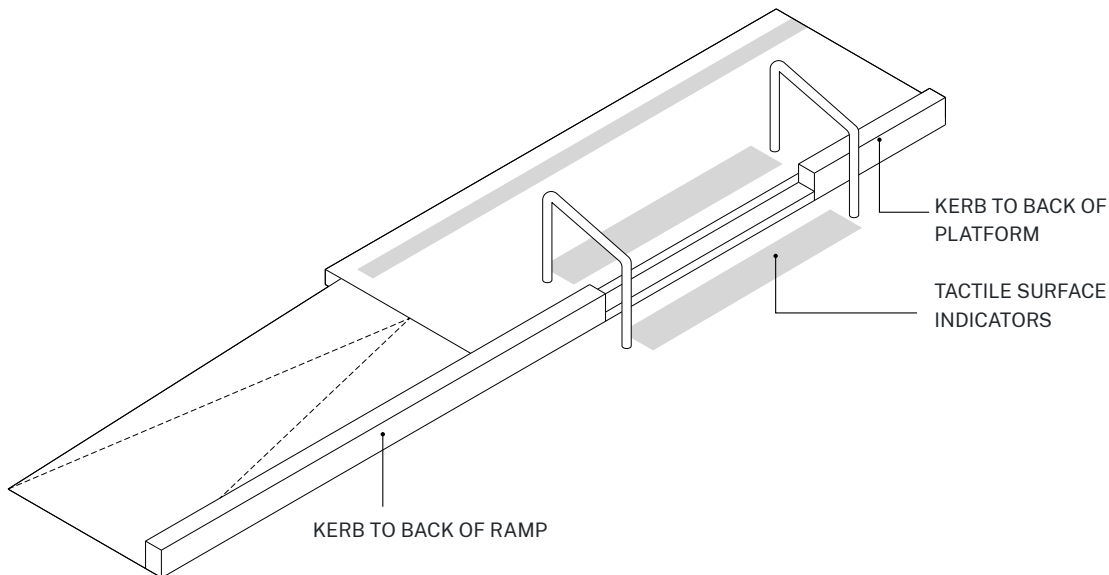


Figure 78. Stair access at back of platform

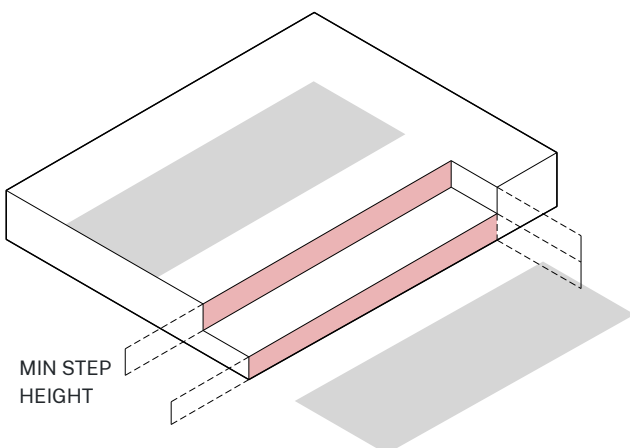


Figure 79. Stair detail



Figure 80. Step precinct integration at Haymarket (CSELR)

### 5.4.3 Stop/Road Integration

Platform edges should be adequately protected from vehicle impacts. This may be in the form of a redirective road kerb. Consideration should be given as to how this kerb is integrated with the platform edge. Ramp and platform kerbs should align.

Drainage on side platforms will fall away from the platform edge and water can drain onto the roadway.

Observe road clearance requirements, specifically where roads can be accessed by buses when placing platform equipment. For example, on CSELR the bus operator requirements dictated offsets of 800mm horizontally from the kerb edge and 4300mm vertically. Consult with the relevant bus operator.

There is no definitive standard for the offset of platform edges to a traffic lane, however road safety processes will consider passengers leaning or sitting on the back of platform balustrades/barriers. Consider passengers leaning or sitting on the back of platform balustrades.

Reduced road speed limits can improve safety around stops and influence design solutions.

### 5.4.4 Bus Lane Integration

Buses may be required to share the LRV corridor but do not stop at a platform.

Shared bus and LRV corridors require the protection of stops from accidental vehicle impacts.

Consider the transition between the kerb running parallel to the platform and the ramps.

Consider integration of kerbs - road, platform and public domain.

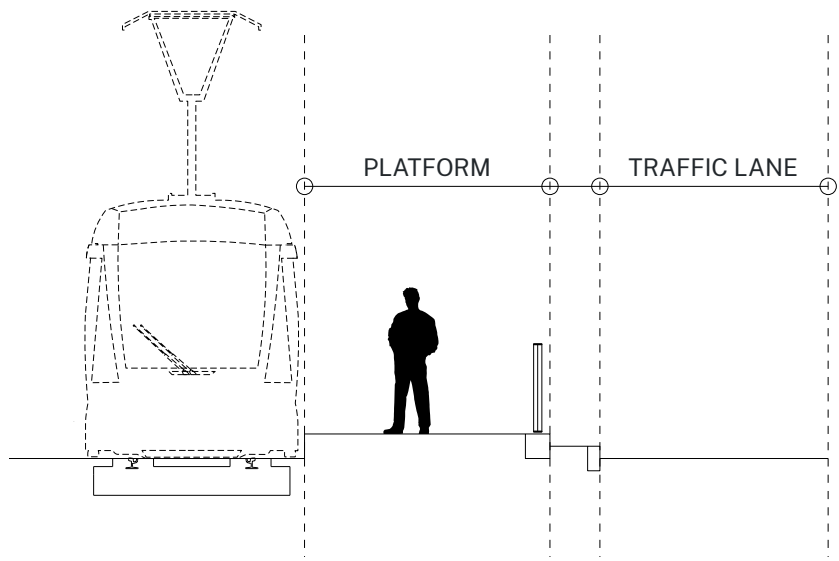


Figure 81. Cross section through side platform showing traffic lane kerb

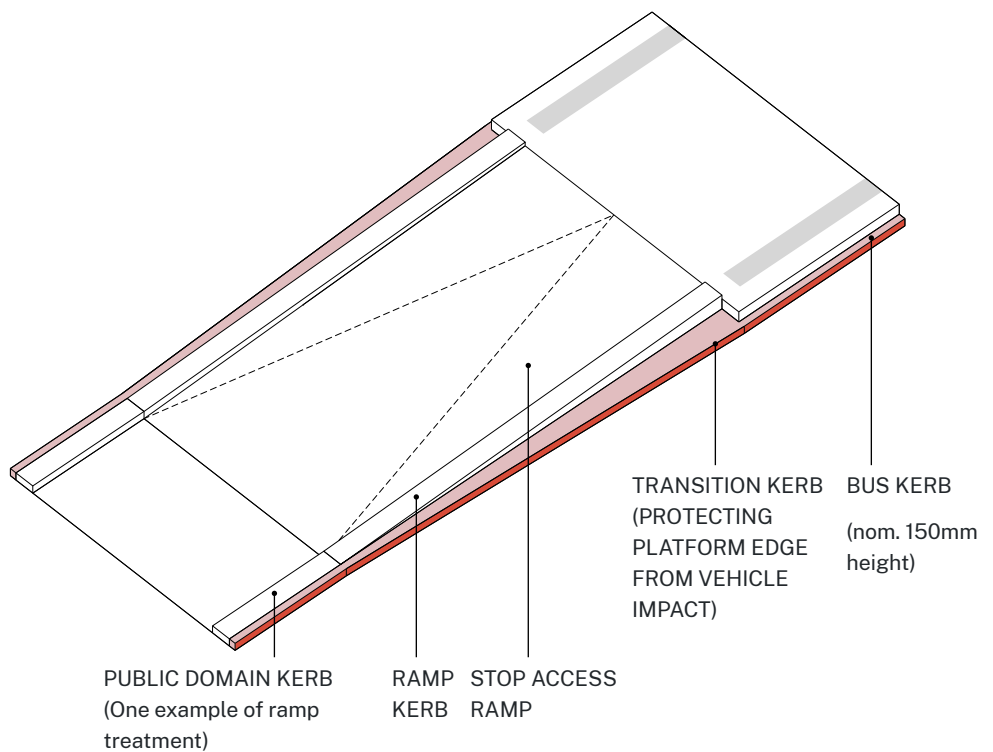


Figure 82. Axonometric view showing bus kerb in shared LRV and bus corridor

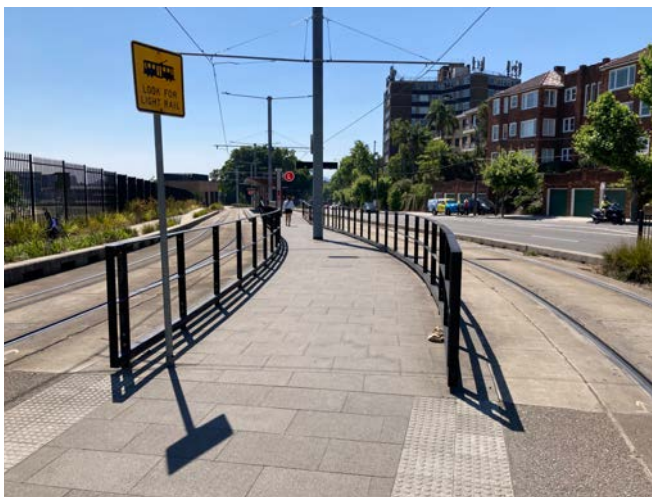
### 5.4.5 Examples of access to stops in road environments



**Figure 83.** Ramp directly from street footpath with landscaped buffer stop (CSELR, Randwick)



**Figure 84.** Ramp from pedestrian median (NLR, Queens Wharf)



**Figure 85.** Ramp from pedestrian median with edge balustrades (CSELR, Wansey Road)



**Figure 86.** Ramp from pedestrian median with central handrail (CSELR, Royal Randwick)



**Figure 87.** Lift access to elevated light rail stop (IWLR, Marion)



**Figure 88.** Long ramp from platform to road crossing (CSELR, UNSW High Street)

### 5.4.6 Dynamic Kinematic Envelope

The DKE is the envelope of the tram vehicle as it moves along the track and around corners, and accounts for the movement and sway of the vehicle carriage

Offsets from stop infrastructure to the Dynamic Kinematic Envelope (DKE) of the light rail vehicle must be observed.

The DKE will depend on the LRV specification and it will vary depending on the location along the alignment (straight track, curved track) and speed of the LRV.

Ensure a minimum offset from the DKE to any kerb of 300mm and 600mm to any longitudinal element (such as a balustrade).

This will be the defining factor for the kerb alignment as it meets the stop platform.

The DKE offsets and platform coping edge DDA requirements will most likely not align.

The proposal below shows how DDA requirements and DKE offset requirements can be integrated. The benefit of this solution is that precinct kerb/ paving alignment can be achieved as well.

DDA requirements have a major impact on successful precinct integration and should be considered holistically. Refer to [chapter 5.7 Equitable Access](#)

Requirements for delineation must be understood in order to achieve a fully successful and integrated design solution.

### 5.4.7 Footpath Integration

Street running light rail requires platforms to integrate with their surrounding public domain both in geometry (alignment) and finishes.

Footpath kerb alignment and detailing, trackway safety zone alignment and detailing (for pedestrianised areas), and pedestrian crossings are three critical interfaces with the stop access point which typically sit within the scope of the landscape architects. This requires coordination between the design team.

With regards to finishes the general platform and access ramp paving will depend on project specific and Local Government or other land owner requirements.

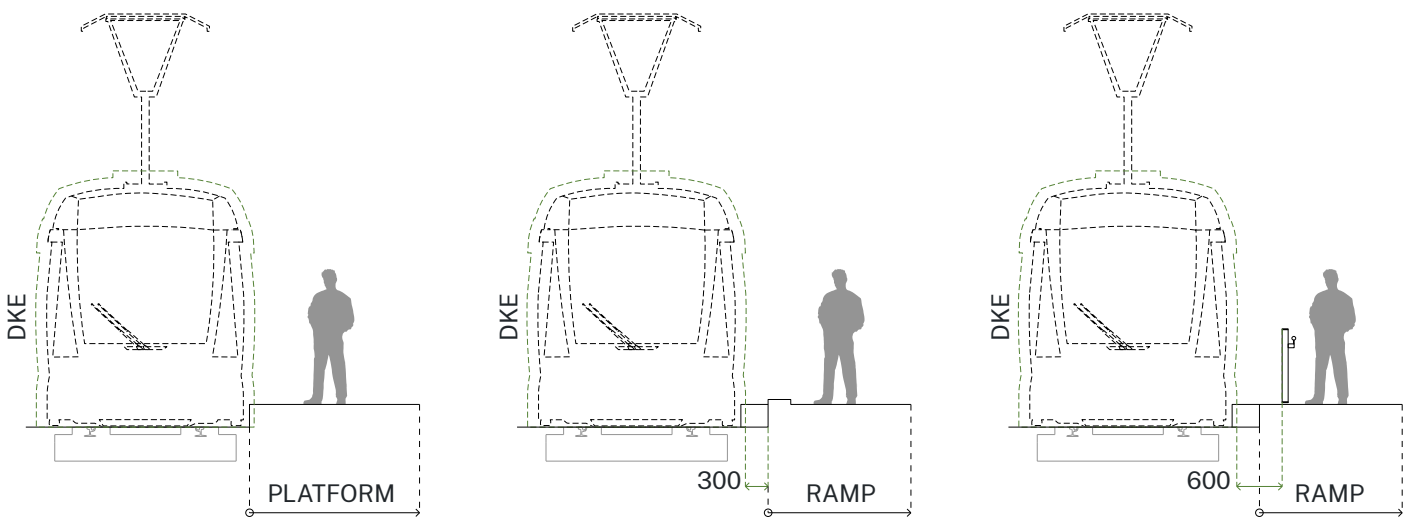


Figure 89. DKE and footpath integration

### 5.4.8 End of Line Treatment

#### Principles

End of line treatment typically consists of a device put in place to prevent the light rail vehicle from going past the end of the track.

There are a number of ways to integrate end of line treatment:

- Wheel stops -most appropriate for an urban setting;
- Bollards -appropriate for an urban setting yet can damage the vehicle; and
- Hydraulic buffer stops -not appropriate for an urban setting.

The selection of the appropriate end of line treatment will depend on the location and design of the terminus.

The design may consist of:

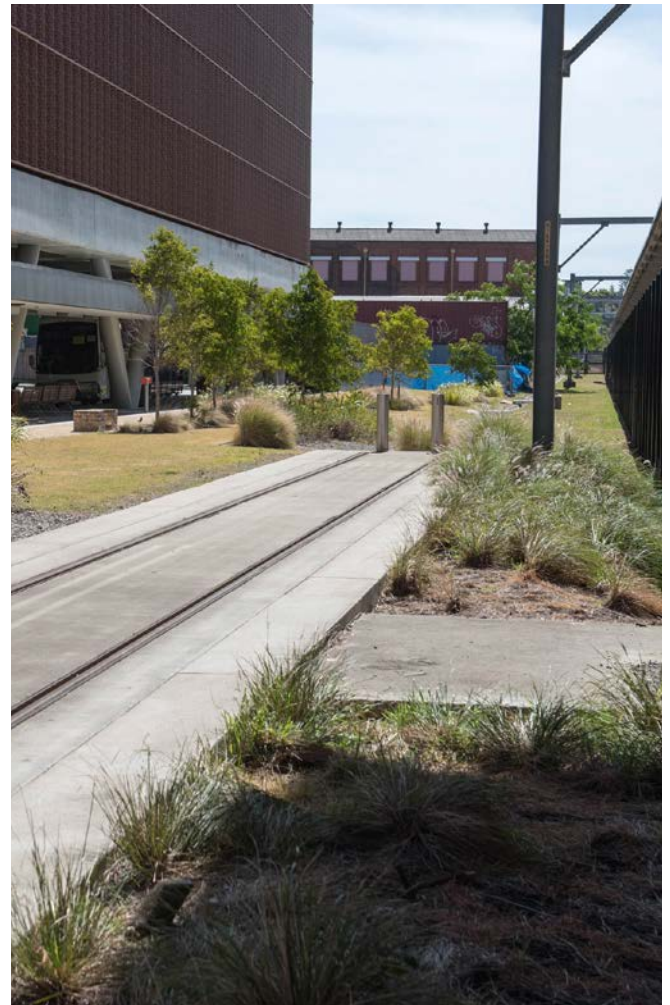
- Wheel stops for each line;
- Precast concrete track obstruction trigger for each line;
- ‘Stop’ sign -bolted down with frangible base for each line; and
- Standard track slab extension beyond the wheel stop with planting zone above.

#### Requirements

- Terminus stops are to have appropriate end of line treatment;
- The end of line treatment must be integrated with the stop architecture for a considered urban design response; and
- Near stop platforms and footpath areas, planting zones with raised edges reduce litter inflow and discourage people trampling vegetation.



**Figure 90.** CSELR Randwick terminus end of line treatment



**Figure 91.** NLR Newcastle Interchange terminus end of line treatment.

### 5.4.9 Drivers' Facilities

#### Principles

Drivers' facilities are required at terminus stops for the exclusive use of tram drivers for toilet breaks. These facilities can be in a new building or incorporated into an existing Transport building. In space constrained or landmark locations, there may be opportunities to minimise new structures and incorporate a drivers' toilet into a state-owned asset. An example of this solution was achieved in the Sydney Light Rail project in a heritage building on the hospital precinct next to the Randwick stop.

#### Requirements

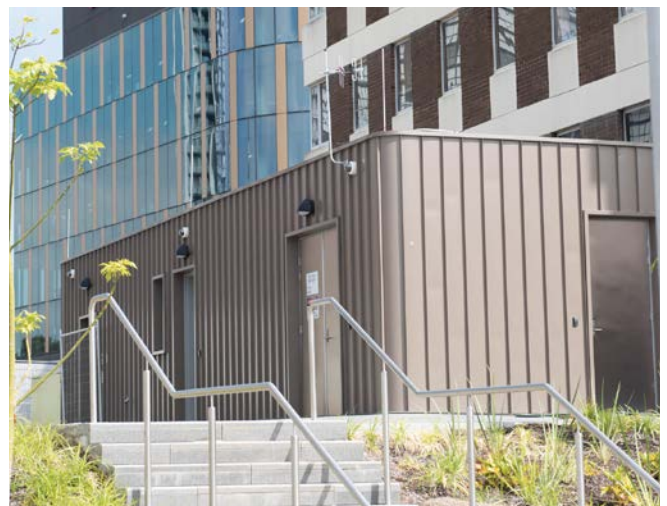
- Must be located must be close to the terminus stop via a direct walking route for the drivers' convenience on quick breaks;
- A discrete building/facility within the context;
- Safe design using Crime Prevention Through Environmental Design (CPTED) principles with a well lit route between stop.
- As an industrial relations requirement, the facility must be a key access facility for light rail operator staff only. Can not be shared with the public or other staff toilets;
- Hard wearing, durable and vandal resistant exterior;
- Typically two toilets in self-contained cubicles with basins to ambulant toilet AS1428.1 standard;
- A cleaners sink;
- Natural ventilation and daylight to interior; and
- Depending on location, may include drinking fountain and/or food preparation bench and sink in small meal area.



**Figure 92.** Drivers' facilities integrated into heritage building (CSELR, Randwick)



**Figure 93.** Drivers' facilities as stand alone building (CSELR, Juniors Kingsford)



**Figure 94.** Drivers' facilities on PLR (Westmead)

## 5.5 Platform Geometry

### 5.5.1 Minimum Platform Length

#### Principles

Minimum platform lengths must be defined in relation to the LRV length. Advice should be sought from the operator as to the stopping distances anticipated for the LRV. Typically a vehicle will not stop short of its stopping line, it may run over, with a common rule of thumb distance of 1.0m.

Typically the platform length should be no less than the length of the vehicle. As an example, the Sydney Light Rail vehicle is 66.7m long and the platform length is 67.0m.

Adding stopping tolerance will aid the driver and ultimately help reduce dwell times.

#### Minimum platform length calculation:

As a dimensional sequence from one end of the platform to the other, the minimum platform length = 300mm platform edge + 600mm tactiles + 1000mm\* overshoot zone + distance to door centreline (half door opening) + distance between first and last door centreline + distance to door centreline (half door opening) + 600mm tactiles + 300mm platform edge.

#### Requirements

- The design is to ensure that all doors can be accessed even in an incorrect stopping position;
- Markers are to be provided on the platforms in line with the driver's cab to indicate to the driver of their stopping position;
- On island platforms the driver stop marker is to be repeated on each coping edge and in the centre of the platform; and
- Coordination with the operator is to be undertaken to determine the best position of the stop markers.

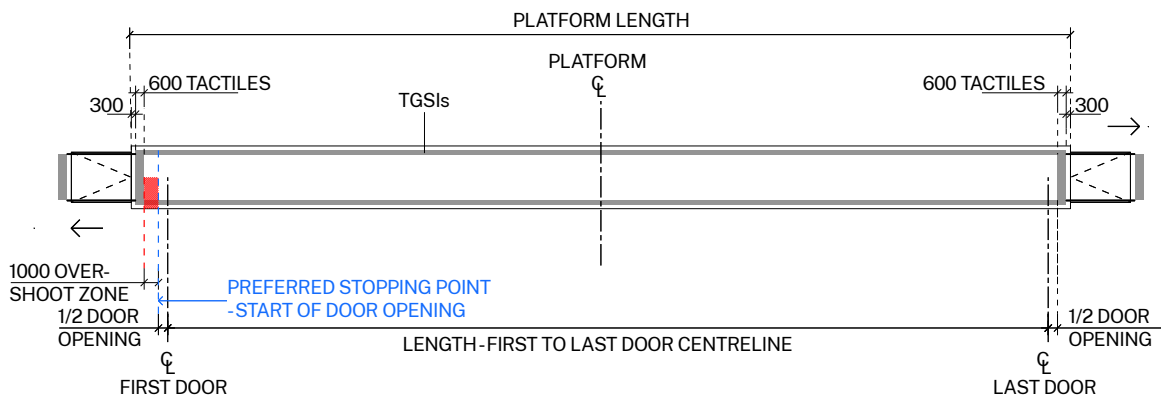


Figure 95. Driver stop marker identification

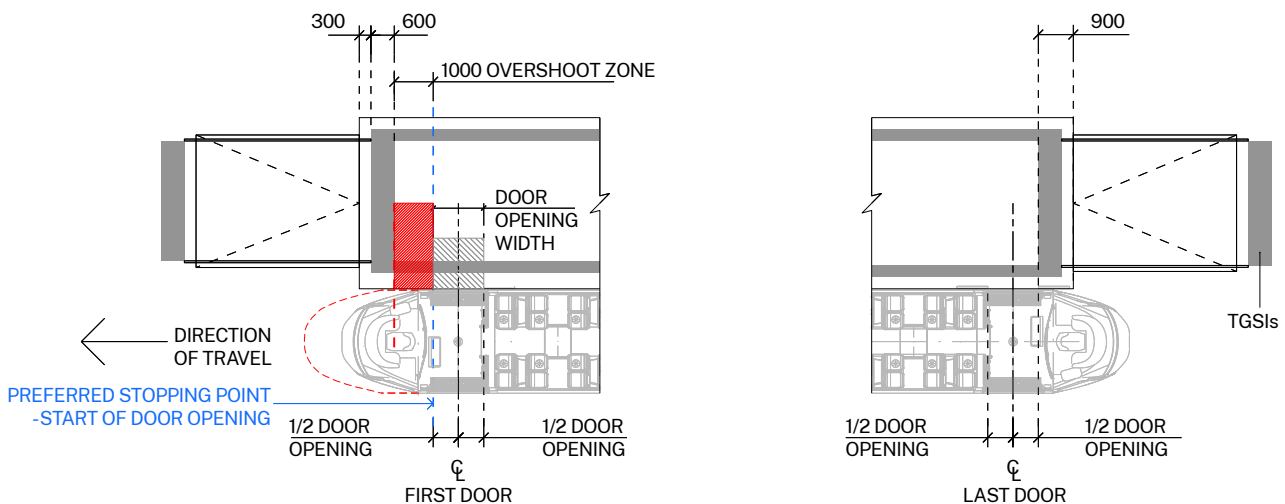


Figure 96. Details at platform ends

## 5.5.2 Minimum Platform Width

### Principles

Platform design will be subject to multiple criteria requiring a spatial trade off between the common desire for wider platforms for light rail passengers versus property, streetscape and civil infrastructure constraints, track geometries, and the spatial needs of other people and activities in the public domain. The following information on minimum dimensions is to inform those design decisions.

Minimum platform widths are typically determined by either DSAPT requirements (which define the dimensions of the platform safety zone, accessible paths and minimum manoeuvring areas in front of ticket machines and Help Points) or forecast patronage figures and Level of Service (LoS) requirements - whichever is the more onerous.

When defining the minimum platform width, consideration should also be given to touch potential issues. Any stop equipment located within 2.5m of the vehicle will require isolation.

The recommended minimum platform widths are:

- 4500mm for island platforms\*
- 3200mm for side platforms\*\*
- \* Assuming a maximum equipment zone/ cabinet overall width of 800mm.
- \*\* For exceptional circumstances 3000mm can be used (note this is the absolute minimum to achieve DDA compliance).

### Requirements

- Minimum platform widths must enable full compliance with the DSAPT;
- Platform widths are to be determined by patronage demand or DSAPT requirements, whichever is the more onerous; and
- Platform widths must be balanced with potential impacts in street reserves such as, kerb adjustments, tree removals and public domain footpaths.



Figure 97. Minimum platform width (CSELR, Circular Quay)

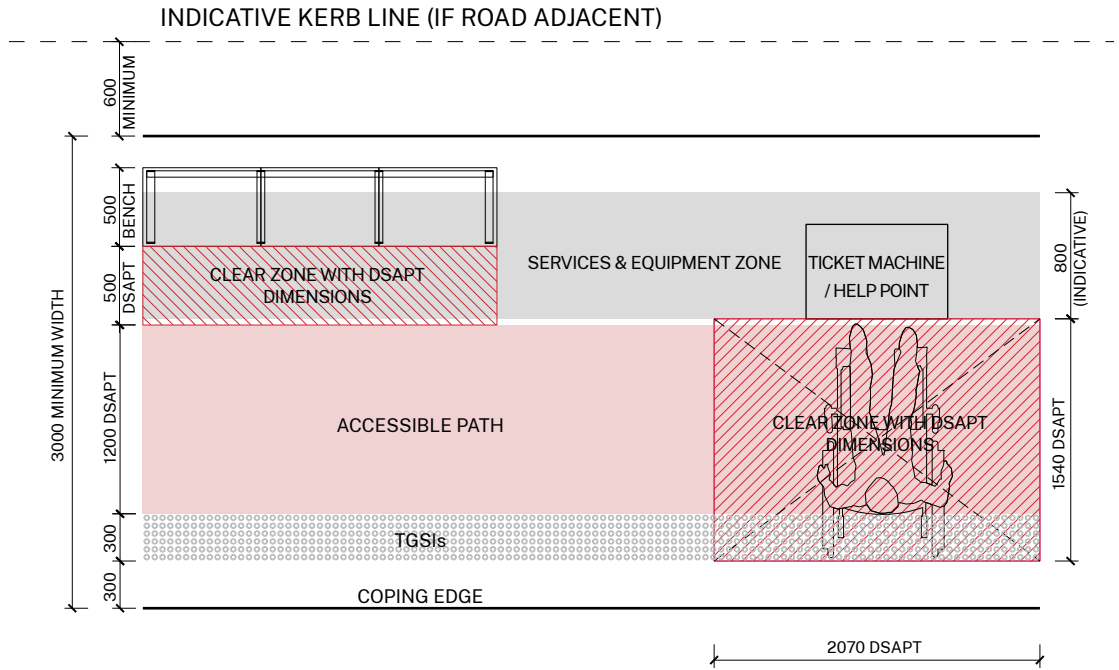


Figure 98. Minimum island platform side plan

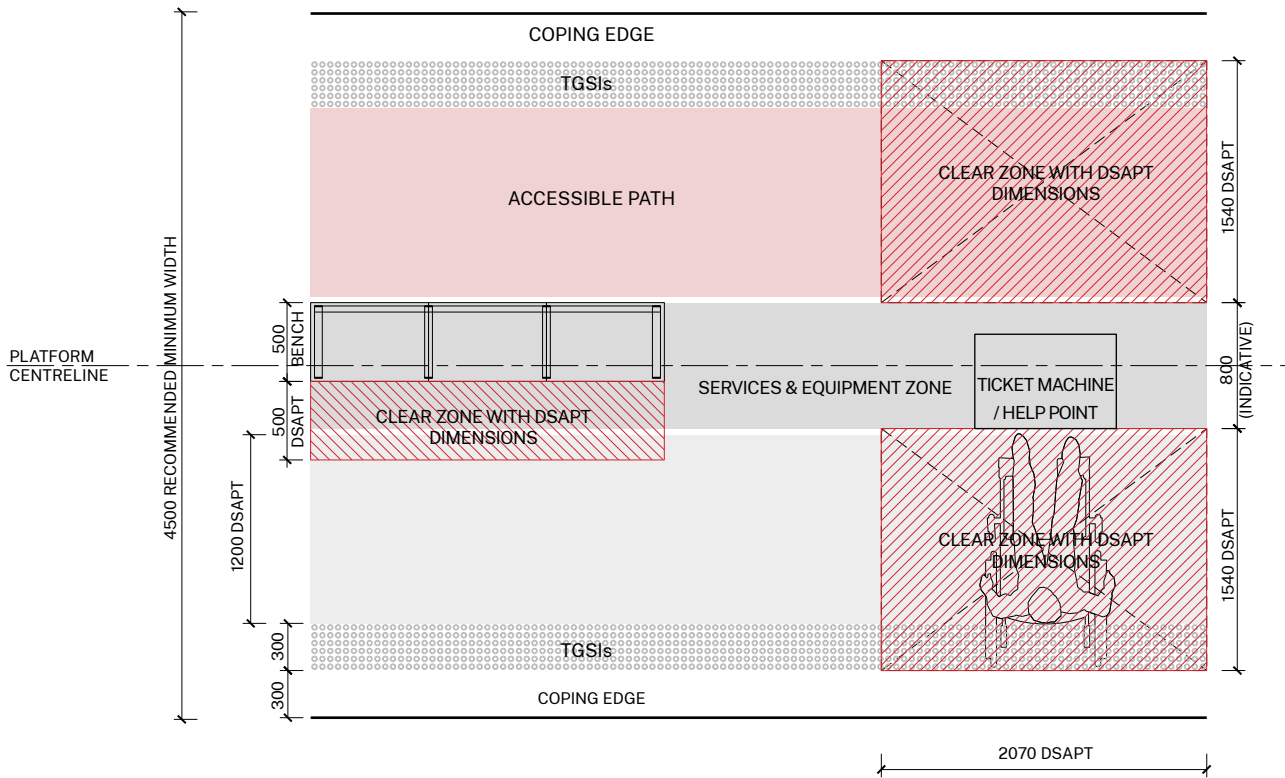


Figure 99. Minimum island platform width plan

### 5.5.3 Coping Strings

#### Principles

Coping strings are used to define the position of the platform edge (coping). Coping strings are three dimensional lines accurately set out from the track alignment.

In early design stages when setting out the extent of platforms, it is recommended to include ramps with the assumption of a standardised length at 1:14 or 1:20 grades.

However, in reality, every stop is on a slightly different gradient of land, therefore every ramp is slightly shorter or longer than the standard length in order to tie-in with the vertical alignment of the track and adjacent public domain. This will be documented in detailed design.

#### Requirements

- Stop access ramps are to be included in the set-out of stop coping strings to allow for greater degree of platform lengths and integration into the surrounding public domain.

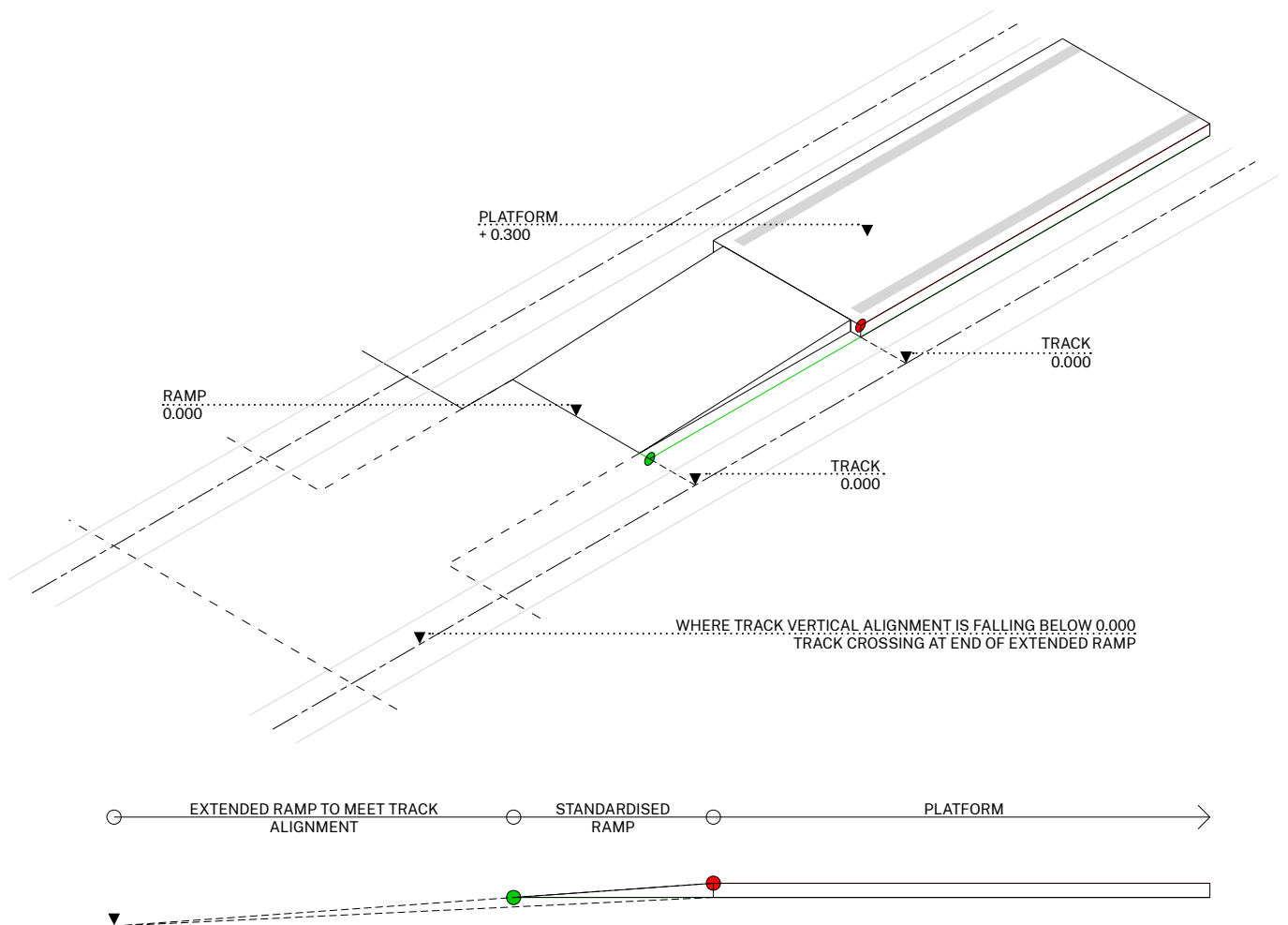


Figure 100. Coping string preferred setout

### 5.5.4 Run-offs

#### Principles

Run-offs are minimum areas of customer circulation relating to certain stop elements. Run-offs help ensure the safety of customer movement.

Large run-offs may be required to suit patronage demand. On island platforms, run-off zones may be calculated by determining the Fruin Level of Service and may provide storage capacity for passengers waiting to cross the tracks.

Note that the further the distance from the stop access ramp to the pedestrian crossing, the more likely passengers are to carry out uncontrolled/unsafe crossings over the tracks. A site specific safety analysis should be carried out.

#### Requirements

- At the base of the stop access ramps it is recommended that a run-off of at least 2250mm by 2250mm be provided to allow a wheelchair user to execute a 360 degree turn (in accordance with AS 1428.2).

#### KEY

1. Recommended minimum based on 360° wheelchair turning area (2250 x 2250)
2. Length determined by context (patronage numbers)

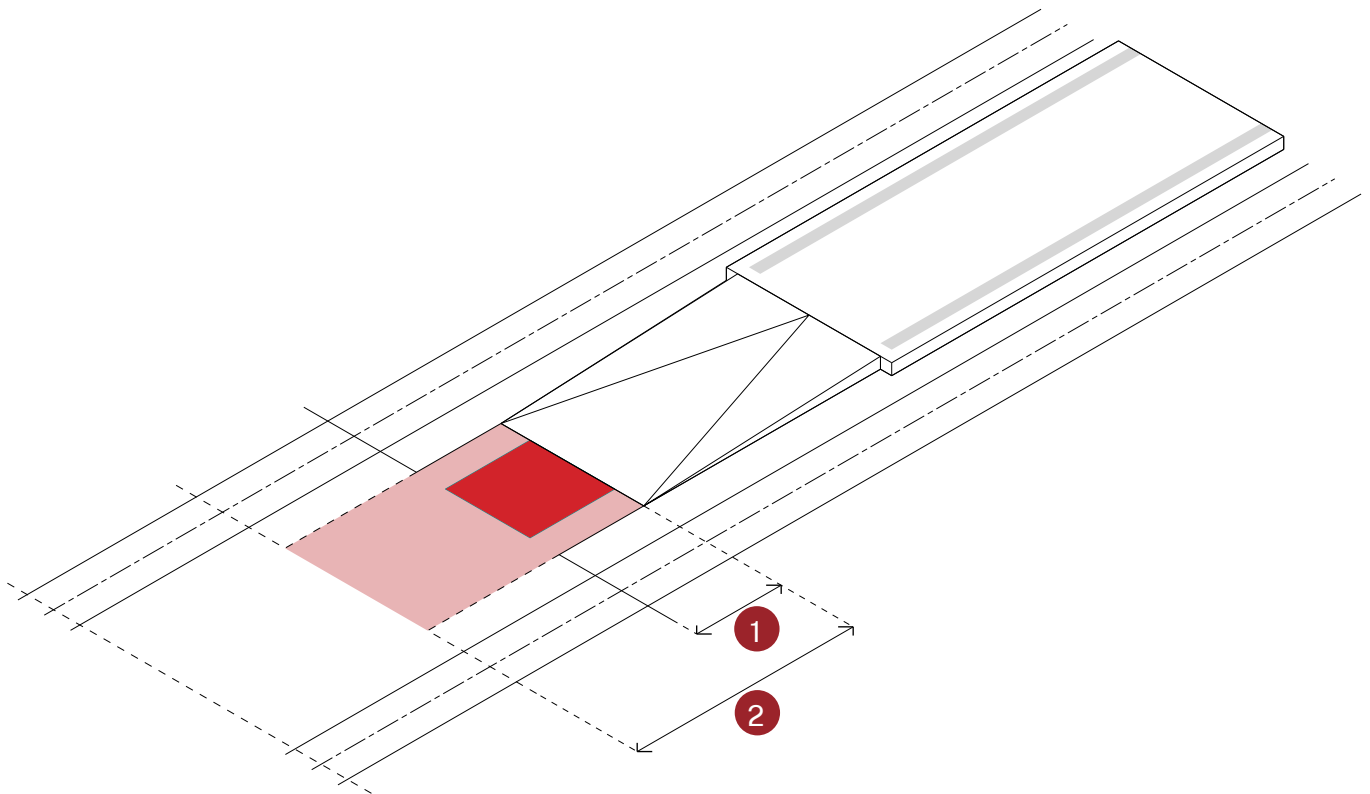


Figure 101. Platform minimum run-off

### 5.5.5 Platform Height

#### Principles

The minimum platform height will be defined in the project Scope and Performance Requirements. The platform height above track level will impact the lengths of stop access ramps as well as become a key consideration of DSAPT and minimum platform gap requirements.

#### Requirements

In order to meet DSAPT requirements the gap between the platform edge and the door threshold of the vehicle must be met at all accessible doors as a minimum:

- +/- 12mm vertically; and
- 40mm horizontally.

Consider at what loading categories the LRV contractually must meet DDA requirements.

Vertical curves and tight horizontal curves require special review and attention.

Priority should be to minimise gaps at marked accessible door points

### 5.5.6 Falls

#### Principles

Platforms should slope gently away from the platform edge in order to prevent objects such as strollers from accidentally rolling off the edge of the platforms.

To comply with DDA, cross falls must be no greater than 1:40.

Island platforms will typically fall towards the centre where a continuous gutter or drainage inlets will be provided. Side platforms will fall to the rear edge of the platform. In this instance drainage may be combined with public domain drainage.

No platforms are entirely flat. Typically a longitudinal fall will also occur. To satisfy DDA requirements the longitudinal fall must be no greater than 1:40.

Compound falls must be considered to ensure full DDA compliance.

In detailing the platform consider all edge conditions and interfaces with the ramps. Figure 103 shows a strategy for a level platform perimeter (including the coping edge and tactiles). The benefit of this solution is lack of geometry changes and potentially cut tactile indicator tiles.

#### Requirements

- Falls are to be incorporated into the platform design to facilitate drainage;
- Platform longitudinal falls and cross falls are to comply with the DSAPT;
- Island platforms are to fall towards the centre of the platform;
- Side platforms are to fall towards the back of the platform; and
- Platform falls are to be detailed in a manner that avoids at platform ends.

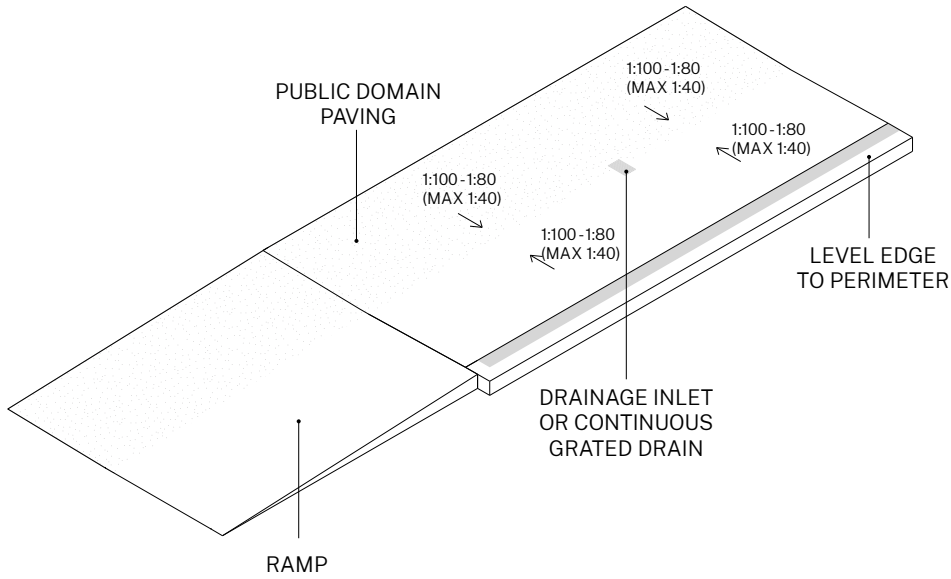


Figure 102. Side platform configuration - falls

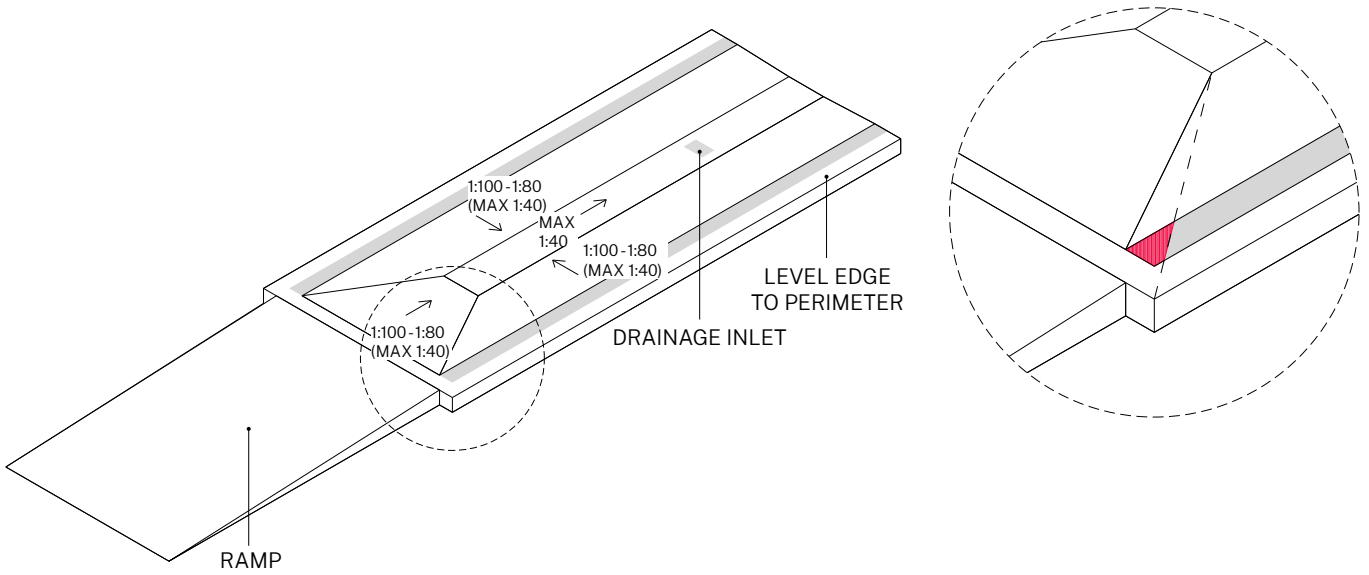


Figure 103. Island platform configuration - falls, with detail showing strategy for level platform perimeter and avoiding cut tactile indicator tiles.

## 5.6 Stop Layout

### Principles

All stops should be designed with a consistent approach for the setting out of canopies and platform equipment.

Platforms will typically be able to be divided into specific zones:

- Access;
- Circulation;
- Waiting (including wheelchair waiting spaces and priority seating);
- Boarding and alighting; and
- Information

Consideration must be given to ensure these zones are not conflicting, eliminating passenger cross flows and congestion.

Separating waiting areas from boarding areas for example will minimise conflicts between passenger movements and accommodate peak crowds. This will ensure that sufficient space for decision making is provided. While people tend to wait in all areas of the platform, this approach also ensures that accessible waiting areas and accessible boarding points are co-ordinated.

Consideration should be given to the different needs of departing and arriving passengers. The departing passenger will require clear and visible next service information, fixed location reader, a place to purchase tickets or top up an Opal card, and waiting/seating areas.

The arriving passenger will require quick and legible wayfinding information, fixed location readers, stop identifiers, local area information and unimpeded exits from the platforms.

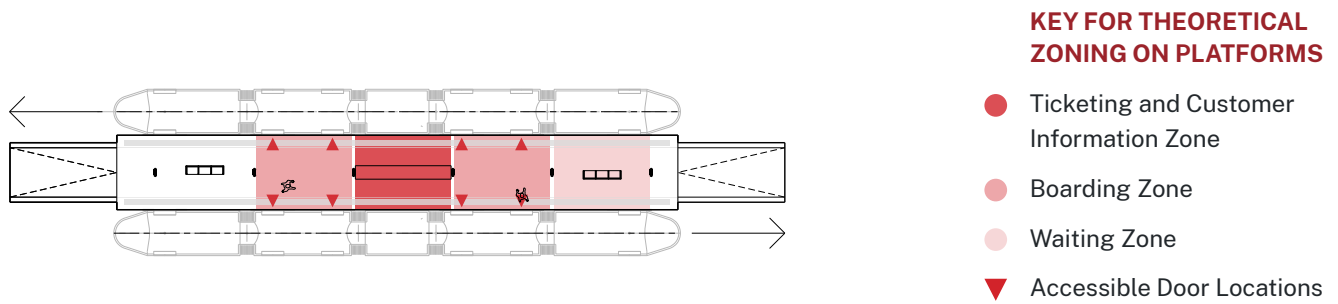
Consideration should be given to the integration and alignment of lighting and OHW poles on platforms.

In busy periods or stops, Fixed Location Readers can be a point of crowding for alighting passengers. Consideration should be given to the number and distribution of Fixed Location Readers, the stop layout and context, and passenger behaviours.

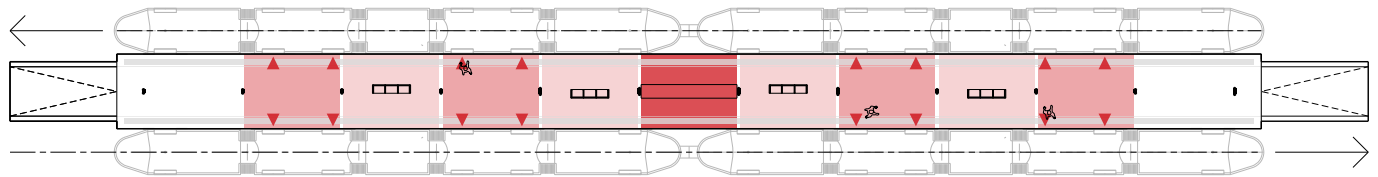
In the future, trams may have a designated place or carriage for stowing bikes, e-scooters or large personal items like surfboards or luggage. Consider demarcating boarding locations for customers with these items.

### Requirements

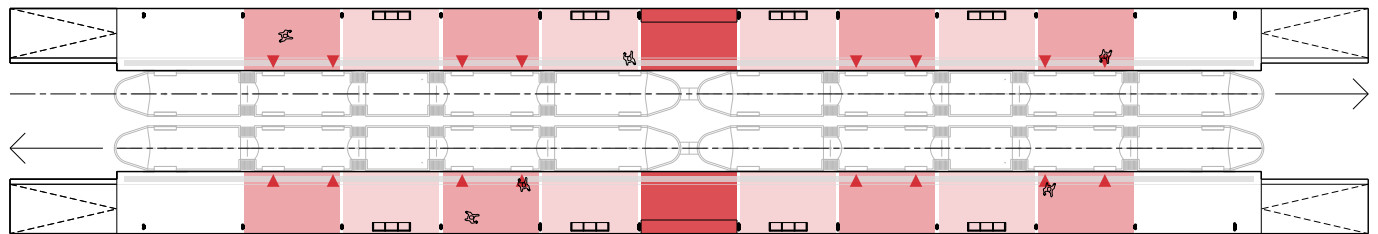
- Areas on the platform where LRV doors are present are considered boarding areas and are to be clear of equipment;
- Seating (waiting) and information zones are to be placed away from LRV door locations; and
- Equipment on stops is to be positioned along the back edge of the platform in a side platform configuration, and along the centreline of the platform in an island platform configuration.



**Figure 104.** Zoning of platforms -single vehicle on island platform



**Figure 105.** Zoning of platforms -coupled vehicle on island platform



**Figure 106.** Zoning of platforms -coupled vehicle on side platforms

## 5.7 Equitable Access

### Principles

Equitable accessibility ensures all people have the same opportunity to access the network, and at the same comfort levels. Provision of such access maximises participation and social inclusion within a community.

The Disability Standards for Accessible Public Transport (DSAPT) have many requirements which have consequences on the spatial layout as well as detailing of the stops.

### Requirements

- Stop designs must ensure equitable access; and
- Stops must be compliant to Disability Standards for Accessible Public Transport and the Disability Discrimination Act.

### 5.7.1 Safety Zone

#### Principles

The safety zone is typically defined as the minimum distance between the platform coping edge and the inside line of the platform coping edge tactile surface indicators.

#### Requirements

- In accordance with DSAPT, the minimum safety zone on LRV platforms must be 600mm, consisting of a 300mm platform coping edge and 300mm of tactile surface indicators.

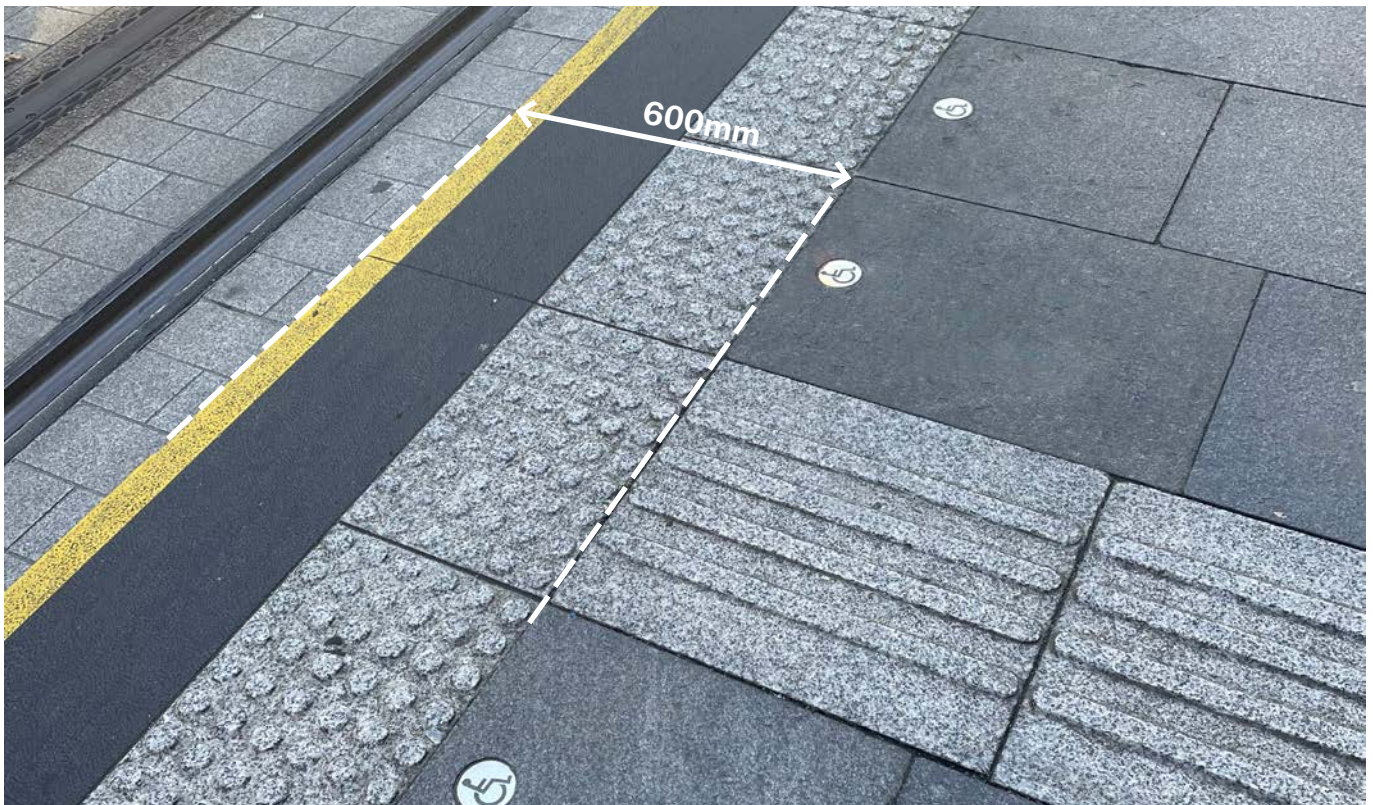


Figure 107. CSELR platform safety zone

### 5.7.2 Edge Delineation

#### Principles

The platform coping edge must provide luminance contrast to the adjacent track zone and platform paving.

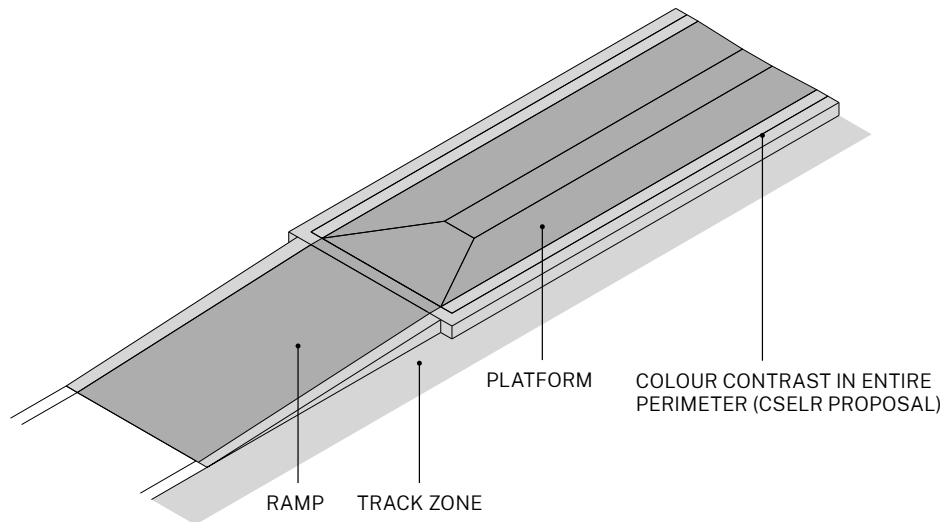
Two options have been illustrated below to demonstrate how a contrasting platform coping edge can be deployed to suit the surrounding public domain.

On the CSELR, the contrast between the platform coping edge and the track zone was retrofitted with a yellow line after initial operations.

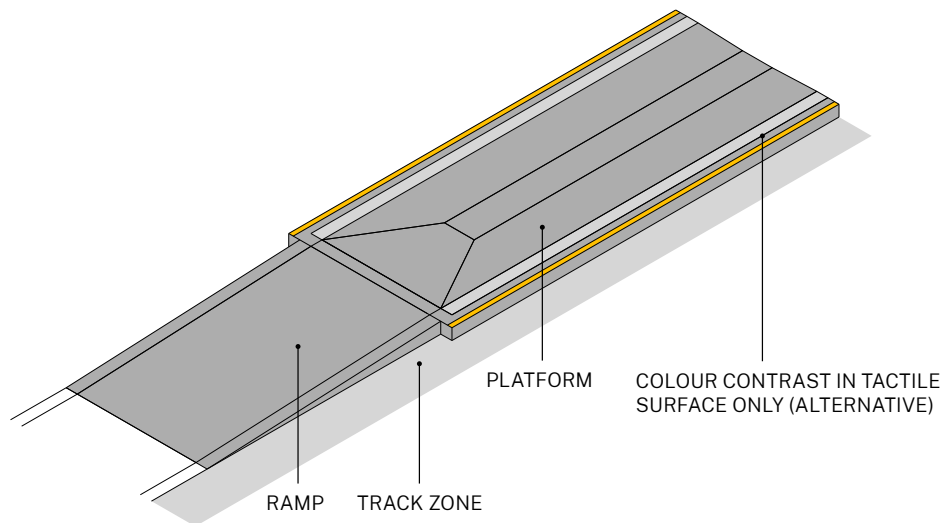
Falling from platforms and stairs is a risk factor for customer safety. The TfNSW Safety team are a source of information on learnings from previous incidents.

#### Requirements

- A contrasting platform coping edge must be provided;
- Luminance contrast must be achieved between the platform coping edge and the trackway as well as the coping edge and the platform;
- Luminance contrast must be resolved consistently along the alignment, including dealing with potential changes in paving materials in different locations.;
- Hazards such as the platform coping edge or changes in level, ramps and stairs must be identified by warning TGSIs and as detailed in accordance with AS 1428.1 and AS 1428.2.; and
- Colour contrast is required between the TGSIs and the adjacent flooring, to comply with AS1428-4 2002 Design and Access and Mobility.



**Figure 108.** Contrast edge Option 01 - Continuous contrasting perimeter option



**Figure 109.** Contrast edge Option 02 - Contrasting TGSIs only with yellow line on coping edge

### 5.7.3 Clear Pathways

#### Principles

To ensure compliance with the DSAPT, each platform must provide a clear accessible path. Island platforms should provide two accessible paths, along each platform edge.

On narrow island platforms, passengers queuing or standing in front of the ticket vending machines may obstruct the accessible path, however an alternative accessible path has been provided on the other side of the integrated services cabinet.

#### Requirements

- Clear, accessible paths are to be provided on all stops in accordance with the DSAPT;
- Each platform is to have at least one priority seating area located under cover, near the centre of the platform and two dedicated wheelchair waiting areas;
- The wheelchair waiting areas are to be demarcated as floor signage integrated as recessed markers within the platform paver (example in figure 92);
- For seating AS 1428.2 requires a 500mm clear zone between the edge of the seat and the accessible path;
- On narrow island platforms seating is to be positioned to provide a clear, minimum 1200mm wide, accessible path at the back of the seat; and
- Recessed accessible markings should be integrated into the paving provided along the edge of the platform to indicate the boarding location for dedicated wheelchair spaces within the tram.

#### KEY

1. LRV wheelchair space (dedicated within LRV for wheelchair users - platform markings locate these areas)
2. Clear area in front of seating
3. Wheelchair waiting space and manoeuvring area
4. Accessible path (1200mm accessible path to the back of the bench seating)
5. Manoeuvring area in front of ticketing machine and Help Point
6. Manoeuvring area in front of LRV accessible door

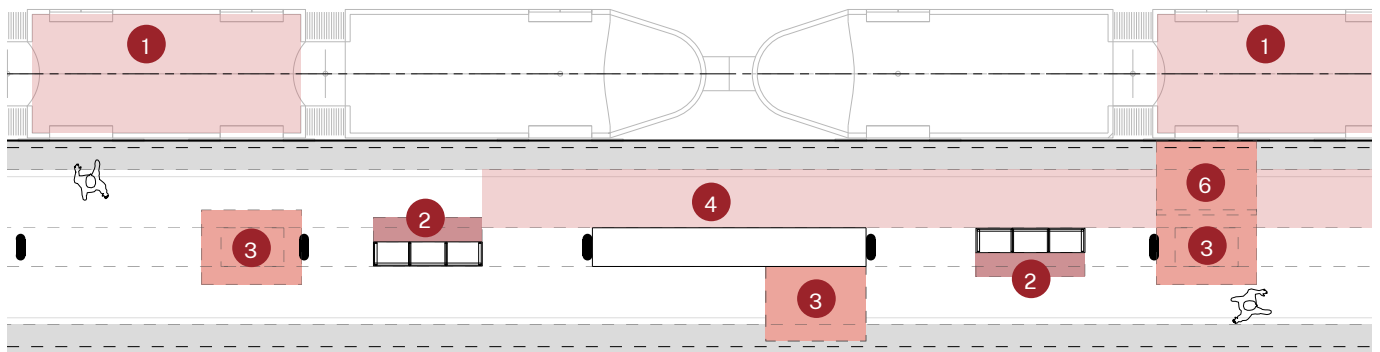


Figure 110. Clear pathways

### 5.7.4 Manoeuvring Areas

#### Principles

In order to meet best practice manoeuvring areas for customers in wheelchairs should be provided in front of customer information, ticketing machines and Help Points.

#### Ticket Machines:

Within Part 25, Payment of fares, DSAPT states at section 25.4 that:

- The circulation space in front of any vending machine must allow for a 180 degree turn as in AS1428.2 (1992) Clause 6.2, Circulation space for 180 degree wheelchair turn.

Clause 6.2 of AS1428.2 requires the minimum clear area of 1540mm x 2070mm. This clear area may be over the hazard warning area, but not the 300mm coping edge.

#### Passenger Emergency Help Points

Section 27.1 of DSAPT states that ‘General information about transport services must be accessible to all passengers.’

Help Points should perform an information as well as emergency role.

There is no explicit clause in DSAPT requiring a wheelchair turning bay in front of an emergency Help Point. This is mainly because Help Points had not been invented at the time that DSAPT was drafted (in the late 1990s and early 2000s).

DSAPT does contain a generic prescription – in section 3.1 – that any area requiring a 180-degree turn for wheelchair users needs to have clear dimensions of 1540mm x 2070mm. A wheelchair user might need to turn 180 degrees in front of a Help Point so that they can physically face the microphone, or to push the button in the first place.

#### Requirements

- Ensure adequate manoeuvring areas are provided on platforms in accordance with the DSAPT and best practice.

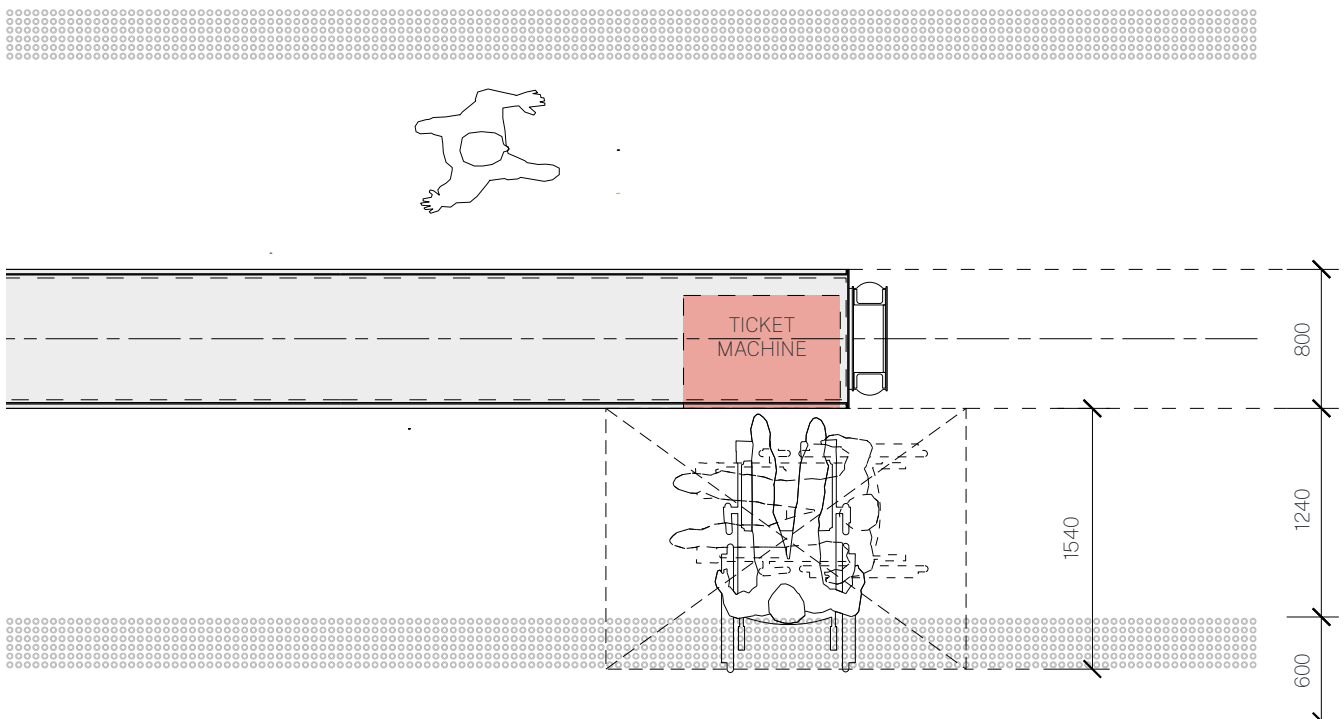


Figure 111. Minimum accessibility provisions at ticket machines

## 5.7.5 Platform Access

### Principles

Access to platforms can be provided via walkways or ramps, which are designed in accordance with Australian Standard (AS), Design for Access and Mobility 1428.2 and Disability Standard for Accessible Public Transport (DSAPT) requirements.

Depending on spatial constraints two solutions can be considered:

1:14 ramp (including associated kerbs, handrails and TGSIs, 4200mm typical ramp length, varying depending on the track alignment);

1:20 walkway (6300mm typical length, varying depending on the track alignment).

Barriers and handrails for 1:14 ramps are to be setback 600mm from the light rail vehicle DKE.

### Requirements

- Access to stops should be provided via walkways (1:20) wherever possible;
- Ramps and walkways must be compliant with the DSAPT; and
- Ramps and walkways must observe minimum DKE offsets.

### Walkways and Ramps

1:20 walkways are preferred as they do not require handrails for DDA compliance. 1:14 ramps may be specified where site constraints or specific safety considerations dictate otherwise.

Typically specific offsets from the DKE of the LRV to stop infrastructure are required. Typically horizontal clearances are required to ramp edges, kerbs and any longitudinal elements.

Ensure a set back of at least 300mm from the edge of the DKE is provided to any ramps and associated kerbs. Ensure a set back of at least 600mm is provided to any longitudinal elements such as handrails and balustrades.

1:20 walkways do not require handrails. AS 1428.1 does however require the provision of the following:

- 65mm high kerb; and
- 600mm contrasting (flush) edge.

The following illustrated example shows how a ramp kerb can align with the contrasting TGSIs and platform coping.

DKE offsets and DDA requirements are challenging to combine. The example adjacent shows how this can be overcome.

1:14 ramps require handrails. Refer to AS 1428.1 also for associated kick rails and kerbs.

Hobs facilitate shore lining for cane users but to avoid slips, trips and falls, hobs must have luminance contrast to the surrounding pavers.

The following illustrated example shows how handrails and balustrades can be placed on platforms. Note one design solution is for the handrail to return at the top of the ramp, to protect visually impaired customers from accidentally stepping off the end of the platform.

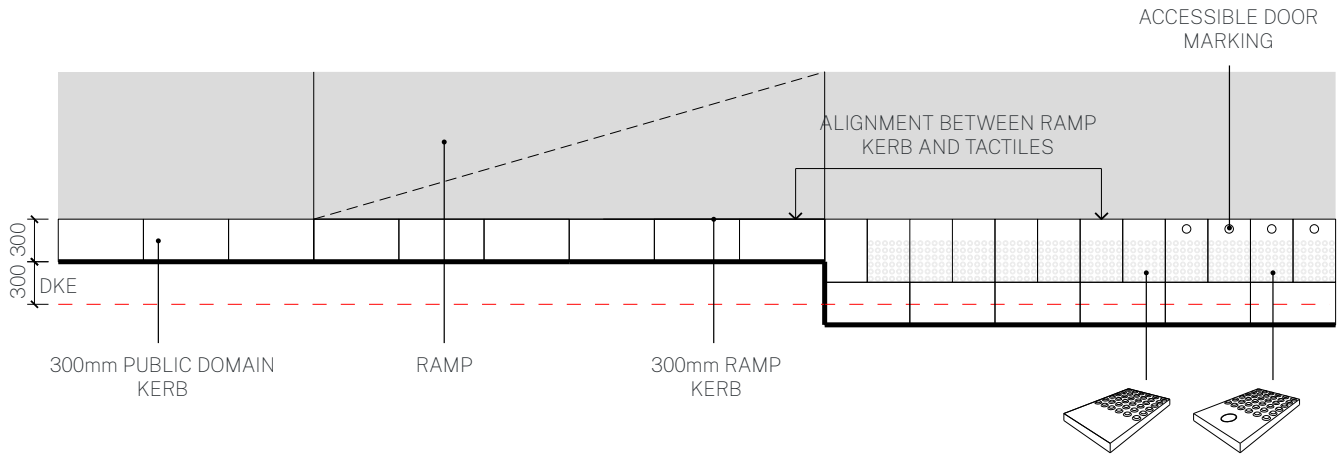


Figure 112. 1:20 ramp with ramp kerb

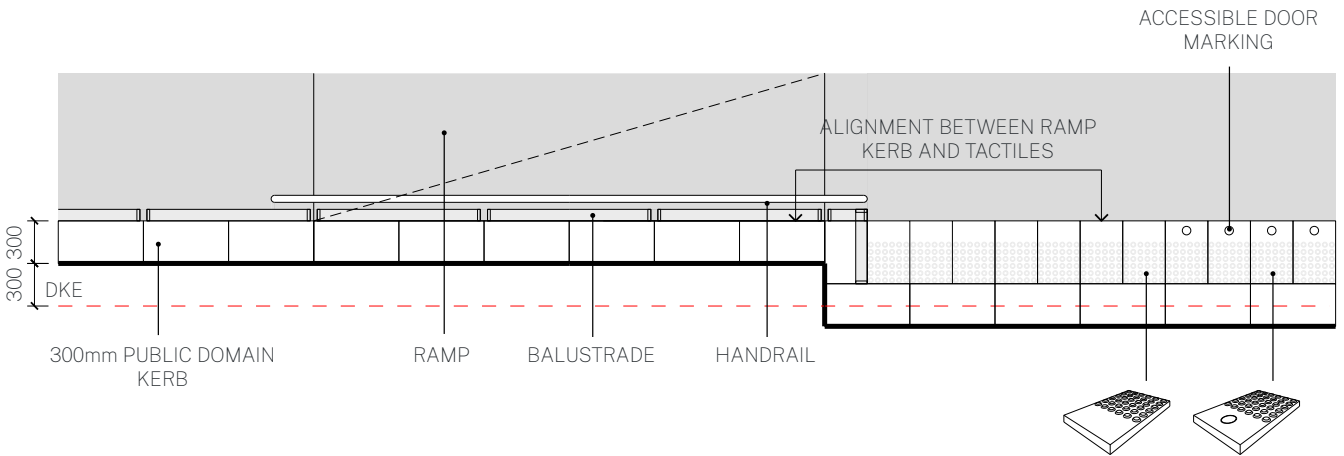


Figure 113. 1:14 ramp with handrail and balustrade

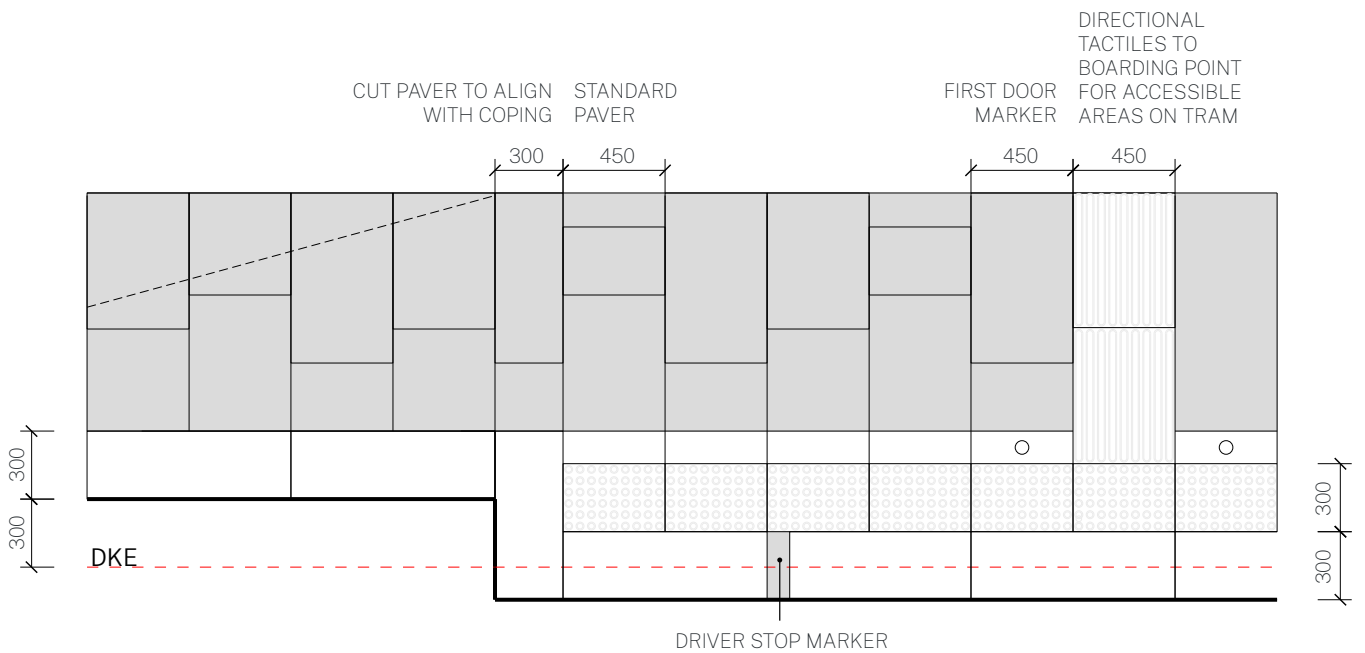


Figure 114. 1:20 ramp at front end of platform showing paving details

### 5.7.6 TGSIs

#### Principles

Tactile Ground Surface Indicators (TGSIs), in conjunction with other indicators, provide cue to assist people who are blind or vision impaired with their orientation.

There are two types of TGSIs:

- Warning TGSIs Used in light rail stops , where an obstruction, hazard or change in direction of travel is less likely to be expected or anticipated, not limited to- platform edges, at ramps and steps; and
- Directional TGSIs indicate a guide to a safe route, designating a direction of travel, which is laid in the course of travel. Used in light rail stops in conjunction with warning TGSIs to direct users to accessible doors on light rail vehicles.

Consideration needs to be given to the durability of the warning tactiles to ensure customer safety. Post fixed TGSI solutions are to be avoided.

TfNSW encourages utilising the same type of durable paver finish as the platform.

Tactile surface indicators are not required on light rail platforms to indicate the location of Passenger Emergency Help Points and Opal self service machines.

Ensure however that these elements are placed consistently on platforms to aid intuitive wayfinding and assist customers with disabilities.

#### Requirements

- TGSIs are to be installed in a consistent manner on all stops;
- For side platforms:
  - Directional TGSIs are to run between the shoreline to the first accessible doors in the first carriage of the LRV. It is sufficient to mark this only in one instance on a platform. Ensure however that this location occurs consistently on all side platforms..
- For island platforms:
  - Directional TGSIs are to run from the platform centreline to the first accessible doors in the first carriage of the LRV.
- Tactile surface indicators are to be integrated into the platform finishes design and are required to provide compliant luminance contrast and slip resistance.
- Directional tactile indicators must be provided at the head of stop on bus interchange platforms. These tactiles should run from the centre of the platform to the edge and terminate on a 600mm by 600mm warning TGSi.

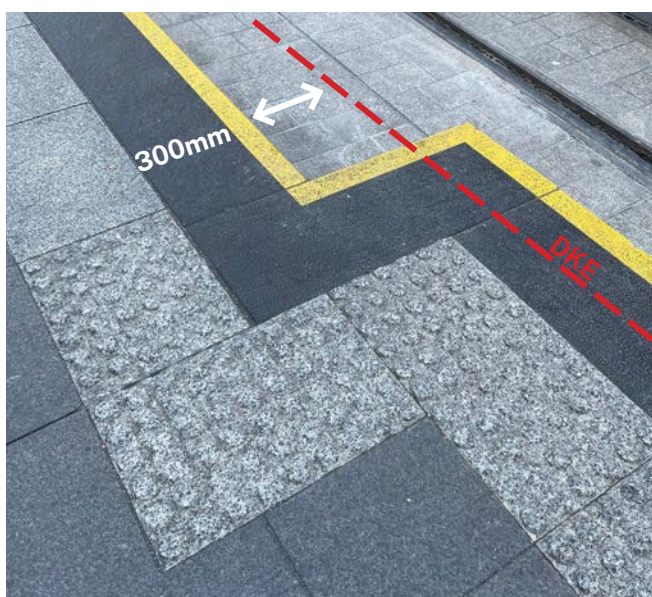


Figure 115. CSELR platform/ramp layout with TGSIs

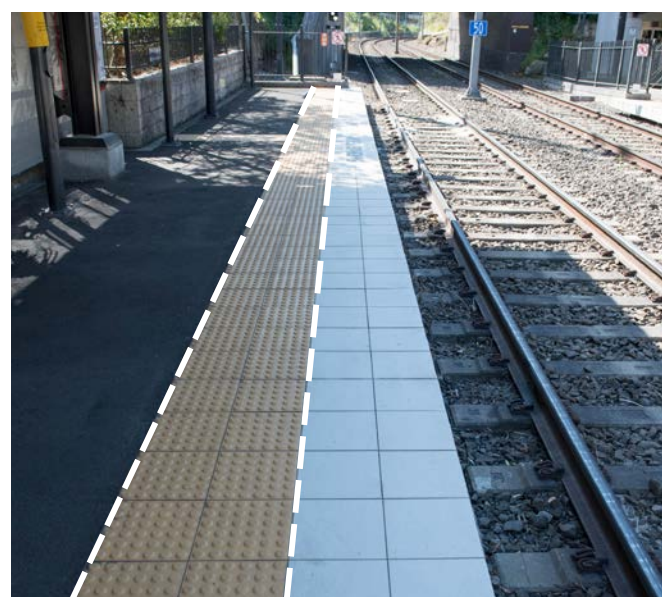


Figure 116. IWLW platform warning TGSi alignment

### 5.7.7 Bus Interchange Platforms

#### Principles

Bus interchange platforms typically have a height above road level of 150mm. A continuous edge of tactile surface indicators is therefore not required. The edge of the platform is defined by a continuous kerb.

Consider the location and impact bus infrastructure (such as poles and signage) on platform edges may have on bus operations (such as defining the 'head of stop'), passenger circulation and accessibility clearances.

Consider the pavement camber of bus stop lanes adjoining bus interchange platforms as this can impact deployment of bus wheelchair ramps and therefore difficulty for passengers boarding or alighting buses.

#### Requirements

- Bus stands must be indicated with a directional tactile and a warning tactile leading from the platform centreline to the head of stop.

### 5.7.8 Floor Signage

#### Accessible Door Markings

Accessible door markings should be provided along the edge of the platform to demarcate the location inside the carriages with dedicated wheelchair spaces within. These may be custom fabricated pavers with a tactile detail.

Post fixed TGSi solutions are to be avoided. TfNSW encourages utilising the same type of durable paver finish as the platform.

#### Wheelchair waiting areas

Wheelchair waiting spaces must be marked on platforms. Recessing floor signage into the floor tile is recommended for a flush finish. The space for a wheelchair, in accordance with AS 1428.2 is a minimum 800mm by 1300mm. Consider the orientation of markers on platforms and the orientation of the waiting customer.

On platforms with minimal canopy coverage, the two wheelchair waiting areas & associated priority bench will be located together in one bay of the canopy.

### Passenger Emergency Help Points

#### Principles

If the Passenger Emergency Help Point (PEHP) operative button(s) need to be physically pressed rather than just touched the operative button(s) should be at a height of between 900-1200mm above FFL, with an absolute maximum of 1250mm above FFL, for DSAPT compliance.

Note the signage above the Help Point mechanism that identifies the mechanism and contains instructions on how to use it. That signage – which will contain Braille and tactile elements – needs to be at a height of between 1400-1600mm above FFL. This may affect the height of the actual Help Point mechanism below it, and vice versa.

#### Requirements

- PEHPs are to be easily identifiable on the platforms;
- PEHPs are to have Braille and tactile information and buttons compliant with Australian Standards and the DSAPT. Refer to Transport Standard for Help Points MU TE 61006 ST;



**Figure 117.** Accessible door marking on Newcastle Light Rail



**Figure 118.** Passenger Emergency Help Point on CSELR

## 5.7.9 Seats

### Principles

Seats must be provided on all platforms.

This chapter relates to the positioning of seats on platforms as there are a number of DSAPT requirements relating to seat design and positioning which have an impact on defining the minimum platform width.

AS 1428.2 defines some critical dimensions relating to the seat design, set out and installation. A key requirement, which becomes a constraint when determining minimum platform widths, is a 500mm clear zone in front of the seat which is to be clear of any circulation paths.

Customer research indicates that customers generally prefer seats with back rests and arm rests. Two way bench seats (i.e. without backrests) are not preferred due to reduced customer comfort, accessibility, and security.

### Side Platforms

Seats should be placed along the back of the platform in a side platform configuration. The design should allow for a 1200mm accessible circulation path along the platform edge adjacent to the safety zone and 500mm in front of the seats.

### Island Platforms

The options overleaf discuss ways to meet accessibility requirements for seats.

**Option A** - Seats placed on the platform centreline, in a single sided configuration, alternating and facing each side of the platform.

This configuration allows for a 1200mm accessible circulation path behind the seat only, The circulation path in front of the seat overlaps with the 500mm clear zone, resulting in an overall platform width of 4400mm.

There is no rule against having the accessible path of travel at the rear of a seat. Wheelchair circulation around the fixed seating, and around other fixtures on the platforms, will be catered for.

A variant of this seat configuration is to accommodate both the 500mm setback and the 1200mm-wide path of travel on both sides of the seat. The resultant minimum island platform width would be 4600mm. Note this would also require the seats to be installed off centre on the platform grid.

Whilst this solution may be the most desirable from a platform design point of view, this width may often not be achievable due to existing physical site constraints. Wind breaks may be achievable in this configuration.

**Option B (Not preferred)** - Seats placed on the platform centreline in a double sided configuration allowing access from both sides of the platform.

This configuration allows for a 500mm clear zone on each side of the seat and a minimum 1200mm accessible circulation path on each side of the seat, resulting in an overall platform width of 5100mm.

Note this configuration does not include wind break screens and also precludes using the preferred benches with backrests.

**Option C (Appropriate for wide platforms)** - Two sets of seats facing each side of the platform.

This configuration allows for a 500mm clear zone on each side of each seat and a minimum 1200mm accessible circulation path on each side of each seat, resulting in an overall platform width of 5100mm.

Note this configuration does not include wind break screens. Should these be required in between the seats the platform width would increase accordingly.

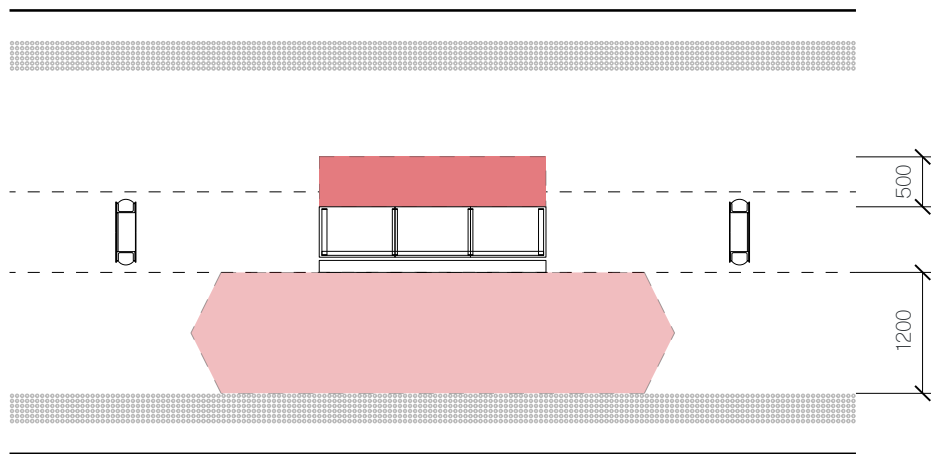
### Conclusion

Option A is tenable as an accessible design for constrained sites.

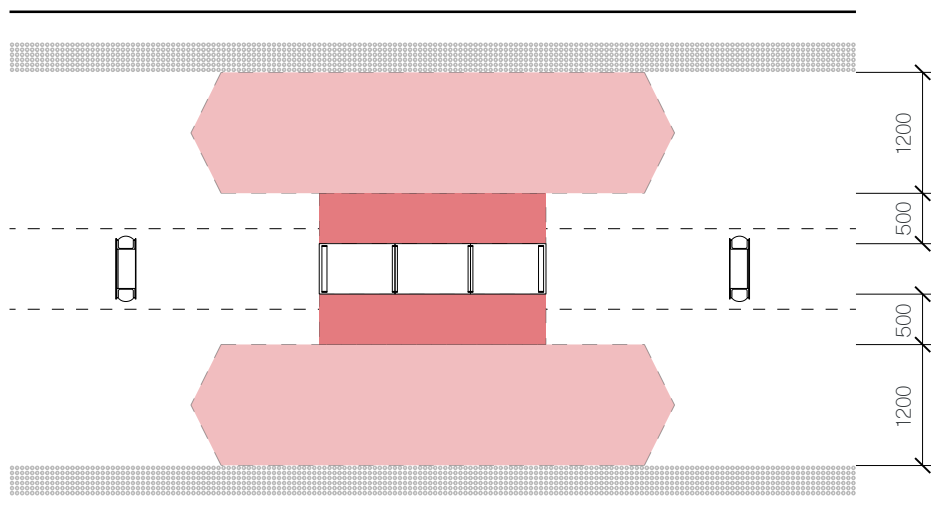
Having the accessible path of travel at the rear of the fixed seating benches would be the most practicable solution that also meets the objects of DSAPT.

Not providing any seating at all would disadvantage some users, especially those with disability who require it to rest or wait for the next tram to arrive.

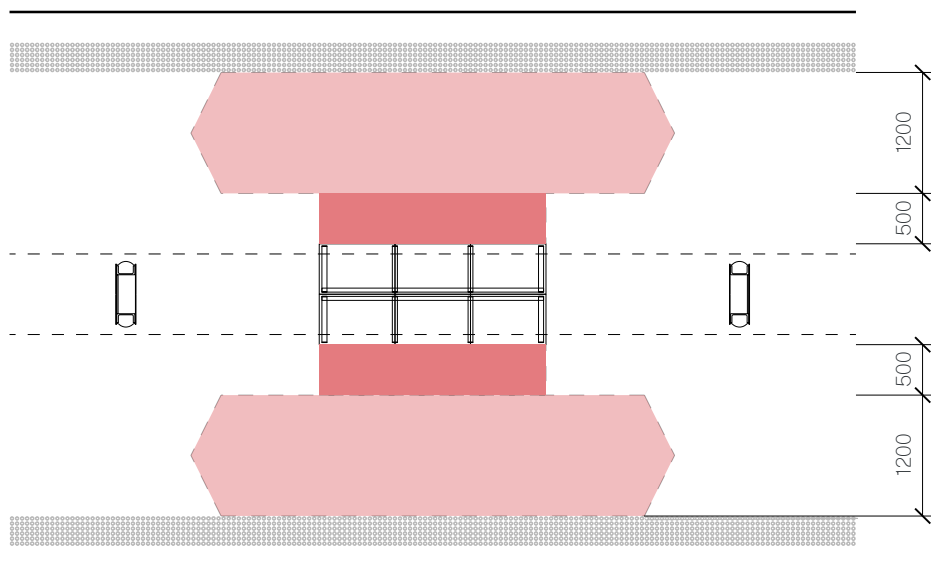
Similarly, providing lean bars only – and no seating – would disadvantage some customers.



**Figure 119.** Seats placed on the platform centreline, in a single sided configuration, alternating and facing each side of the platform



**Figure 120.** Seats placed on the platform centreline in a double sided configuration allowing access from both sides of the platform



**Figure 121.** Two sets of seats facing each side of the platform

Service	Destination	Time
L2	Circular Quay	6 min
L2	Town Hall	12 min
L2	Circular Quay	15 min

Surry Hills

Tap and go

Tap and go



---

## Stop Elements

Attractive, intuitive and comfortable stops for customers are highly technical feats of architectural and industrial design. This chapter explains requirements for elements including canopies, totems, equipment integration, furniture, materials and signage.

**Figure 122.** An array of stop elements make up the customer experience on platform (CSELR, Surry Hills)

## 6.1 Kit of Parts

### 6.1.1 Standardisation

#### Principles

Design standardisation can support a more efficient product procurement, installation and maintenance process.

Standardisation can also lead to benefits such as off-site, modular construction and thus shorter construction programmes, less waste, reduced community disturbance and increased quality.

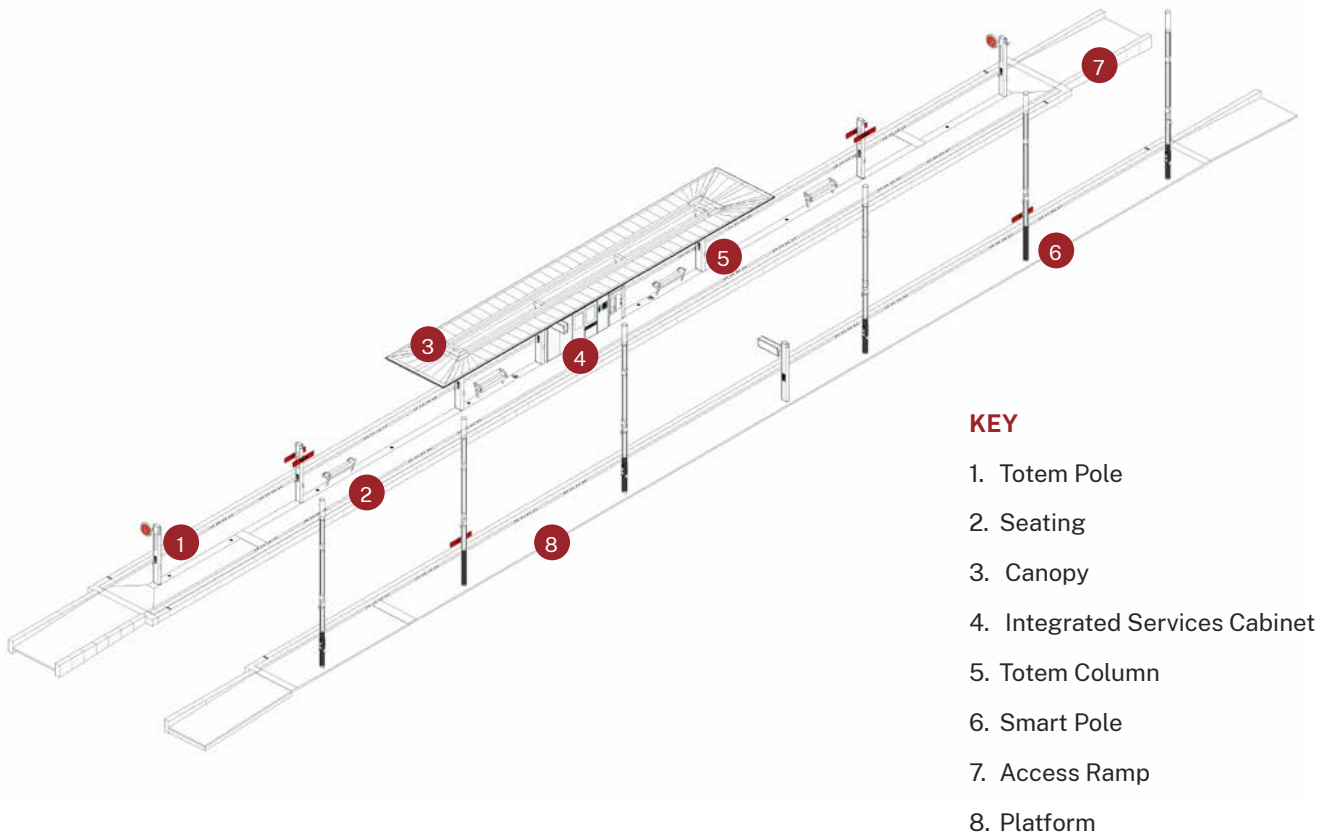
Applying standardised elements or modular designs for materials and products can lead a reduction in construction waste and easier reuse opportunities.

Standardisation of details can minimise tooling costs whilst maximising quality.

Planning and design standardisation of light rail stops can also provide a more consistent outcome leading to customer benefits such as improved accessibility and intuitive wayfinding.

#### Requirements

- Stop elements including canopies, equipment cabinets, totems and furniture are to be developed as a consistent, standardised kit of parts;
- Light rail stop elements should be developed as a family of component parts, with a consistent approach to detailing;
- Canopies are to be developed as a family of consistent typologies that suit the varying stop configurations;
- The canopy structure as well as panel types and sizes are to be standardised for minimised waste and ease of replacement;
- A range of multi functional elements is to be utilities to group essential services;
- A ‘plug and play’ approach is to be adopted for ease of maintenance and replacement;
- Long-life (e.g.. cladding) are to be separated from shorter life (e.g.. technology elements) for ease of maintenance, replacement and technology upgrades;
- Light rail stop canopies and equipment enclosures are to be designed for reconfiguration and disassembly;



**Figure 123.** Example of a CSELR stop showing the kit of parts

### 6.1.2 Modules and Grids

#### Principles

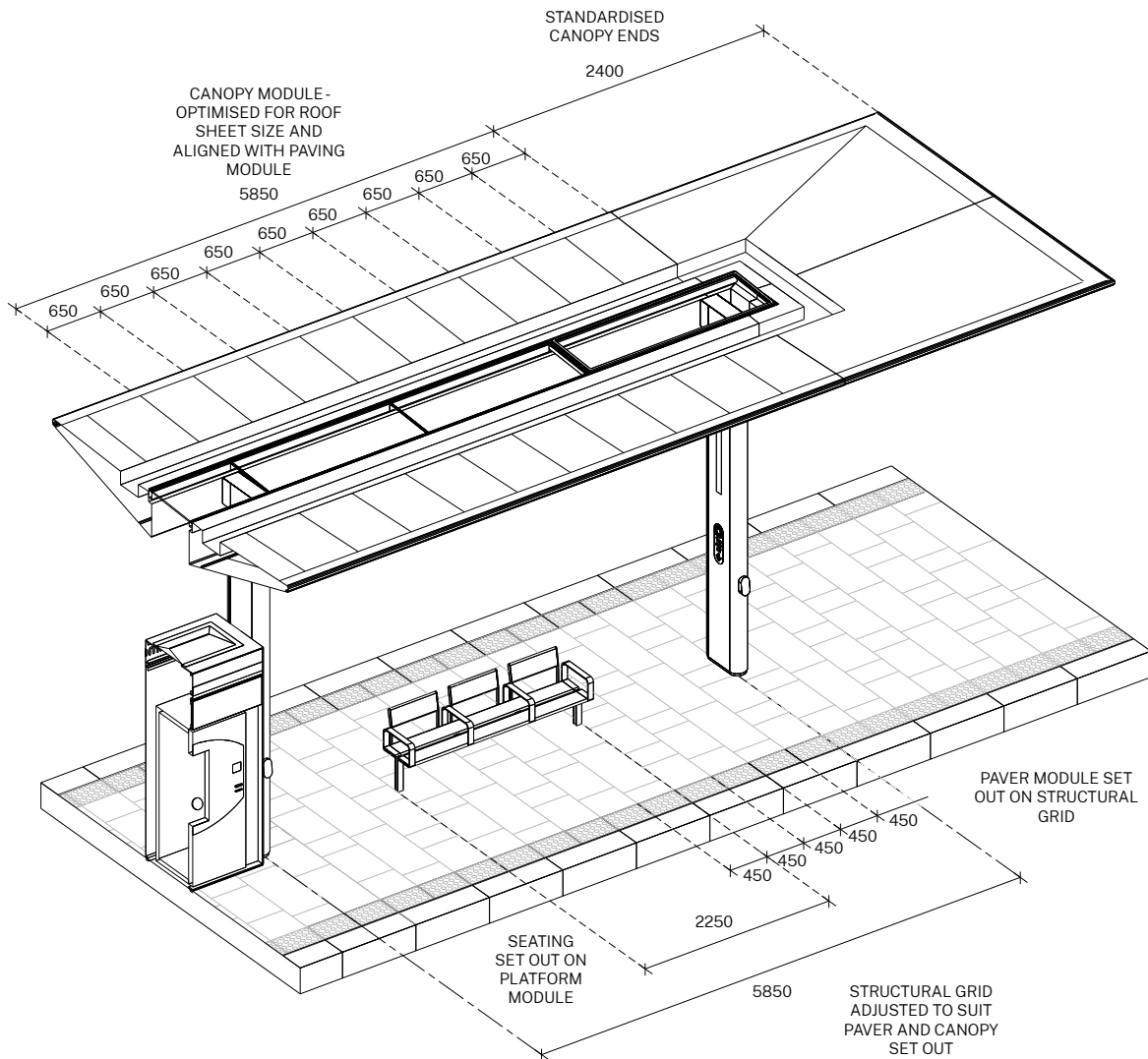
A strategy based on modular set-out principles should be developed for light rail stops.

On the CSELR the stop finishes and equipment layouts are based on a single, consistent grid which ties together the canopy cladding module with the paving module and all associated fixtures, furniture and fittings. The setout grid and module was defined based on paver sizing and coordinated with the canopy cladding sheet sizing.

#### Requirements

- Stop designs are to be based on a modular approach and constructed from a series of common component parts;

- Standardisation is to be maximised to achieve repetitive floor, wall and soffit cladding systems for ease of installation and ongoing maintenance;
- Grids and modules are to be defined to optimise material efficiency;
- Cladding module sizes are to suit selected materials and align to industry standard sizes to avoid unnecessary waste from off-cuts;
- A large number of bespoke cladding panels is to be avoided;
- Horizontal datums are to be used to organise signage, access to services and lighting;



**Figure 124.** Example of a CSELR stop modules and grids, platform paving and canopy cladding

## 6.2 Canopies

### 6.2.1 General Requirements

#### Principles

The primary function of canopies is to provide weather protection to customers.

Canopies are also the defining feature of the stops and should contribute to the city streetscape.

For line identity, the design, procurement and construction efficiency, cleaning and maintenance, the canopy design will be a standardised suite for a project. Contextual application of that standardised suite will be responsive to patronage, site weather characteristics, operational or urban contexts.

Canopies should be designed as a family of consistent typologies to suit the various platform configurations, however special canopies may be considered as a particular contextual response, for example in high civic value precincts, termini or as architectural landmarks.

#### Requirements

- Canopies are to be provided on all light rail platforms;
- Canopies are to be designed to fit comfortably within their urban context without dominating or detracting from it;
- Passenger movements and customer interfacing equipment locations are to be considered when positioning canopies on platforms;
- Canopies are to be appropriately sized to align with the forecast stop patronage but may be responsive to specific contextual requirements subject to approval by TfNSW;
- Canopy extents are to consider clearances to rail and road infrastructure;
- Canopies are to be modular and allow for future extensions;



**Figure 125.** Example of a CSELR stop canopies in relation to heritage context. (CSELR, Town Hall)

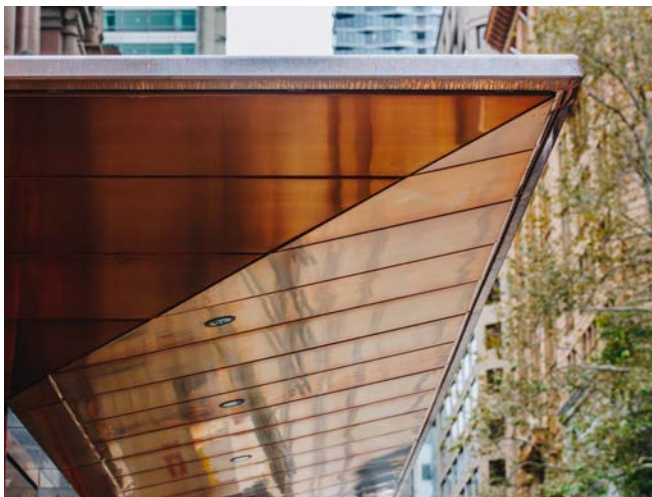
### 6.2.2 Examples of Canopy Details



**Figure 126.** Rounded canopy ends and profile (PLR)



**Figure 127.** Narrow single canopy (NLR)



**Figure 128.** CSELR canopy detail



**Figure 129.** IWLR canopy detail



**Figure 130.** NLR canopy detail



**Figure 131.** PLR canopy detail

### 6.2.3 Weather Protection

#### Principles

Canopies provide weather protection - shade from the sun and shelter from the rain to customers waiting to board.

The extent of weather protection should consider the urban context and the local climate, such as hotter areas requiring more shade.

The extent of weather protection on light rail stops is determined by a number of factors such as electrical clearances or bus operator clearances and minimum canopy soffit height requirements.

Typically the canopy minimum heights are determined by maximising weather protection as well as considering what signage and fittings may be located underneath.

Canopy lengths are determined by the forecast patronage whilst canopy widths are determined by electrical clearances.

If required weather protection can be improved by adding wind break panels on platforms.

#### Requirements

- Canopies are to provide maximised weather protection whilst taking into consideration clearances to platform mounted equipment, observing requirements such as electrical clearances and site topography;
- If the ground plane is sloping, canopies may need to be higher at one end to maintain a consistent horizontal line. Significantly sloped sites should be treated on a case by case basis, and maybe require separate canopies. Stepped canopies are generally to be avoided.

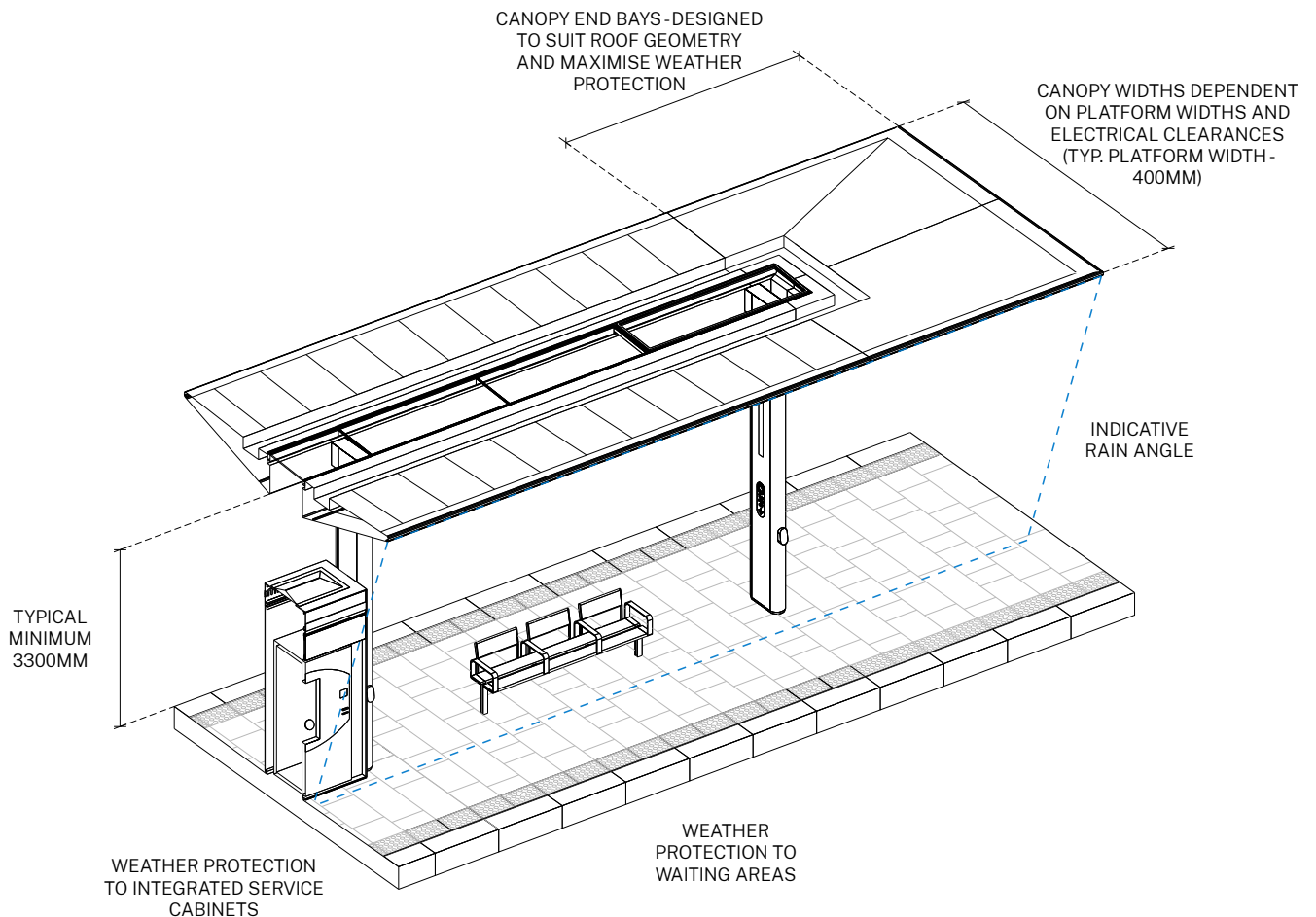


Figure 132. Weather protection diagram (CSELR)

## 6.2.4 Visual Impact

### Principles

- Canopy soffits have the potential to become a key intuitive wayfinding element, signifying the location of the stop and forging a line wide identity.
- The visual bulk of the canopy should however be minimised to reduce the visual impact on the surrounding environment. This is of particular importance in heritage and parkland settings.
- In city centre locations on stops with low boarding patronage demand, canopy extents may be reduced where shelter exists under adjacent building awnings. However, this approach is not applicable to high boarding patronage platforms, where cross movements congest footpaths and lengthen dwell times, and waiting customers may impede the shoreline.

### Requirements

- Canopies are to be horizontal and level;
- To achieve a visually elegant outcome, the bulk of canopies is to be minimised by providing a thin leading edge;
- Canopies are to enhance the perception of space and visual permeability;
- The space between the soffit of the canopy and any equipment below is to be maximised to ensure visual permeability but also to facilitate maintenance access to the equipment below;
- The visual impact of canopies is to be considered especially in heritage contexts to ensure the heritage context retains dominance;
- Canopies are to be orthogonal and rectilinear in shape. Circular or rounded geometries and profiles are to be avoided as the detailing, construction and maintenance requirements are more complicated;



**Figure 133.** Stop canopy in urban context (CSELR, Surry Hills)

### 6.2.5 Minimum Dimensions

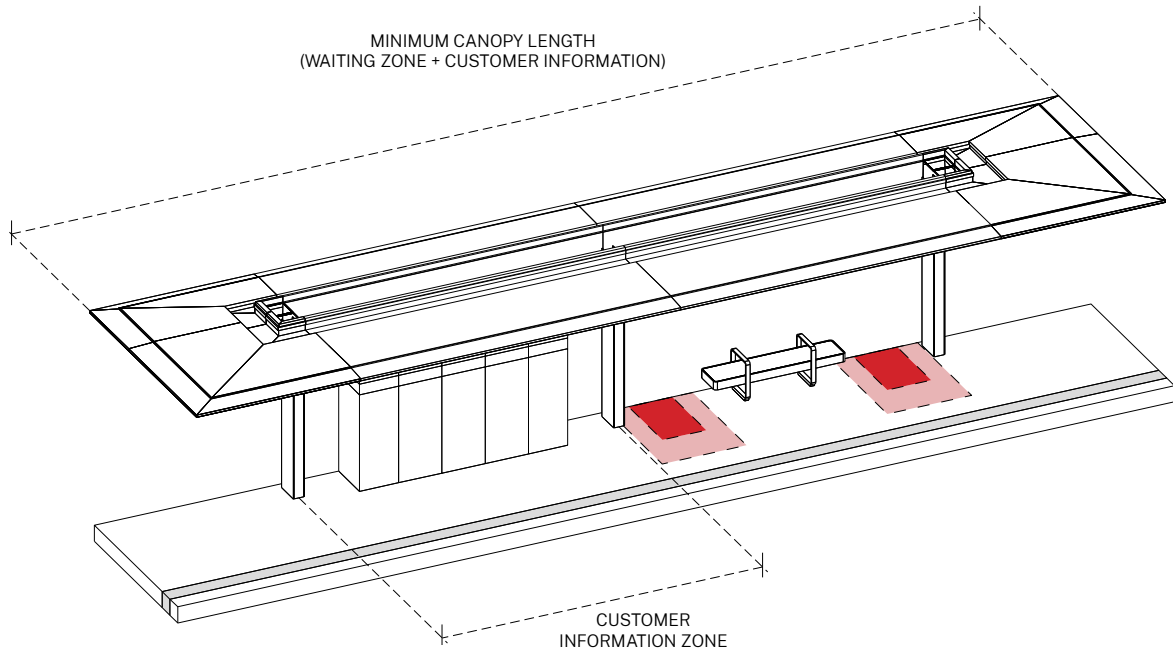
#### Principles

The diagrams below illustrate the minimum required canopy extents based on the following configurations:

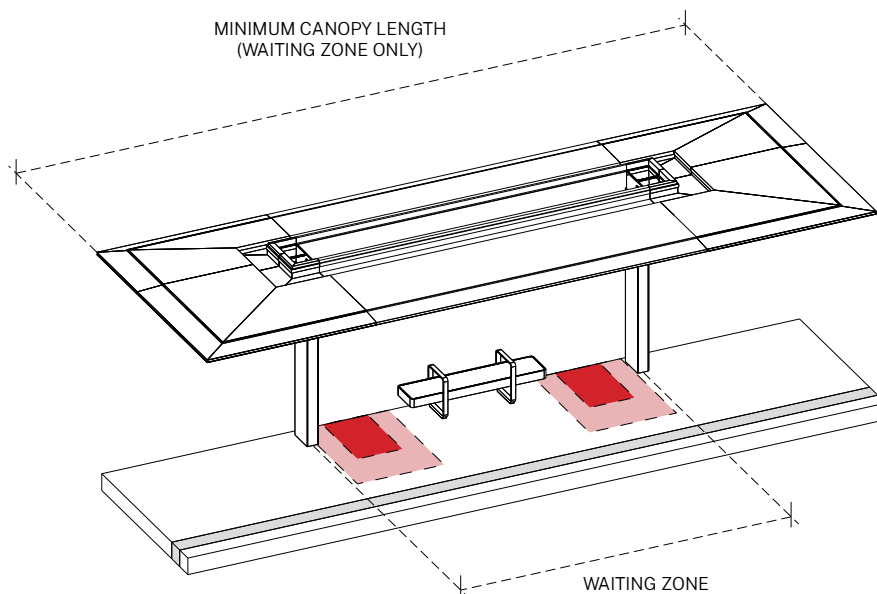
- Side platform with a single services cabinet module and single waiting area module;
- Side platform with a single waiting area module only;

#### Requirements

- As a minimum, light rail stop canopies are to provide weather protection to the dedicated priority seating, wheelchair waiting areas, customer information, Help Points and ticketing equipment;
- Every side platform is to have at least one canopy bay to shelter the wheelchair spaces and priority seating;



**Figure 134.** Minimal canopy for island platform or side platform with the integrated services cabinet (CSELR)



**Figure 135.** Minimal canopy for accessibility requirements on side platforms (CSELR)

### 6.2.6 Patronage

The total extent of canopies will be informed by patronage demand, acceptable Fruin levels of service and a contextual response.

The following table demonstrates TfNSW’s methodology for determining the appropriate minimum canopy length, based on the demand model defined in the project business case.

STEP	ACTIVITY	EXAMPLE
1	From demand model in business case, find number of boarding customers per peak hour “A”.	2246
2	Calculate number of services per hour assuming peak hour headways “B”.	4 minute headways = 15 services per hour
3	Calculate theoretical number of waiting customers by dividing A/B = “C”.	2246/15 = 150 people
4	Depending on route, determine number of customers who will not board first service. “D”. Add C + D for total number of waiting customers = E.	Southbound city stop on CSELR service with 2 branches. Assume 1/3 customers board any southbound service as destination prior to branch. 1/3 boards correct destination service and 1/3 wait longer for desired branch destination. $150/3 = 50$ $150 + 50 = 200$
5	Calculate canopy cover area for the nominated Fruin level of service Use “Queuing Zone” Fruin Level of Service C 0.93-0.65m <sup>2</sup> /person. $E \times 0.93 \text{ m}^2 = F$ $E \times 0.65 \text{ m}^2 = F$ At small theoretical canopy lengths (e.g. 24m) the area lost to a large cabinet may need to be added in at step 5.	$200 \times 0.93 = 186\text{m}^2$ $200 \times 0.65 = 130\text{m}^2$ So range of acceptable area is 130-168m <sup>2</sup> .
6	Calculate range of theoretical canopy length by dividing theoretical area by width of canopy.	$130\text{m}^2/3.2\text{m} = 41\text{m}$ $186\text{m}^2/3.2\text{m} = 58\text{m}$ The range of theoretical canopy length is 41-58m
7	Decide on best match of modular length to theoretical length.	Closest modular length match = 42m or 48m
8	Consider other factors in finalising canopy length. Stakeholder issues or urban design e.g. heritage buildings, sight lines may also inform final canopy length.	Final canopy length 42m given streetscape context.

### 6.2.7 Canopy Extents

#### Principles

Canopy maximum extents will vary depending on a number of factors, such as:

- Stop typologies (see Chapter 5);
- Minimum electrical clearance requirements; and
- Minimum transit requirements (applicable to stops with shared bus and LRV routes and bus interchange stops).

Canopies will typically be set back by 200mm from the platform edge to meet electrical clearance requirements (in accordance with BS EN 50122-1:2011+A1:2011).

Note this offset may not be required in the event of a third rail application as there is no danger of electrocution during maintenance activities. There are also clearance dimensions for the safety zone for maintainers on the roof of the canopy, which needs to be outside the electrical exclusion zone. These touch potential dimensions, shown in red on the diagram below, are specific to the rolling stock and its associated catenary position. The specific touch potential is calculated by using various standards, informed by technical notes such as T MM SS 900002 ST and input from the rail systems engineers and human factors advice

For bus interchange stops a minimum 800mm horizontal clearance and 4150mm vertical clearance is typically required to any stop infrastructure (measured from the platform edge), in accordance with the NSW State Transit Bus Infrastructure Guide, Clause 3.11 “Clear Zones”.

For stops within a shared LRV and bus corridor a minimum 600mm horizontal clearance and 4000mm vertical clearance is required to any stop infrastructure (measured from the platform edge).

A decision must be made to either raise the canopy above the clearance envelope or reduce its width (for maximised weather protection).

Consultation with the relevant bus operator should occur to agree on minimum clearances to stop infrastructure.

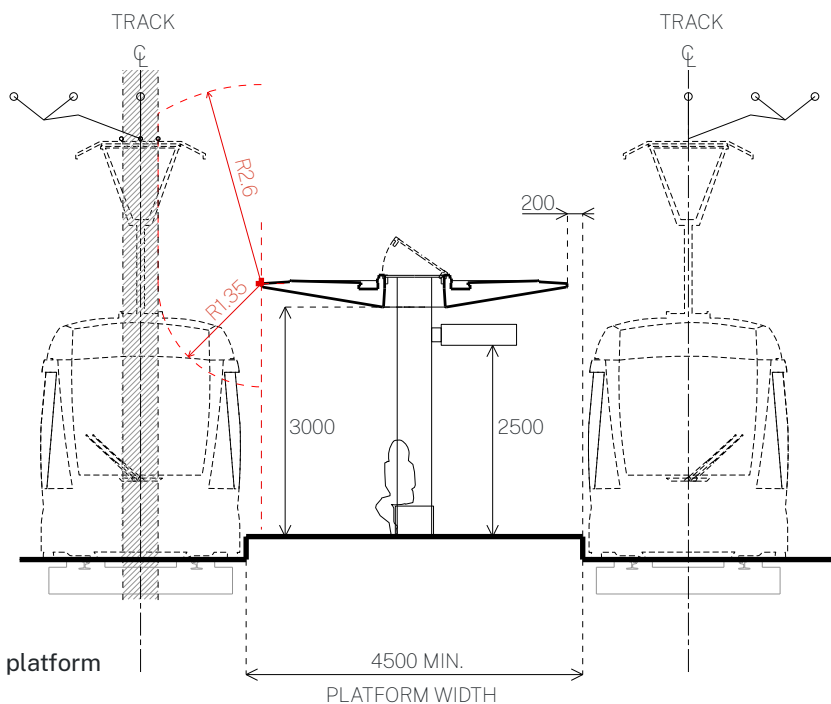
In order to prevent damage from vandalism, any suspended signage or light fittings must be fixed at a minimum height of 2500mm AFFL. This will ultimately determine the minimum height of the canopy soffit.

As an example, on the CSELR the minimum canopy soffit height was set at 3000mm above finished floor level to maximise weather protection whilst allowing for passenger information displays to be fixed beneath.

Check with bus planning team in the project area if design needs to take into account double decker buses.

#### Requirements

- Canopy extents are to meet electrical clearance requirements; and
- Interchange platforms and shared bus/LRV platforms are to observe bus operator clearances.



**Figure 136.** Typical island platform canopy extent section.

\* RESULTANT HEIGHT FROM ROAD SURFACE TO CANOPY AT POINT OF HORIZONTAL CLEARANCE SATISFIED MINIMUM 4000MM VERTICAL CLEARANCE IN SHARED CORRIDOR.

NOTE: PLATFORM SLOPE AFFECTS CANOPY HEIGHT THIS IS THE MINIMUM.

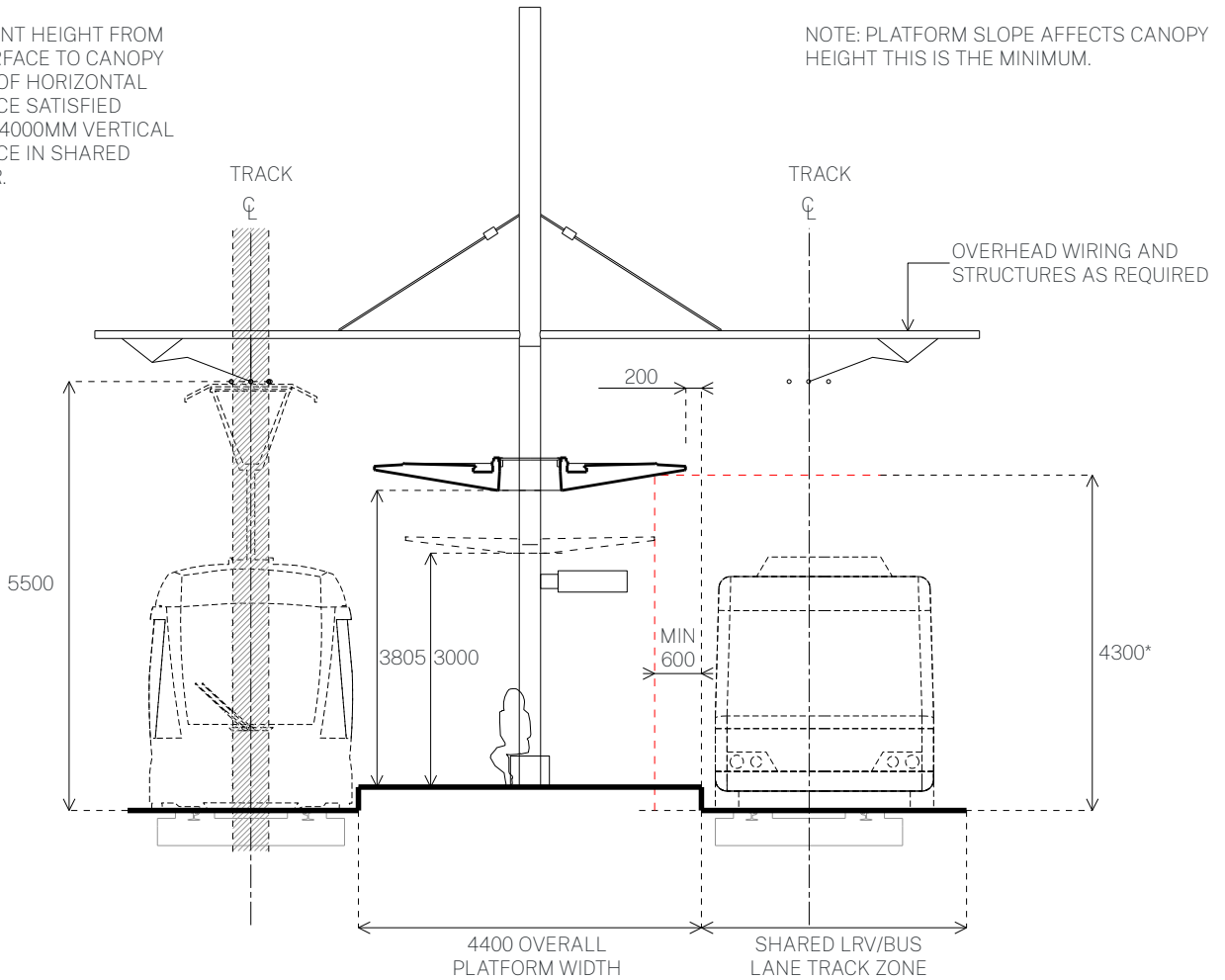


Figure 137. Example of shared LRV/bus platform canopy section from CSELR

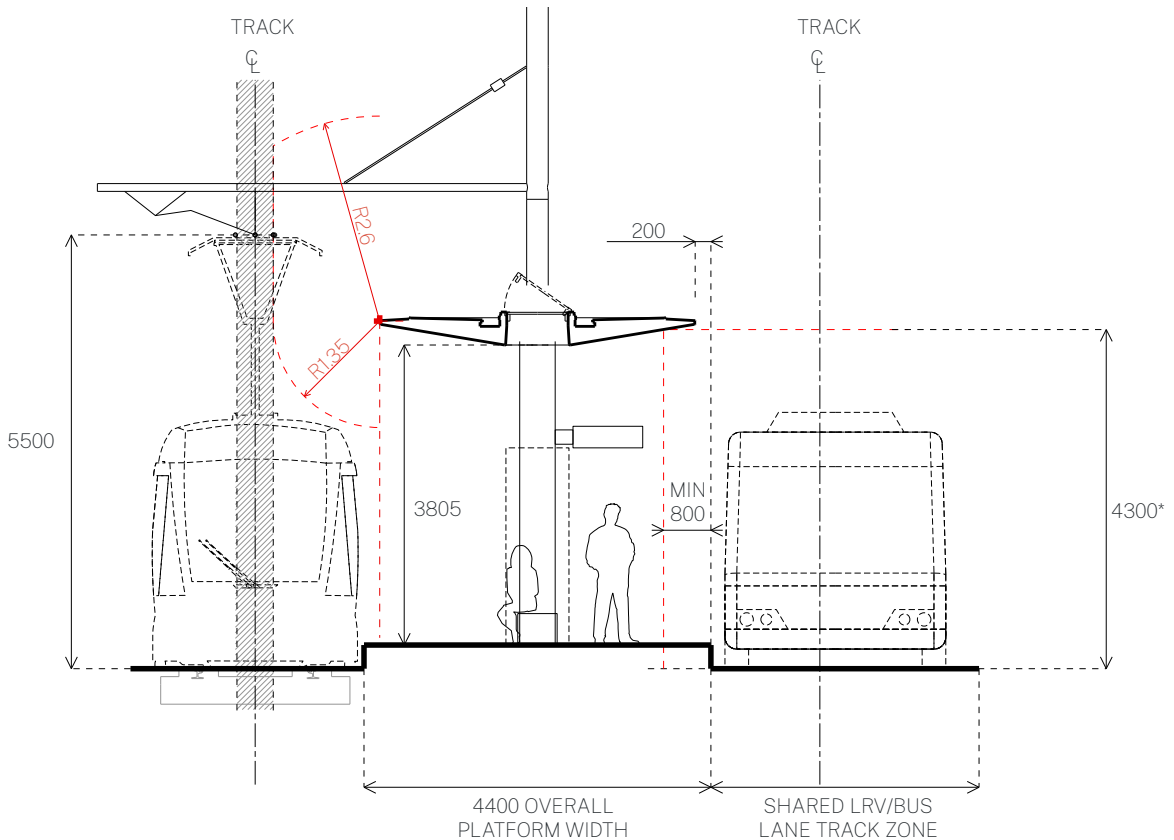


Figure 138. Example of bus interchange platform canopy section from CSELR

## 6.2.8 Detailing

### Principles

Careful detailing is critical to the success of light rail stop canopies. Key details should be tested as digital models, 1:1 physical models and through prototyping.

Consideration must be given to prefabrication. Canopy framing sections may come to site fully fabricated to allow for simple bolted connections to occur on site to complete the structural framing installation.

### Requirements

- Canopies are to be designed as orthogonal, rectilinear geometries;
- Canopy roofs to have sufficient fall to avoid ponding and satisfy roof sheeting warranty (typically at least 3 degrees) while maintaining a horizontal appearance;
- Canopy roofs to have a plumb horizontal appearance, not sloping with the ground plan;
- Maintenance access to the roof is to be considered when detailing the canopy such as the frequency and means of access plus any required access equipment and fall restraint systems;
- For canopies with integrated overhead wiring structures column connections are to occur above the canopy. Note that those columns may not be able to accommodate integrated equipment;
- Canopy edge profile dimensions are to be minimised to ensure a slim appearance;
- Canopy edge profiles are to be detailed in a manner that prevent water from tracking along the soffit;
- Canopy edge profiles are to be detailed to accommodate varying soffit angles, as the width of the canopy may vary;
- The canopy design is to identify a hierarchy of joints and associated joint widths;
- Fixings are to be concealed;
- Canopies are to be designed as modular elements to allow for future extensions;
- Canopy modules are to be designed in a manner that enables additional modules to be easily added in the future for greater coverage. Any additional modules should match the existing materials and finishes of the canopy
- In the event of canopy extensions all services are to be easily added, coordinated and concealed;
- Face fixed equipment such as CCTV cameras are to be avoided;
- The number of component parts is to be kept to a minimum in order to minimise waste; and
- Canopies should be detailed in a manner that will enable them to be constructed as pre-finished modules that are prepared off site.



**Figure 139.** 8000mm canopy module at Moore Park stop to cater for large crowds during events (CSELR)

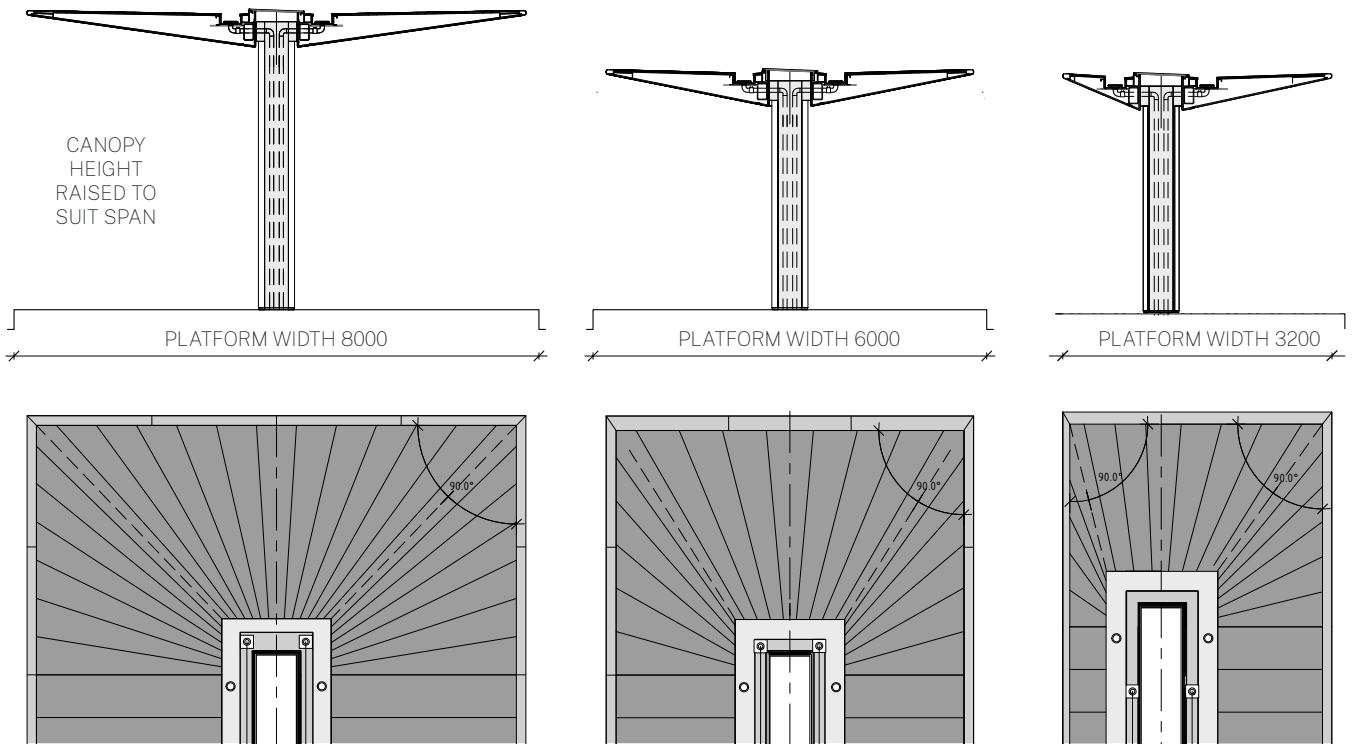


Figure 140. CSELR canopy family developed to suit the various platform typologies and dimensions

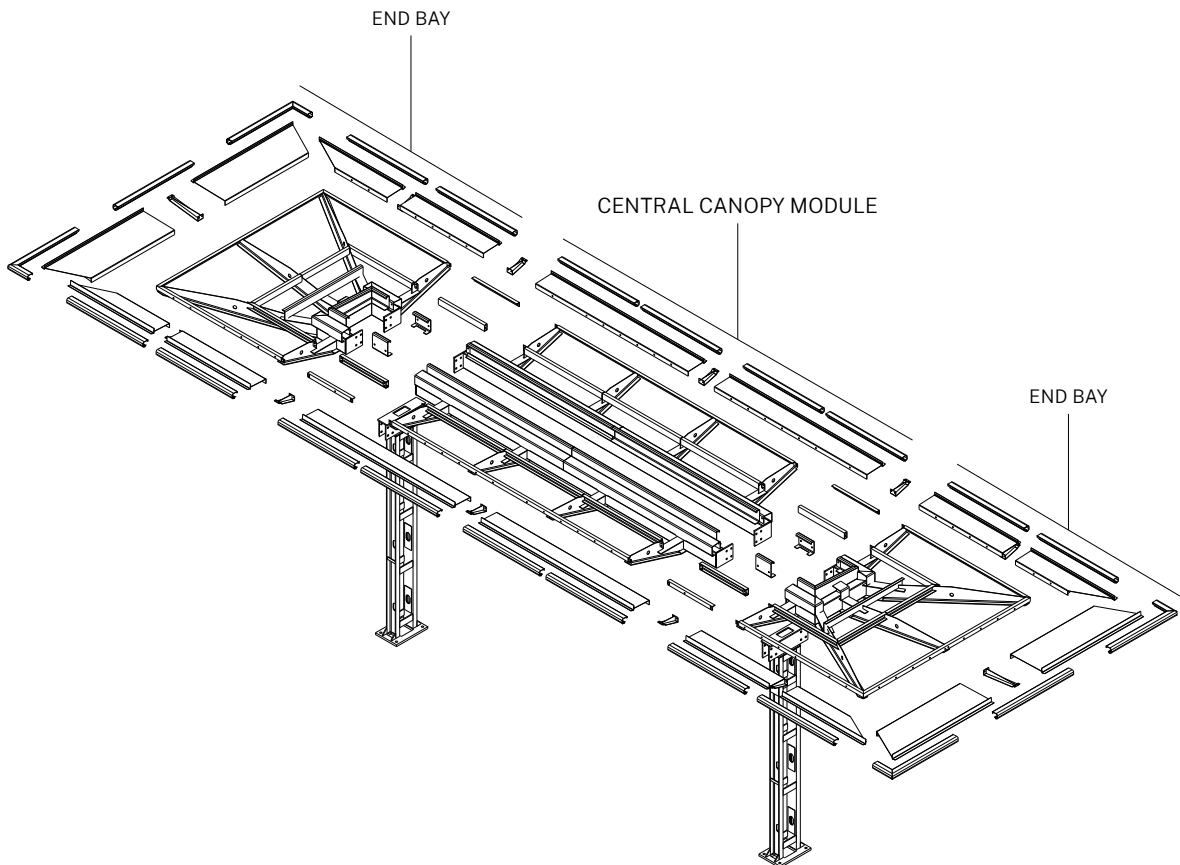


Figure 141. CSELR canopy structure showing assembly and modules

### 6.2.9 Drainage

#### Principles

The collection and drainage of rainwater from canopies are required to comply with AS/NZS 3500.3:2015 which has several consequences for the determined building classification and the selected geometry.

For a canopies with an internal box gutter arrangement, adherence to AS/NZS3500 requires a gutter, sump, overflow and leaf guard arrangement that results in an increased the depth of the canopy. This may not be an issue on larger canopies, or canopies without a central skylight, however it may be difficult to accommodate on smaller canopies without a detrimental impact to the bulk and scale.

To avoid this issue on the CSELR, an alternative solution was developed which included a siphonic drainage system.

The use of a siphonic drainage solution may be avoided with the use of an open valley gutter and a rainwater head however this would eliminate the canopy end bays in order to accommodate the rainwater head and overflow.

#### Requirements

- The collection and drainage of rainwater from canopies is to comply with AS/NZS 3500.3;
- Alternative solutions may be developed and presented to TfNSW for approval;
- Rainwater is not to discharge directly onto the platform;
- Access is to be provided at inspection points;

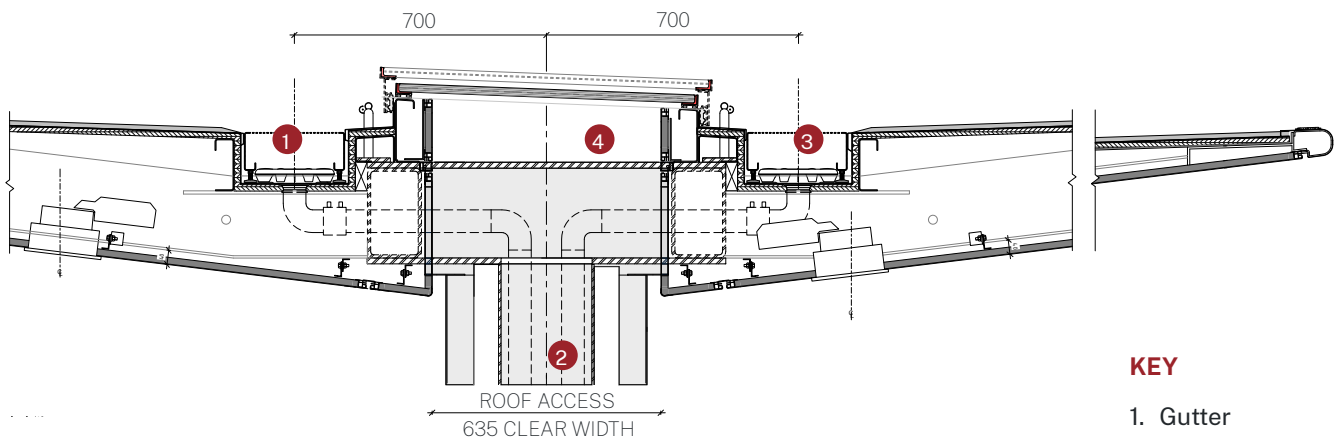


Figure 142. CSELR canopy drainage detail sections -larger width canopy

#### KEY

1. Gutter
2. Down pipe
3. Overflow
4. Skylight

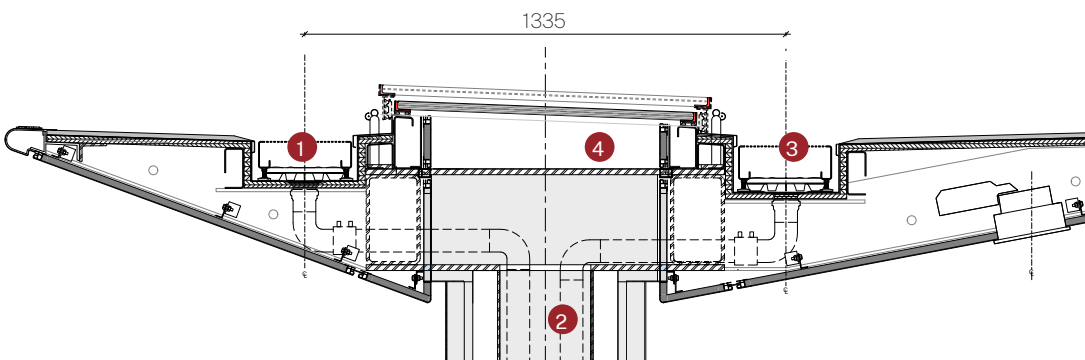
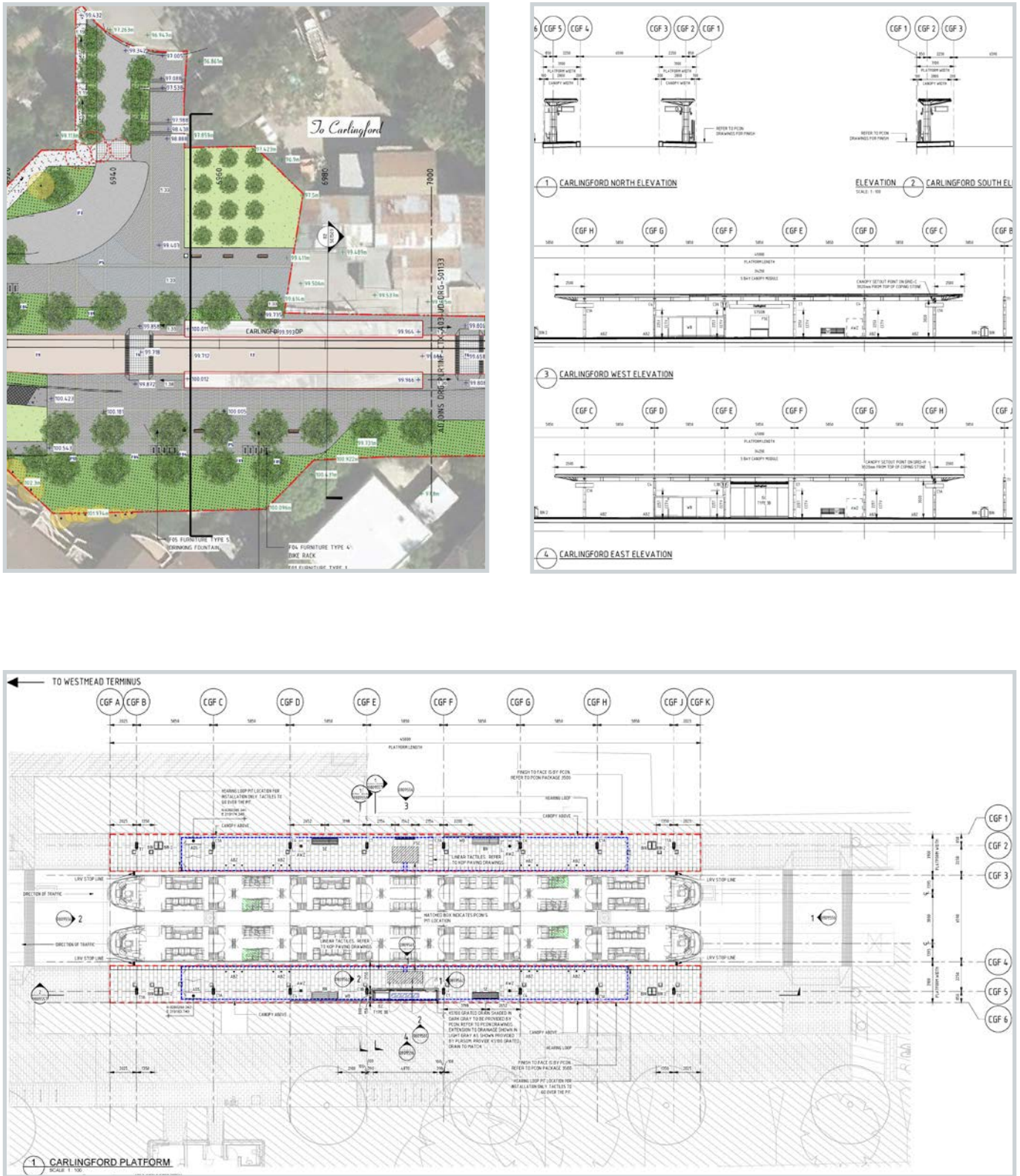


Figure 143. CSELR canopy drainage detail sections -smaller width canopy



**Figure 144.** Low resolution images of technical architectural documentation examples (indicative only) showing high level of technical detail and coordination with other packages

## 6.3 Materials Selection

### Principles

Cladding serves several functional requirements such as being weather resistant, durable and suitably robust for its environment. However, it is also important to consider how the selection and application of materials can contribute to the line wide identity of future light rail networks as well as potentially enabling a contextual response.

The project team may consider if materials are the same along the alignment or alter in colour or texture as a response to changes in precinct, neighbourhood or parkland settings.

It may be appropriate for fixed assets to be neutral in material, colour and finish while movable and replaceable assets to reflect the mode colour or individual identity.

The CSELR elected to use the same bronze material throughout where changes in exposure and distance from coastal zones would result in varied rates of weathering, whilst Newcastle Light Rail chose stainless steel for the canopy cladding to distinguish it from Sydney Light Rail. Stainless steel was also selected as it performed better in the maritime/riverine context of Newcastle. Caution is advised however, when selecting stainless steel given the potential of excessive tea staining,

The design detailing, materials palette selection and specification should be coordinated for all of the stop architectural elements, fixtures and fittings.

The design intent and materials selection should be communicated through 3D studies and materials boards.

The example below shows a materials board developed for the CSELR, considering the canopy finish, floor finish and signage components.

### Selection Criteria:

The following criteria should be adopted when evaluating the appropriateness of materials, finishes, fixtures and fittings:

- **Functionality** - the selection balances the architectural design intent and functional requirements. For example when the architectural design requires components to be recessed within a cladding system, the cladding material must allow for this integration;
- **Customer Experience** - the design must enhance the light rail environment through implementation of best practice;
- **Sustainability** - materials are to contribute towards sustainability benchmarking schemes;

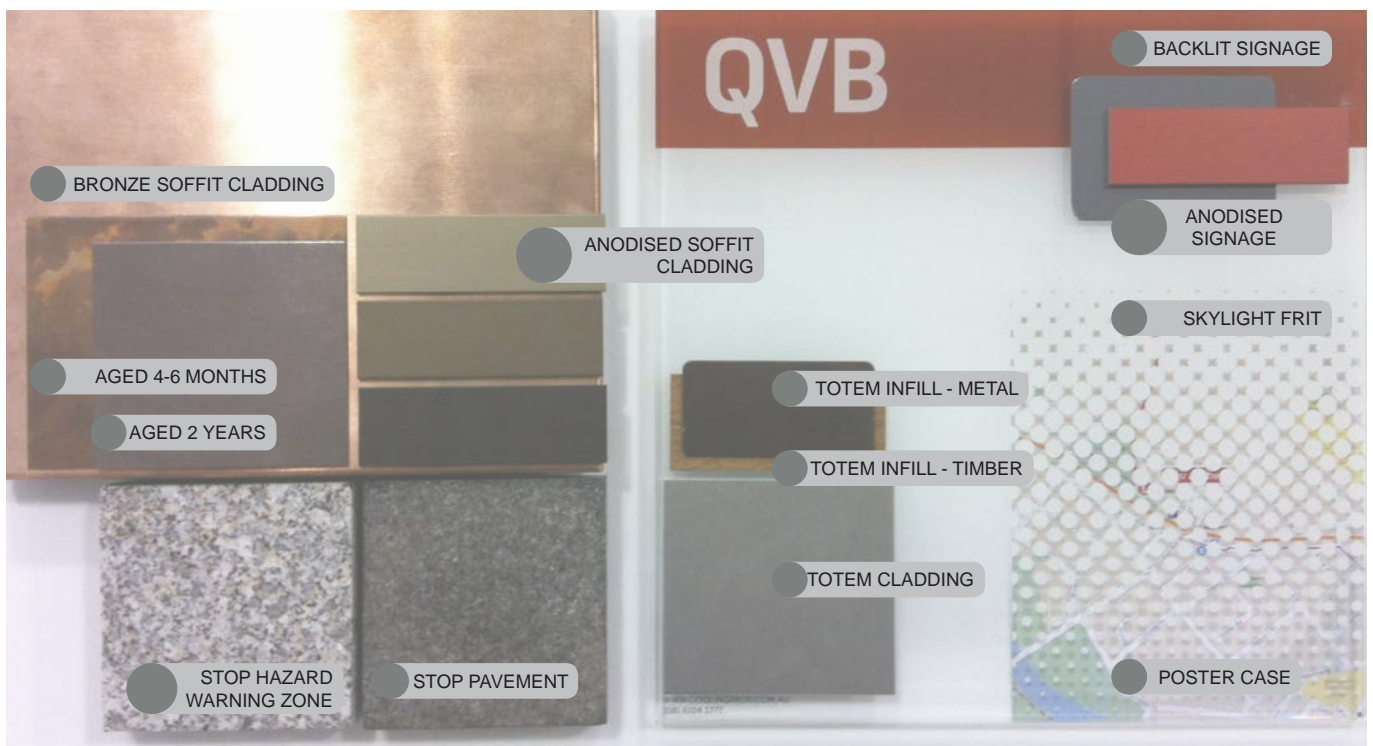


Figure 145. CSELR stop materials palette

- Cost - materials should be evaluated on a whole of life basis, the asset lifespan along with material cost, supply rate and installation;
- Construction - consideration of modularity, standardisation, fabrication and installation ; and
- Health and Safety - consideration of materials selection through categories such as manufacture, installation and disposal.

There is a potential cost uplift associated with some materials. The budget for finishes must allow for this, with emphasis on capital expenditure. There are also potential programme implications due to lead times needing consideration. This can be mitigated by liaising with material manufacturers early in the programme to understand availability and opportunities for materials specifications that don't add to cost and programme.

Designers and contractors should include the necessary performance data when researching materials, including, for example, the specification of Environmental Product Declarations (EPDs).

**Requirements**

- Selected materials are to be of a high quality, durable (long lasting) and self finished (low maintenance);
- Selected materials are to suit the light rail environment and enhance the identity, but are not to impede wayfinding, orientation and access;
- Selected materials are to contribute towards sustainability benchmarking schemes;
- Selected materials must achieve performance and technical requirements (SDG and ISCA) and consider service life, operational and embodied carbon emissions, recycled content, end of life and disassembly;
- Selected materials are to enable carbon reductions;
- Selected materials are to contribute to improved health and well-being for customers through material ingredient transparency and optimisation; and
- Consideration to meeting any materials procurement and local suppliers' targets in the project.



**Figure 146.** PLR stop materials at high fidelity prototype

### 6.3.1 Material Option Selection

The table below shows a comparison of material options based on the selection criteria outlined on the previous page.

**Functionality:**

- Refers to the ability to achieve completely flat panels. Note that on the CSELR the bronze panel flatness was achieved through a fabrication process which consisted of a thin layer of bronze sheet on an aluminium honeycomb panel.

**Customer Experience:**

- Refers to the ability to achieve a high quality finish and distinctive line wide identity.

**Sustainability:**

- Refers to the material embodied carbon relative to an anodised aluminium baseline (assumed 3mm, 79kgCO2/m2 sheet material only, no substructure).

**Cost:**

- Relative cost based on an anodised aluminium baseline. Note the comparable cost of anodising to bronze is due to the bronze panel fabrication process which consisted of a thin layer of bronze sheet on an aluminium honeycomb panel.

**Fabrication:**

- Refers to the ability to allow for expansion.

**Installation:**




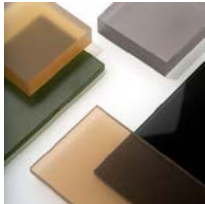

















































- Refers to the ability to achieve concealed fixings completely flat panels.

**Maintenance:**

- Does the material offer minimal maintenance?

**Health & Safety:**

- Does the material require specialist lifting equipment during installation and maintenance activities?

	<b>Cementitious</b>		<b>Glass</b>		<b>Plastic</b>		<b>Timber</b>
Brand names are indicative only	Fibre-C	Vitrapanel	Back painted & Laminated Glass		3 Form		Prodema
							
<b>KEY</b>							
 Positives							
 Negatives							
 Neutral							
							
FUNCTIONALITY							
CUSTOMER EXPERIENCE							
SUSTAINABILITY							
COST							
FABRICATION							
INSTALLATION							
MAINTENANCE							
HEALTH & SAFETY							





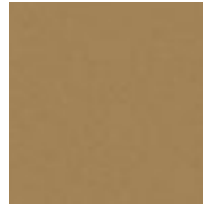







**Figure 147.** Table comparing material options developed for CSELR

### 6.3.2 Material Application

During design development phase the selected materials should be further evaluated for their ability to accommodate;

- Cladding modules (e.g. sheet material minimum sizes);
- Colour (e.g. is it applied or embedded?);
- Fabrication requirements;
- Durability and resistance to scratching;
- Maintenance regimes and panel replacement;
- Reflectivity requirements (e.g. specular or diffuse texture);
- Resistance to fading;
- Patching, buffing and other remediation
- Low risk supply and lead times;
- Local sourcing;
- Environmental Product Declarations; and
- Low embodied carbon.

#### Metals

Anodising	Bronze	Stainless Steel	Zinc	Powder Coat	Vitreous Enamel
					
					
●	●	●	●	●	●
●	●	●	●	●	●
●	●	●	●	●	●
●	●	●	●	●	●
●	●	●	●	●	●
●	●	●	●	●	●
●	●	●	●	●	●
●	●	●	●	●	●

## 6.4 Equipment Integration

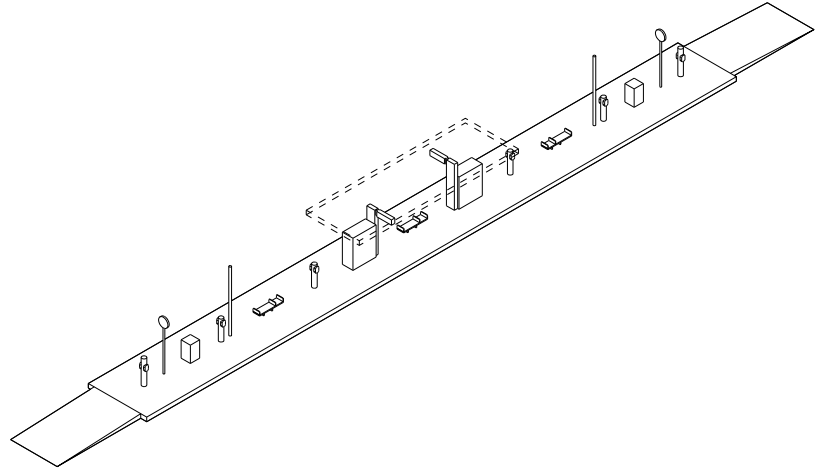
### 6.4.1 Why Integrate?

#### Principles

Randomly placed objects on stops such as rail systems cabinets, customer signage boards and single use poles should be avoided.

Locating equipment and customer information consistently in the same location on platforms will aid intuitive wayfinding and prevent congestion, which in turns minimises LRV dwell times. This is also important for vision impaired customers who rely on consistent layouts and tactile cues to navigate the stop.

Local modifications to setout principles are acceptable when responding to particular contextual requirements subject to approval by TfNSW.



**Figure 148.** Example of proliferation of single use objects on a platform creating clutter



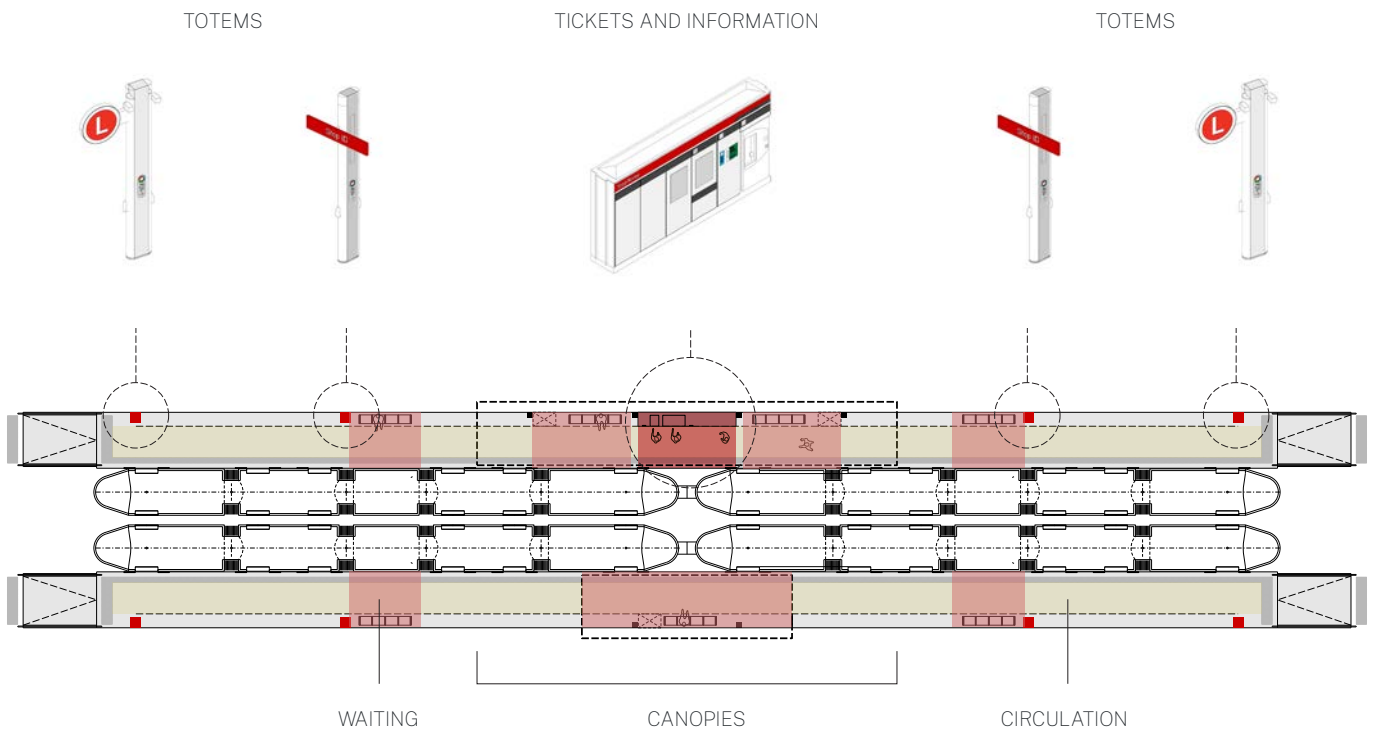
**Figure 149.** Clutter free platforms maximise space for customers (CSELR, UNSW High Street)

**Requirements**

- In order to provide clear sight lines and open and spacious customer circulation, equipment on stops is to be grouped together;
- A single ticketing and customer information zone is to be provided per stop;
- For side platforms, the side with the higher boarding patronage is to be used for the placement of the ticketing and customer information zone;
- The ticketing and customer information zone is to coincide with an area on the platform where passengers are unlikely to queue to board and alight the Light Rail Vehicle (LRV);
- Consolidate equipment and signage into purpose designed totems (multi-use poles and columns) to avoid random pole clutter on the platform.



**Figure 150.** Totems with integrated equipment (CSELR, Surry Hills)



**Figure 151.** Example of arrangement for integrating stop equipment with activity zoning (CSELR)

## 6.4.2 Integrated Services Cabinets

### Principles

The principle behind developing integrated services cabinets is the intent to group equipment such as customer information, ticketing, comms, power and signalling together into a single location and therefore minimise the need for equipment anywhere else along the platform thus keeping the stop environments clean and uncluttered.

Integrated services cabinets can provide the departing passenger with information relating to their journey through customer information systems, Help Points and wayfinding.

The cabinets should have fully integrated ventilation, lighting and cable management systems and may be designed as integrated cubicles (where internal equipment, racks, etc and the external cladding are one system) or as structures independent from the equipment cubicles housed within.

The latter offers the most flexibility for selection and procurement of equipment as well as future proofing and full control over the external appearance, however it has the largest footprint due to the doubling up of structures.

### Stop Equipment and its functions

Typically the integrated services cabinets will contain the following equipment:

- Signalling Equipment (SIG) – for the control of LRV signals (located on stops near cross-overs);
- Communications Equipment (COM) – servicing the platform communications equipment;
- Uninterrupted Power Supply (UPS) – providing back up power in the event of power failure to all critical stop infrastructure (note this equipment may require air conditioning);
- Electronic Ticketing Systems (ETS) Station Computer and distribution board;
- Electronic Ticketing Systems (ETS) equipment – Self-Service Machine (SSM) ;
- Passenger Emergency Help Point (PEHP); and
- Electrical equipment associated with bird deterrent system (if using shock tape).

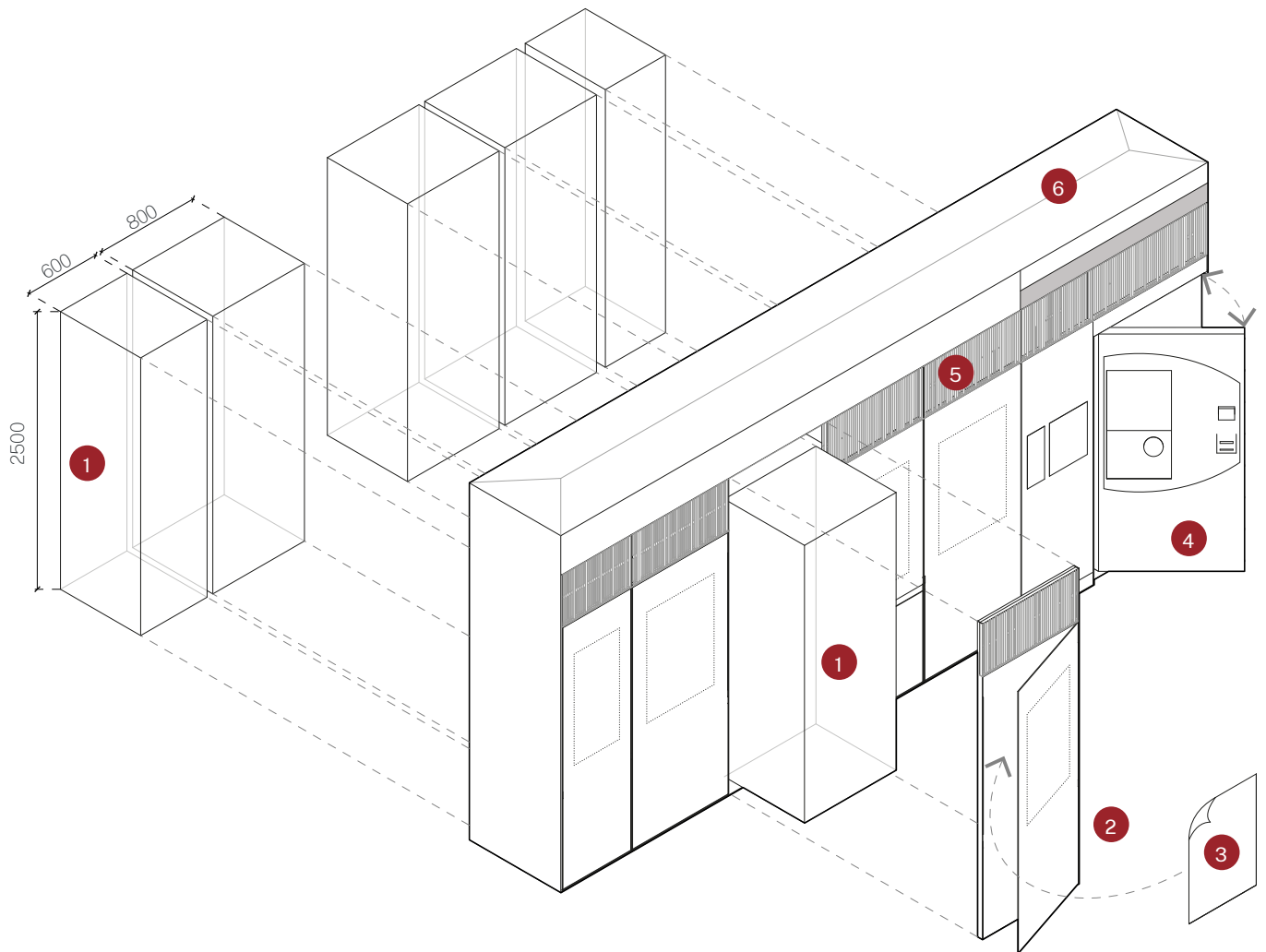
The size of the integrated services cabinet will vary depending on the equipment within and the ultimate equipment specifications.

A maximum envelope for stop equipment cabinets should be defined at the reference design stage as it will impact the general stop planning including defining minimum platform widths. The envelope should then be agreed at the outset of the detailed design stage.

Stops with cross overs located adjacent may require signalling cabinets (number of cabinets to be determined by the project). Ensure all dependencies are understood when space-proofing equipment within cabinets - including maximum cable runs between equipment and EMC sensitivity.

Key considerations:

- Equipment ventilation and/or cooling requirements - impacting the design through the integration of fans, louvres and in some instances air conditioning;
- Flooding - some stops may require the equipment inside cabinets to be reconfigured and raised above a certain level to prevent damage from flooding. This may result in larger (longer and potentially taller) cabinets;
- For space-proofing assume a cabinet width of 800mm overall which will allow for a standard 600mm rack to be fitted within plus an allowance for structure and cladding of the cabinet. Assume a maximum overall height of 2500mm;
- The equipment cubicles located within the integrated services cabinets are to have a maximum height no greater than 2000mm AFFL to ensure safe working maintenance and inspection access;
- The minimum gap between the top of the cabinets and the underside of canopy should enable visual permeability and sufficient space for maintenance access. Full height cabinets should be avoided;
- A large services pit may be provided at the base of the cabinet allowing for cabling to be fed into the individual cubicles; and
- Advertising screens are unlikely to be integrated into cabinets as revenue contracts find customization costs unappealing compared to standalone products and contracts require constant upgrades to the latest screen technologies.



**KEY**

- 1. Internal services cabinet
- 2. Full height door with integrated poster cases (for customer information)
- 3. Customer information poster
- 4. Ticketing machine
- 5. Ventilation louvres
- 6. Profiled roof capping

**Figure 152.** Schematic of integrated services cabinet from CSELR

**Integration with Wayfinding**

Integrated services cabinets offer an opportunity to utilise their wall space for customer information and wayfinding.

Cabinet doors should integrate the TfNSW suite of poster case signage and signage setout datums should be coordinated with the cabinet datums.

The poster case module and mounting position should fit harmoniously with the module of the services cabinets.

Integration of wayfinding elements with cabinet doors should not impede access to the services within and should allow TfNSW to undertake their activities in relation to replacement of signage content.

Opportunities may exist for digital information screens to be included onto cabinets. This requires expert industrial design and early hardware coordination with the digital wayfinding team. If included, avoid locating digital displays in full western sun as difficult to protect and use.

**Requirements**

- Stop equipment performance requirements are to be defined at the reference design stage;
- Minimum dimensions are to be defined and agreed at the outset of the project
- The envelope of integrated services cabinets is to be minimised;
- Equipment performance specifications are to be understood early in particular with regards to IP rating and ventilation/cooling requirements;
- The cabinets should be designed to have individual secure lockable doors to each compartment within, facing the platform edge and to be aligned flush with surrounding cladding panels.
- Ensure hinges and door hardware are adequately engineered to withstand frequent use and door weights; Locks are to be positioned at an easily accessible and convenient height;
- Equipment within the cabinets that requires regular access is to be positioned at an easily accessible and convenient height;
- Cabinet façades are to have integrated customer information and other customer facing functions; and
- Otherwise blank cabinet façades may consider the integration of public art, heritage interpretation, etc.



**Figure 153.** Signage integration within cabinet cladding (CSELR)

### 6.4.3 Examples of Service Cabinets on Platform

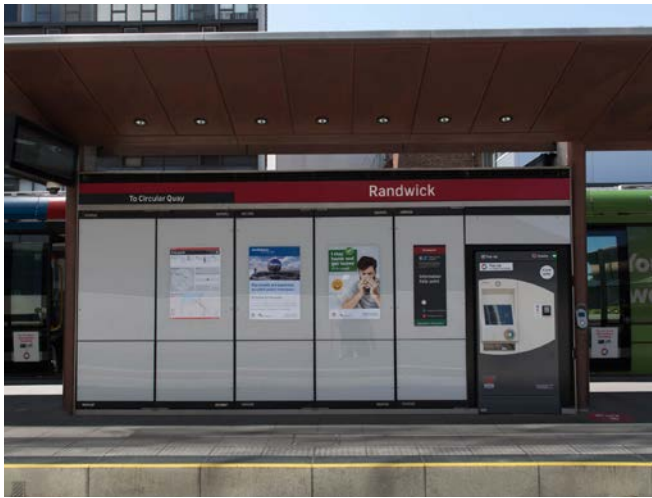


Figure 154. 6 module services cabinet (CSELR, Randwick)



Figure 155. 5 module services cabinet (NLR, Civic)



Figure 156. 4 module services cabinet (CSELR, UNSW High Street)



Figure 157. 5 module services cabinet during installation (PLR)



Figure 158. 4 module services cabinet during installation (PLR, Telopea)



Figure 159. A non integrated solution leads to a cluttered platform (IWL, Jubilee Park)

### 6.4.4 Multi-Use Poles (Totems)

Multi-use poles are called “Totem Poles” (free standing on platforms) and “Totem Columns” (supporting the canopy)

Totem poles may be proposed on the platforms as a means for integrating equipment and signage.

The multi-use poles are intended as hard working technology elements with services and equipment mounted within. Equipment integration will include Public Address speakers, Passenger Emergency Help Point, CCTV cameras, signage, passenger information displays and Opal card readers. Totems may also require additional data and power conduits for future uses, such as sensors for data collection.

An efficient and modular totem structural design is key to the successful integration of equipment. Utilising the totem structure as cable and drainage distribution allows for increased flexibility in the totem design.

OHW poles may be integrated with totem columns.

#### Spacing

The spacing of totems will be based on the stop structural grid and depend on the functional requirements of the equipment within. The types of equipment integrated with the totems will also impact on their heights.

#### Lighting Integration

When considering lighting integration with totem poles note minimum mounting height requirements for fittings to achieve the optimum illumination (the trade off is closer totem spacing).

For stop functional lighting, integrating light fittings with OHW poles reduces the number of light sources required.

Consider integrating architectural feature lighting with totem poles. Lighting colour and intensity should be coordinated with the immediate surroundings to ensure consistent and uniform lighting and accessibility needs. Lighting at designated ‘special event stops’ may have different performance requirements

#### CCTV Integration

CCTV coverage to stops and stop access points is required. CCTV cameras can be mounted on brackets on totem poles typically at each end of the platform.

Consider how CCTV cameras interact with other totem mounted elements such as the mode identification signage. A better solution may be for CCTV to be integrated with nearby OHW poles. This should be considered early on in the project.

Start discussions about CCTV housing specifications early in order to influence the selection prior to procurement.

#### PA Integration

Totem poles and totem columns can house Public Address (PA) speakers.

Define the maximum spacing of PA speakers to inform totem spacings. Integrate speakers behind a cladding system.

Consideration must be given to the perforation extent and geometry

#### Services

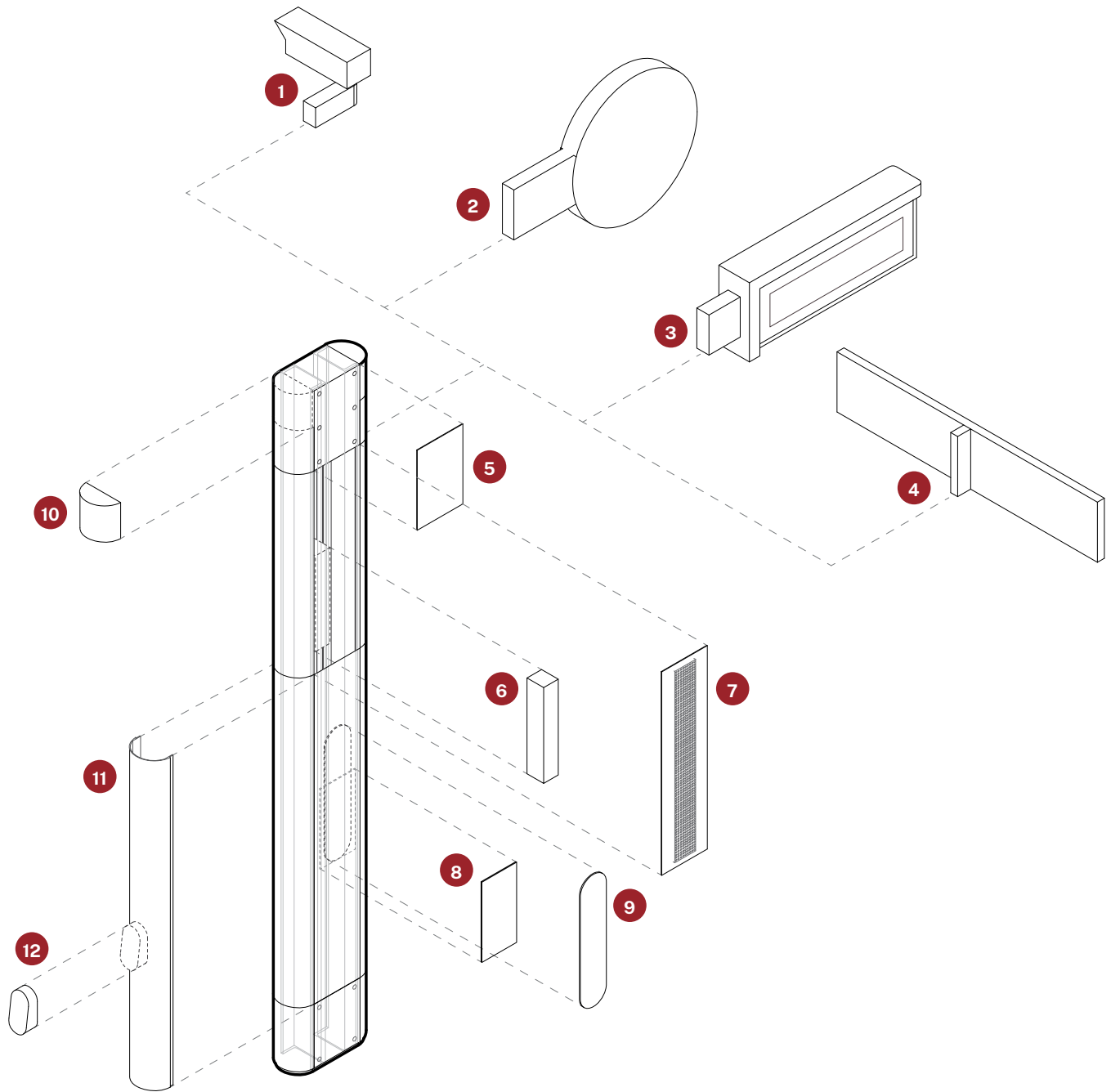
Conduits are to be provided from the stop cable management. The conduit reticulation needs to consider aesthetic impacts to the stop and should be concealed. Ideal reticulation areas are located within the totem structure, cabinet, soffit framing and platform structure.

The totem cladding strategy requires consideration of access for inspection and maintenance of the conduits as well as future cabling.

Totem columns may also contain canopy drainage. The drainage strategy is key in informing the totem space proofing.



Figure 160. Multi-use totem pole (CSELR, Royal Randwick)



**KEY**

- |                                  |   |                      |
|----------------------------------|---|----------------------|
| 1. CCTV Camera                   | 6. Speaker  | 10. Lighting         |
| 2. Mode ID Sign                  | 7. Speaker Grille Panel   | 11. Cladding panel   |
| 3. Passenger Information Display | 8. PEHP or please remember information signage panel (where required) | 12. Opal card reader |
| 4. Stop Name Sign                | 9. Signage (if required)  |                      |
| 5. Access Panel                  |   |                      |

**Figure 161.** Multi-use totem pole exploded axonometric

**Opal Integration**

Ensure Fixed Location Readers (Opal card readers) are consistently placed on the platforms in a manner that avoids congestion.

The number of FLRs is usually determined by patronage provided in the Scope and Performance Requirements but the quantities and positions should be reviewed with the operator.

Consider placing Opal card readers on approach to the stop in particular in high patronage locations.

Additional Opal card readers may be required at event stops to deal with increased capacity.

In order to improve circulation totem poles with FLR readers less should not be place less than 2000mm from the platform end (unless the position of the first LRV door dictates otherwise).

Should FLRs be integrated within the multi-function totem, consideration must be given to the geometry of the totem cladding to take the Opal reader.

Opal card readers should be integrated yet easily identifiable on the totem to avoid signage decals.

**Smart Poles**

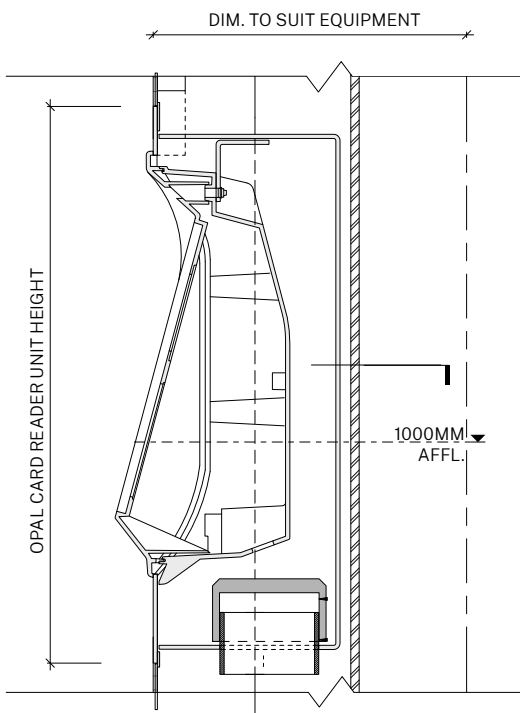
Smart Poles and other types of multi use poles which belong to a Local Council suite of street furniture may be placed on stops in lieu of totems.

This requires coordination with the suppliers of these products and may be problematic when additional space proofing is required for conduits and equipment.

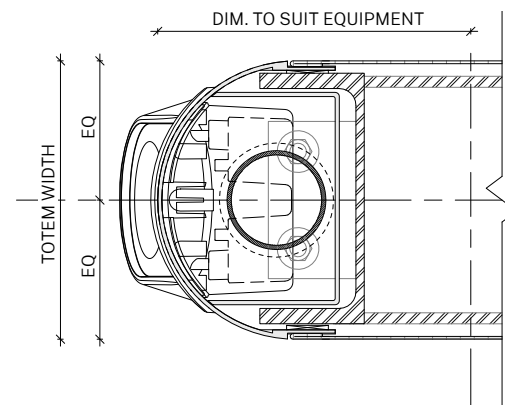
The CSELR successfully integrated stop signage, PA and Opal card readers with the City of Sydney Smart Poles.

**Requirements**

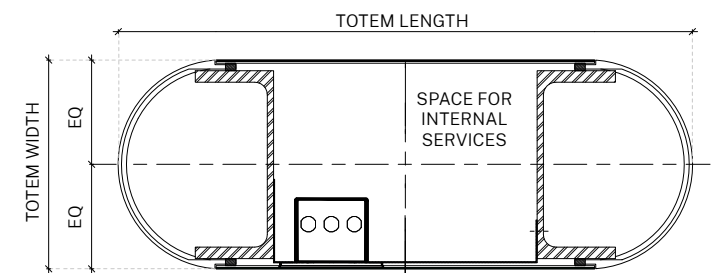
- Proliferation of single use poles on stops is to be avoided;
- Equipment is to be consolidated on multi function poles for an uncluttered, well designed and coordinated stop appearance;
- Surface mounted equipment such as signage or CCTV is to be consolidated on brackets;
- Removable panels are to be provided for access to cables and equipment behind;
- Conduit layouts, cable routes and equipment are to be standardised within totems;
- Opal conduits are to be provided for each totem for potential future installation of card readers; and
- The totem structural design is to consider a modular approach.



**Figure 163.** FLR fixing detail section (CSELR)



**Figure 162.** FLR fixing detail plan (CSELR)



**Figure 164.** Totem detail plan (CSELR)

### 6.4.5 Services Integration

#### Equipment on Platforms (within PLRC)

A stop equipment location strategy should be developed for each new light rail project which set out rules of thumb for the placement of elements on stops in order to achieve a consistent, familiar outcome.

Equipment on stops should be set out on datum levels in order to provide consistency and ensure positions are vandal resistant.

#### Connection to Combined Services Route (CSR)

Electrical, communications and signalling services will typically be supplied to the stop from the CSR. A large combined services pit may be associated with the integrated services cabinet and aligned with the location of the general CSR connection point to the stop.

#### Pits and Manholes

Services on the stops should be accessed via pits. Pit locations should be kept to a minimum.

On the CSELR platforms have one large services pit associated with the integrated services cabinet.

Inspection points for conduits are provided within totems, eliminating the need for additional pits on the platforms. Pit lid locations and dimensions should be coordinated with the platform paving module.

Earthing and bonding pits located on platforms are concealed underneath paving. Pit lids have not been provided in this instance as access will be highly infrequent. Tiles located above these pits are marked.

#### Cable management within stop

Within the stop itself, cabling will typically run underneath the platform slab from the services pit, parallel to the platform edge. Inspection points for cabling will typically be provided via pits or access panels in the cladding of stop elements.

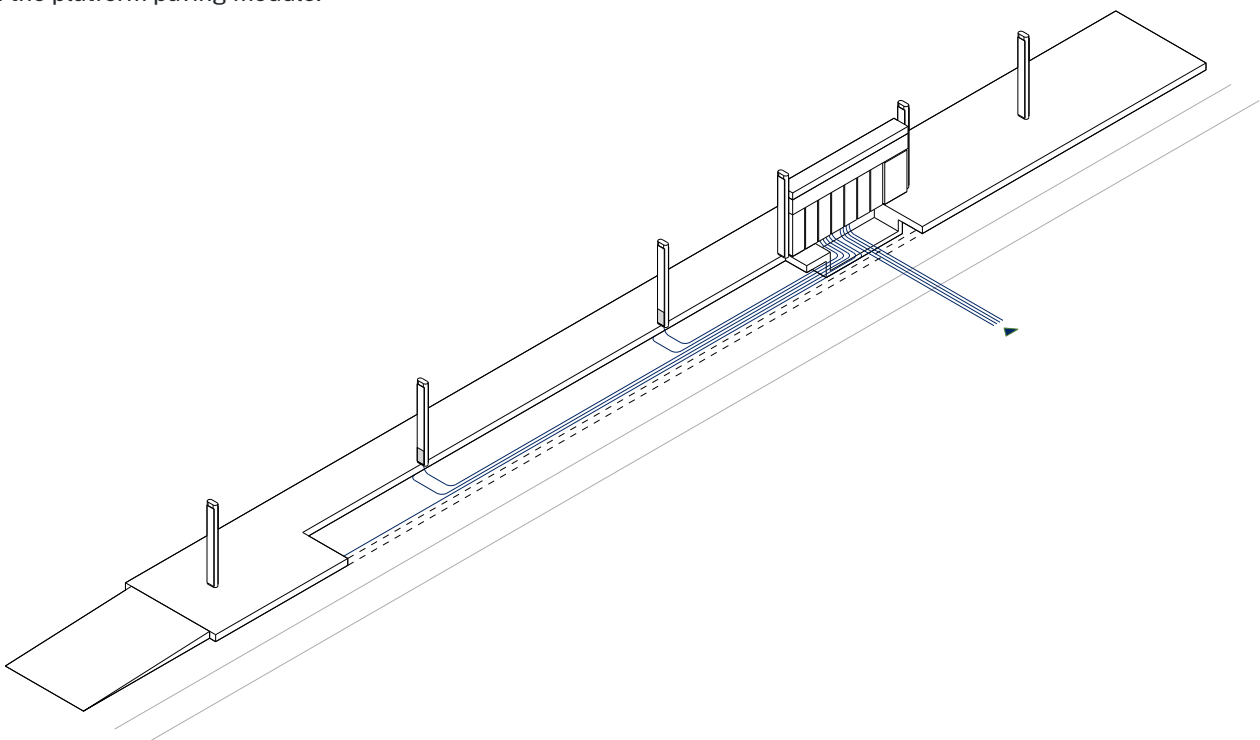
The CSELR utilised multi purpose totems with access panels which minimised the number of pits on the platforms.

If future canopy extensions are to be considered conduits should be provided to each modular point (footing).

#### Platform Drainage

At surface level the platform drainage should consist of localised inlet locations situated on the platform structural grid and aligned with the paving module. On side platforms these will be located along the back edge and on island platforms these will be located on the centreline of the stop.

The drainage inlet should be coordinated with the paver layout and platform paving module and grid.



**Figure 165.** Platform services diagram showing cable reticulation from CSR to integrated services cabinet and totems (CSELR)

**Access and Maintenance**

Totem designs should provide inspection points for cabling via access panels in the cladding.

Direct access to the CSR should be made available at the integrated services cabinet.

The integrated services cabinet pit access system is to be developed early in the design and coordinated carefully with all disciplines. The hatch integration and access method is crucial to ensuring a high quality aesthetic outcome and a successful access and maintenance strategy,

**Requirements**

- Services are to be Safely and easily accessible;
- The number of floor services access pits is to be minimised;
- All services are to be concealed;
- Platform drainage inlets are to be coordinated with the paving design and paving module;
- Service pit lids are to contain infill paving consistent with the surrounding public domain paving.

**Help Points**

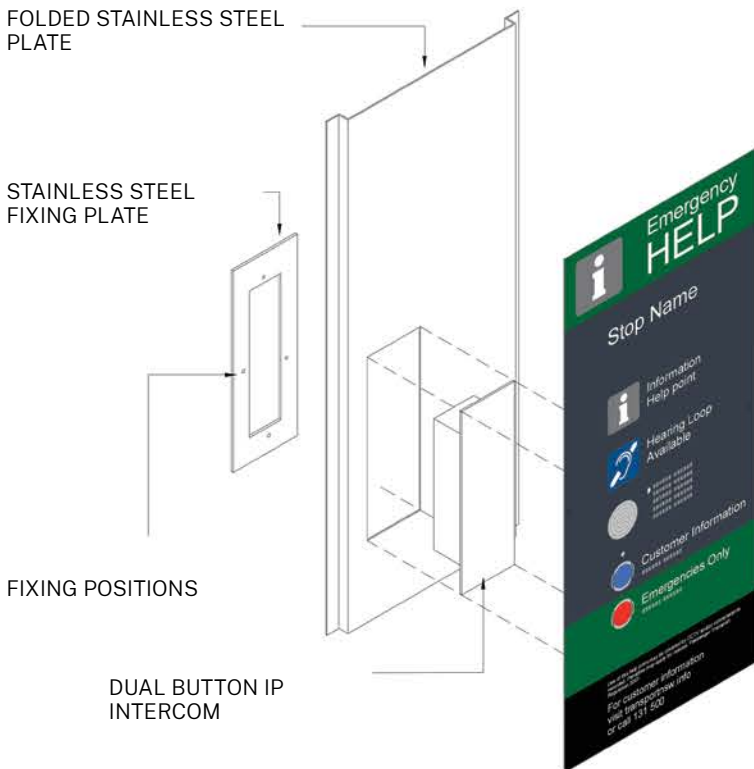
Help Points are intended for information assistance as well as emergency and should therefore be appropriately designed and signed.

Consideration may be given to the provision of signage directing customers to the Help Point and identifying the Help Point location on the platform

Help Point push buttons should be proud of the surface.

**Requirements**

- Help Points are to be provided on all platforms;
- Help Points are to be consistently placed on platforms to ensure intuitive wayfinding; and
- Help Points are to be easily identifiable when integrated within services cabinets and totems.



**Figure 166.** Help Point exploded axonometric



**Figure 167.** Help Point integrated into totem (CSELR, UNSW High Street)



**Figure 168.** Service cabinet pit access on platform (CSELR)



**Figure 169.** Maintenance access to canopy roof through skylight (CSELR, Wansey Road)



**Figure 170.** Platform drainage channel recessed into surface (NLR)

Furniture, fixtures and fittings help create a line wide identity for a light rail service, and should be conceived as a family of consistently detailed elements.

## 6.5 Furniture, Fixtures and Fittings

### 6.5.1 Balustrades and Handrails

#### Principles

The extent of fencing and balustrades on and around stops will be driven by safety considerations, but over reliance on fences and balustrades should be avoided through integrated design solutions that satisfy the safety considerations. This will help reduce clutter at stops.

Note that implementing balustrades on ramps considerably reduces the effective clear width of the ramps due to the DKE clearance requirements. Handrails and safety barriers, where required, must typically be set out 600mm from the DKE.

Pedestrian modelling should take into consideration the reduced ramp widths.

A safety case may be prepared to assess the most appropriate design solution for extents of fencing.

Consider the materials of handrails and their temperature in very hot or cold weather when customers like to avoid icy or hot metal handrails.

#### Requirements

- Stop precincts should be designed to avoid balustrades and handrails wherever possible;
- Balustrades and handrails are to be robust and durable;
- Balustrades and handrails are to be designed in a manner that maximises visual permeability;
- Balustrades and handrails are to consider climbability;
- Child safety is to be taken into consideration when designing fencing;
- A handrail turned down through 90 degrees to the ground is the preferred detail for mobility and vision impaired customers;
- Customer rail and traffic side entrapment is to be taken into consideration when designing the fencing;
- Fencing, balustrades and handrails is to be consistent in design and materials on and around a stop including ramps, public domain and road crossings;
- Balustrades are to be designed for modularity and ease of assembly;
- Standard sections are preferred to create simple, replicable assemblies;
- Where kerb rails are required, these are to be integrated as part of the balustrade system;
- Ensure infill panel materials can vary depending on the concept;
- All fixings are to be concealed below the floor finish;
- Earthing and bonding connections, when required, are to be concealed; and
- Glass balustrades or infill panels are not preferred.



**Figure 171.** Use of balustrades on island stop (CSELR, Wansey Road)

## 6.5.2 Wind Break Screens

### Principles

Wind break screens may be proposed on platforms to improve weather protection from prevailing winds and wind driven rain.

Placement of wind break screens should as a minimum be associated with dedicated priority waiting areas.

### Requirements

- Wind break screens are to be set out on the platform structural grid in order to align with the canopy cladding and platform flooring modules;
- Robust and durable, self finished materials such as SS316 stainless steel are to be used for framing of wind break screens;
- If glazed, laminated, toughened and heat soaked glass composition is to be used;
- Glass wind breaks can be integrated into the public art and heritage interpretation strategies while maintaining visual permeability
- Glass is to be protected from vandalism and graffiti using protective films;
- Earthing and bonding connections, when required, are to be concealed; and
- Glass wind break screens are to have a manifestation band compliant in height and luminance contrast with provisions set out in the DSAPT.



**Figure 172.** CSELR wind break screen behind seat

### 6.5.3 Advertising Screens and Freestanding Postercases

#### Principles

Some stop platforms may require freestanding digital advertising screens or postercases.

To ensure best practice stop design and customer amenity, advertising signage needs to be incorporated into the initial design of any stop and included in any DA. The location, size and volume of advertising assets needs to be informed by engagement with the TfNSW Revenue Management Team (Advertising Revenue team) so they blend into the infrastructure asset and also provide the financial benefit they are intended to, i.e. fit for purpose.

When considering the development of any new advertising assets at light rail stops the requirements of the SEPP (Industry and Employment) 2021 Chapter 3 Advertising and Signage need to be planned and actioned. Tasks will depend on whether the advertising asset is 'being primarily viewed from a road or the light rail station'.

At the time of writing this document, all developments will require a DA submitted for formal approval as the existing Exempt Development rights under the SEPP do not formally expand to cover light rail stations (only heavy rail stations). However if a proposed advertising asset is in a spot that is primarily viewed from the light rail station, then an informal discussion with the NSW Government planning department should be undertaken including photos that clearly show these views. That informal conversation may lead to an agreed outcome that may not require a formal DA submitted, i.e. it may become an Exempt Development.

If a DA is required to be submitted for approval to the NSW Government planning department, then a Pre-DA meeting needs to be arranged with both TfNSW Land Use and TfNSW Network Safety Services (road safety considerations) prior to any DA lodgement. An independent Road Safety Assessment needs to be undertaken by a specialist external to TfNSW. Only if that Road Safety Assessment is supportive, can the Pre-DA meeting be arranged.

If the Pre-DA meeting supports the development, then the DA can be submitted.

Upon any DA being approved, the NSW Government planning department will issue the Conditions of Consent applicable during the life of that developed asset. Any approved DA will have a time period attached to it e.g. approved for 15 years.

Therefore any approved DA will need to be filed and a reminder noted in any Asset Register to reapply for a renewed DA/consent.

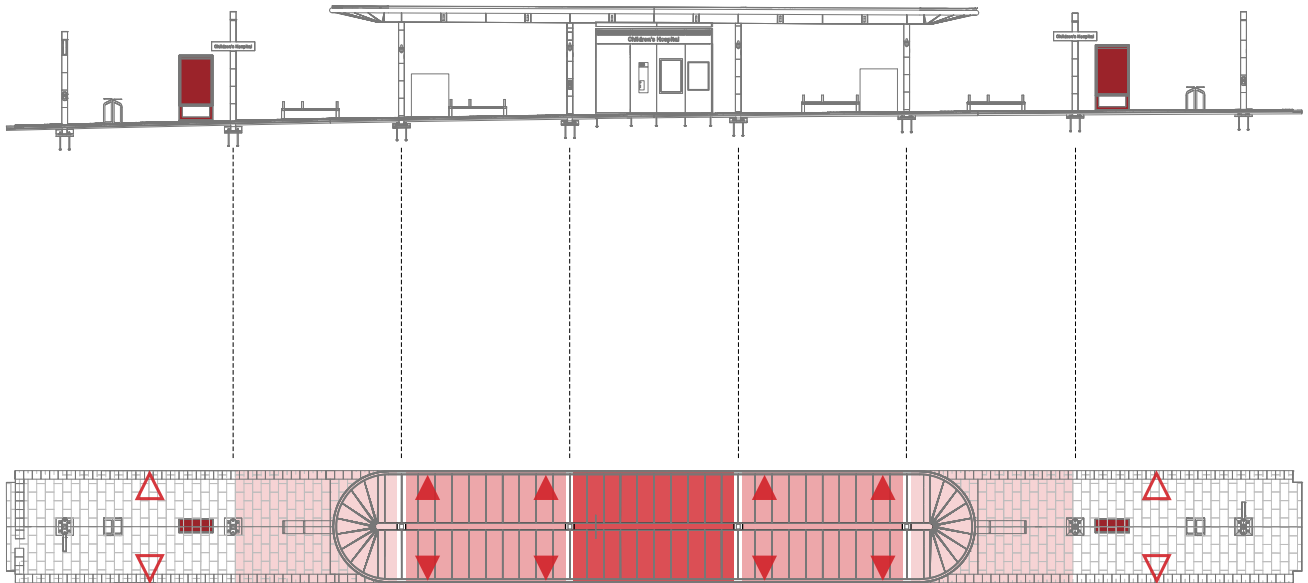
Freestanding poster cases are to be designed as part of the stop furniture palette and coordinated with the Wayfinding team for technical requirements.

#### Requirements

- Refer to State Environmental Planning Policy (Industry and Employment) 2021, Chapter 3 Advertising and Signage, Part 3.4 Miscellaneous, Section 3.30 Exempt Development, and its related guidance. Advertising on stops near roads is subject to the Transport Corridor Outdoor Advertising and Signage Guidelines;
- Freestanding screens or poster cases are to be located on the same layout line as the totem columns to maintain DDA clearances and avoid the impression of a random, cluttered environment;
- Dimensions for advertising units varies by advertising companies, but as a guide, the overall size of typical freestanding units is 2200 (H) x 1360 (W) x 300 (D);
- Freestanding advertising units require power only as they contain their own mobile communications equipment inside the unit; and
- Coordinating the siting of screens on stops is important early in the design process to avoid abortive design or construction work in later stages.



**Figure 173.** Example of advertising unit recently used in Transport environment



**KEY FOR ZONING ON PLATFORMS**

- Ticketing and Customer Information Zone
- Waiting Zone
- Boarding Zone
- Indicative locations for advertising screens (individual cases determined in discussion with TfNSW Revenue Management)
- ▽ Door Locations
- ▽ Accessible Door Locations

**Figure 174.** Indicative locations for advertising screens



**Figure 175.** Location of advertising screen not affecting circulation (IWLR, Jubilee Park)



**Figure 176.** Poor placement of advertising screen hindering platform circulation (IWLR, Exhibition)

### 6.5.4 Seating

#### Principles

The desired seating capacity will be determined by TfNSW.

Seats can be selected from the council or stakeholder agency suite of street furniture or be a project specific line wide design, or specific to certain stops to meet stakeholder requirements.

#### Requirements

- Seating is to be located on the stop structural grid and aligned with the paving module and cladding module of the stop canopy;
- Seats are to be positioned at the back of platforms in a side platform configuration, and along the centre line in an island platform configuration;
- In an island platform configuration an equal number of seats are to be facing each side of the platform;
- Priority seating is to be located under the stop canopy, with an adjacent wheelchair waiting space;

- Seat design and installation is to be in accordance with the provisions set out in the DSAPT;
- Some seats are to have back rests and arm rests to assist people with disabilities and elderly customers;
- The seat design should be easily detected by visually impaired customers using a cane, that is, the bench has four legs at the four corners rather than recessed or cantilevered arrangements;
- Seat materials are to achieve sufficient luminance contrast to adjoining surfaces. In particular, the luminance contrast should identify the leading edge of the seat;
- Material selection is to consider heat conductivity;
- Fixings are to be concealed;
- Earthing and bonding connections, when required, are to be concealed; and
- Seats are to be designed in a manner that takes into consideration site topography and enables the seats to be levelled.



**Figure 177.** Bench seating with back (CSELR)



**Figure 178.** Bench seating armrests only (NLR)



**Figure 179.** Bespoke bench at existing interchange (NLR)



**Figure 180.** Seating on platform with informal seating at platform end (NLR, Queens Wharf)

### 6.5.5 Bins

#### Principles

Generally bins should be provided on light rail platforms.

Bins may not be required at side platforms integrated with the footpath where public bins are available in the vicinity.

The quantity of bins will be determined by TfNSW.

Bins can be selected from the council or stakeholder agency suite of street furniture or be a project specific line wide design.

An angled top surface is preferred to prevent rubbish being put on top of the bin. Future projects may require smart bins with electrical and communications connections.

#### Requirements

- Bins are to be located on the stop structural grid, situated at the back of the platforms in a side platform configuration and along the centreline in an island platform configuration;
- Bins are to be positioned near to stop access and exit points, out of the primary circulation path, and away from seating and principal waiting areas;

- Bin locations are to be the same across all stops for consistency;
- Bins are usually approximately 80 litre capacity;
- Bins are to be covered and secured, including bird proof lids/enclosures;
- Internal bins and liners are to be easily removable for maintenance;
- Bins are to be comprised of resilient and graffiti proof materials;
- Bins are to be lockable and clearly labelled for waste and recyclables;
- Chute heights are to be in accordance with AS1428.2;
- Bins are to consider an angled top surface for ease of maintenance;
- Fixings are to be concealed;
- Earthing and bonding connections, when required, are to be concealed; and
- Bins are to be designed in a manner that takes into consideration site topography and enables the bin to be levelled.



Figure 181. Bin design for CSELR



Figure 182. Standard bin product used in NLR

Platform detailing is important for holistic integration of a stop into the public realm. Interfaces with the track zone, footpaths and pedestrian crossings are examples of areas requiring a considered well detailed outcome.

## 6.6 Platform Details and Paving

### 6.6.1 Strategy

#### Principles

Platform detailing has a vital part to play in the successful, holistic integration of a stop into the public realm.

Interfaces with the track zone, footpaths and pedestrian crossings are examples of areas which are critically important in achieving a considered well detailed outcome.

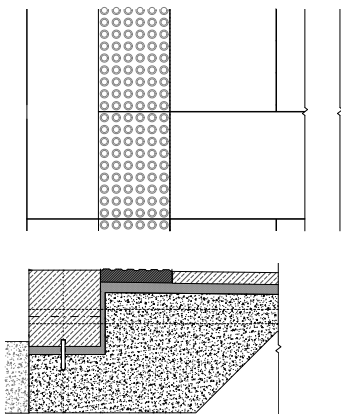
Key interface areas which require careful consideration of setout, alignment and detailing are:

- Platform edge and track side integration:
  - Edge delineation and luminance contrast;
  - Minimum vertical and horizontal gaps for LRV accessibility;
  - 300mm coping edge + 300mm tactile indicators;
  - Coping detailing - preference for single stone or concrete block, rather than a 'clad' solution; and
  - Penetrations for platform drainage outlets.
- Side platform footpath integration (along the rear of the platform):
  - Coordination of levels at the rear of the platform to tie in with existing or proposed adjacent footpaths;
  - Cross falls and accessibility;
  - Drainage line setout;
  - Paving module alignment between new and existing footpath paving; and
  - Paver specification (thickness typically not required to match trafficable pavers on footpaths).
- Side platform access ramp and footpath kerb edge alignment:
  - DKE offsets to kerb edges and alignment of kerbs with access ramps and platforms;
  - Kerb widths typically not aligned with platform safety zone width; and
  - Alignment and integration of balustrades (if required).
- Island platform access ramp and median kerb edge alignment:
  - DKE offsets to kerb edges and alignment of kerbs with access ramps and platforms;
  - Kerb widths typically not aligned with platform safety zone width; and
  - Alignment and integration of balustrades (if required).
- Access walkways/ramps:
  - Walkways (1:20) preferred due to the lack of handrails and balustrades;
  - DKE offsets to kerbs and balustrades;
  - Ramp detailing to meet accessibility requirements; and
  - Detailing of tactile surface indicators at the top and bottom of ramps (if required).
- Pedestrian crossings:
  - Where pedestrian crossings at the stop access point are close to platform access ramps tactile surface indicators associated with the crossings may coincide with those required for the access ramps. Their alignment requires coordination.
- Stairs:
  - Integration of tactile surface indicators, luminance contrast provisions and handrails with the platform design; and
  - To avoid add-on yellow strips on steps, integrated nosing strips with paving tread.
- Platform drainage:
  - Falls to avoid ponding; and
  - Drainage grate design integration with paving module and stop grid.
- Floor markers:
  - Accessible door markers;
  - Wheelchair waiting area markers; and
  - Detailing and durability.

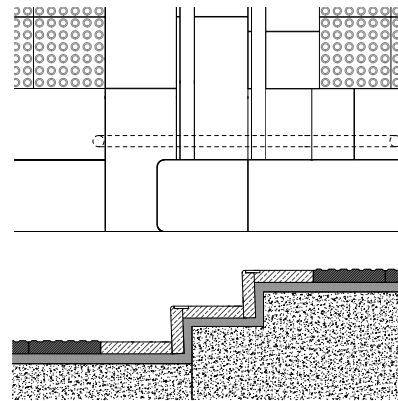
- Pits and covers:
- Integration with platform module and paving may require bespoke solution; and
- Materiality and durability.
- Tactile surface indicators:
  - Detailing and durability;
  - Luminance contrast;
  - Alignment between stop and public domain track zone edge delineation; and
  - Directional tactile indicators and their alignment from the platform edge to the shoreline.

**Requirements**

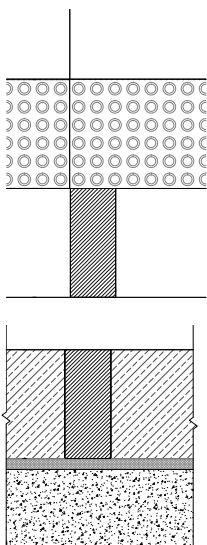
- The interface between the stop and the public domain (often in different packages) to achieve a holistic outcome with the same, similar or complimentary paving;
- Accessibility requirements are to be holistically integrated into the stop and associated public realm;
- Durability is to be considered in detailing and material selection;
- Contrast requirements that can be met for platform edge delineation through different coloured materials. However, since the Sydney Light Rail project, the convention has been established on the TfNSW light rail network as a yellow line; and
- Simplicity in paving layout including avoiding short paving cuts prone to dislodge over time.



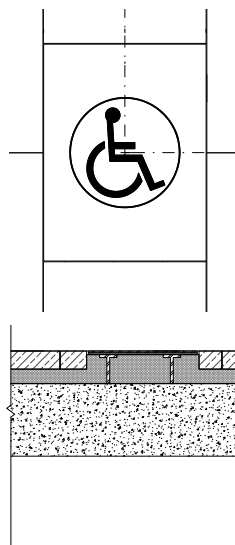
**Figure 183.** CSELR example of a typical platform plan and typical platform section



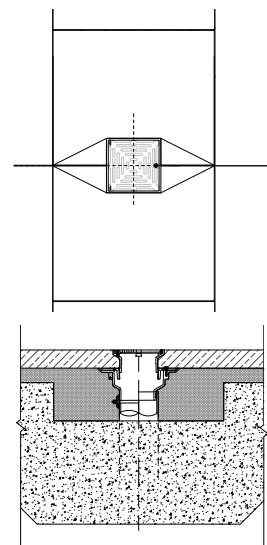
**Figure 184.** CSELR example of a typical stairs detail plan and typical stairs cross section



**Figure 185.** CSELR example of a driver stop marker plan and driver stop marker section



**Figure 186.** CSELR example of a wheelchair space floor plan and wheelchair space floor section



**Figure 187.** CSELR example of a point drain plan and point drain section

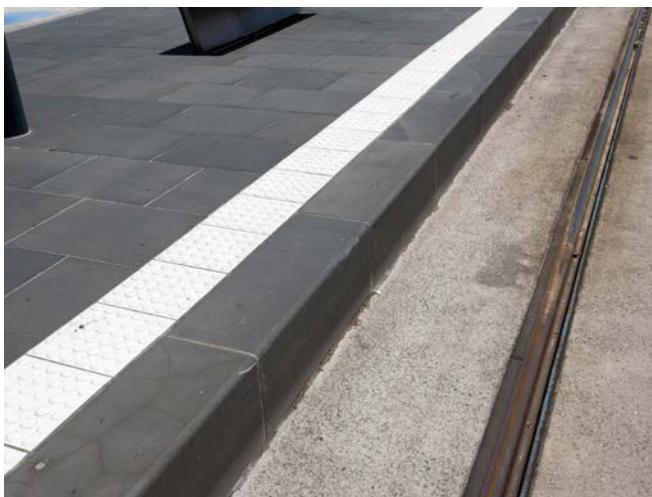
### 6.6.2 Examples of Paving Surfaces and Coping Edges



**Figure 188.** Yellow line retrofitted to coping stone (CSELR)



**Figure 189.** Gap filler as a retrofit solution on the older IWLRL line system; should not be necessary on new projects



**Figure 190.** Luminance contrast between platform and track materials (NLR)



**Figure 191.** Special paving of track zone in heritage precinct (PLR)



**Figure 192.** Falls and drainage grate integrated with paving module (CSELR)



**Figure 193.** Side platform with same footpath and platform paving (CSELR)

Wayfinding signage must comply with the TfNSW Wayfinding Planning Guide and Kit of Parts. Signage is a complex component requiring close coordination with the TfNSW Wayfinding team.

## 6.7 Signage and Wayfinding

### 6.7.1 Strategy

#### Principles

In developing a wayfinding strategy for future light rail networks, the designers should:

- Recognise that for the passengers who use the light rail it may only be part of a longer customer journey and therefore consistency in customer interface is key;
- Use built form and lighting design to create intuitive environments for wayfinding that is supplemented by signage (this can be achieved by ensuring consistent placement of stop equipment such as ticket machines and Help Points to avoid additional signage); and
- Propose a signage system based on the TfNSW standards and guidelines, and is simple, clear and consistent in use.

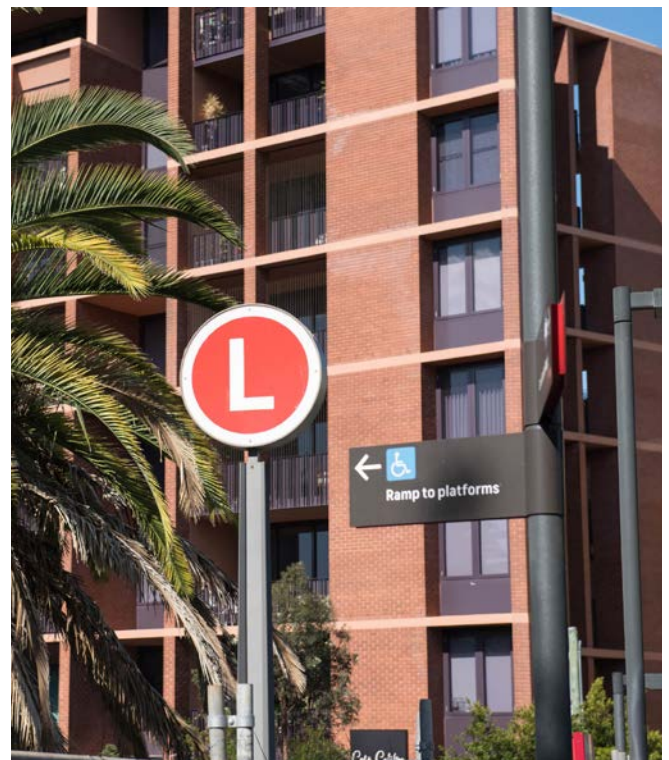
Note TfNSW have developed a signage kit of parts which is to be replicated across all networks. TfNSW typically work with a panel of approved designers and likewise a panel of approved suppliers which are familiar with the TfNSW specifications.

The types of signs required, and their respective locations must be informed by the TfNSW Wayfinding Guidelines.

It is critically important to understand the documentation requirements associated with producing a signage and wayfinding package in accordance with TfNSW Wayfinding Guidelines and to agree the responsibilities, work-flow and programme.

#### Requirements

- A suitably qualified and experienced designer is to lead the light rail signage and wayfinding design;
- The designers are to consult with TfNSW throughout the design process to ensure all signage and wayfinding is compliant with the TfNSW Wayfinding Guidelines; and
- When integrating signage elements into the built form, the signage elements must offer the same functionality as the TfNSW standard suite of signage intended for that application.



**Figure 194.** Signage helps customers navigate around the stops (IWLR, Arlington)

### 6.7.2 Totem Mounted Signage

#### Mode ID

The Mode ID sign informs the customer that they are at a light rail stop. This sign is a key mode identifying element and its size, colour and typography is dictated by TfNSW.

The Mode ID is an illuminated sign which is typically located at the entrances to the light rail stop. Typically there will be 2 such signs per platform. The CSELR had these signs integrated with the totem poles. Bus interchange platforms will require both modes to be shown.

#### Stop name sign

The Stop name sign informs the customer of the stop name.

The Stop name sign is a flag sign, typically mounted at a minimum of 2500mm AFFL and spaced at regular intervals along the platform. The CSELR had these signs fixed centrally fixed to the totem poles.

NOTE: Consistent datum levels should be established for the set out of this sign type and ensure it is mounted no less than 2500mm AFFL.

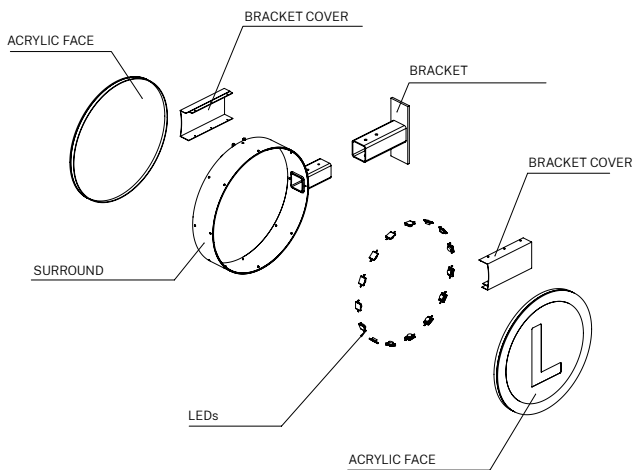


Figure 195. Mode-ID components (CSELR)

#### Passenger Information Display (PID)

PIDs are digital, dynamic information signs. One PID is typically provided per platform and mounted in the centre for maximised visibility. The proposed size, type and locations of the PIDs should demonstrate compliance with the viewing distance of text. The PID screen hardware type should be directly compatible to, if not improvement upon, the currently deployed (late 2016) Sydney Trains PID solution – reference Full HD motion video (1920/1080p) LCD/LED etc.

All screen content and style presented is determined and designed by TfNSW Wayfinding using existing TfNSW data sources / service offerings.

PIDs are typically mounted in a double sided configuration. The weight of the unit must be taken into consideration when designing mounting brackets on columns. Due to the fact that PIDs are typically mounted beneath canopies, their minimum mounting height requirements and size will drive the canopy soffit level up. Sufficient space should be left between the top of the PID and the canopy soffit for visual permeability, whilst considering weather protection.

NOTE: Establish consistent datum levels and ensure mounting of signage and PID is no less than 2500mm AFFL.



Figure 196. Passenger Information Display (CSELR, UNSW High Street)

### 6.7.3 Cabinet Mounted Signage

#### Stop name sign (Integrated)

The integrated Stop ID sign is a continuous horizontal frieze sign mounted to the integrated services cabinet. Typically this sign will consist of the stop name as well as the route information and terminus.

NOTE: This sign may be suspended from the canopy on platforms where a cabinet is not provided.

#### Poster cases

Poster Cases enable TfNSW to provide customers local area information, campaigns, etc. Typically poster cases will include the following:

- Passenger Information;
- Campaign Information; and
- Local Area Information.

The number of poster cases on each stop should be discussed and agreed with TfNSW.

#### Emergency Help Point and Hearing Loop signage

Signage associated with the function of the Help Point. Note these may be integrated with totem columns or totem poles where a cabinet has not been provided.

#### Conditions of entry sign

This sign is integrated with the services cabinet cladding. It can be located on the one cabinet on the stop.

Note these may be integrated with totem columns or totem poles where a cabinet has not been provided.

### 6.7.4 Public Domain Signage

Public Domain Signage will typically consist of:

- Directional Signs - signs positioned in the vicinity of the stop access point directing customers off the stop;
- Directional Flag Signs - signs positioned in the public domain (at nearest cross street or as applicable) directing customers to the stop. This sign should be integrated with any existing or proposed poles; and
- Local Area Information - signs provided by the Local Council, most likely belonging to the Local Council suite of wayfinding and information signage. NOTE: Where local area information is provided by the council, it does not need to be included in the services cabinets on the stop - to be discussed and agreed with the relevant council and TfNSW.

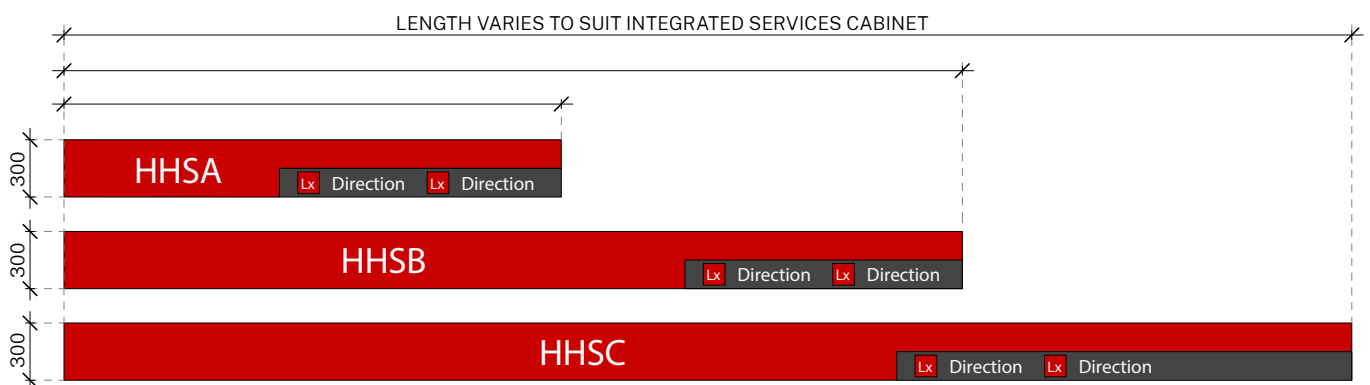


Figure 197. Stop name and direction sign artwork setout with wayfinding product codes

### 6.7.5 Other Signage

There are a number of signs associated with light rail stops which do not belong to the TfNSW suite of signage and wayfinding elements.

#### Opal Card Reader Sign

The Opal Card Reader sign is a decal on the totem pole identifying the position of the integrated Opal card reader. This sign should be positioned perpendicular to the path of travel on the face of the totem pole or column.

#### Floor Signage

The following floor signs may be considered.

- Accessible Marker - a marker recessed within the paving tile to indicate the boarding doors for dedicated wheelchair spaces within the tram;
- Wheelchair Waiting Space Marker - a marker recessed within the paving tile and located on the platform adjacent to the priority bench seat; and
- Earthing and Bonding Pit Markers - for the identification of pits concealed below the floor finish.

### 6.7.6 TfNSW Templates

Ensure TfNSW signage documentation templates are adhered to. Wayfinding documentation packages must use TfNSW's site naming protocols. TfNSW will provide templates for a very specific documentation format, which includes:

- Site Boundary and Connections Plan;
- Site Relationships Diagram;
- Flow and Zone Plan;
- Site Strategy Plan; and
- New Signs Request Schedule.

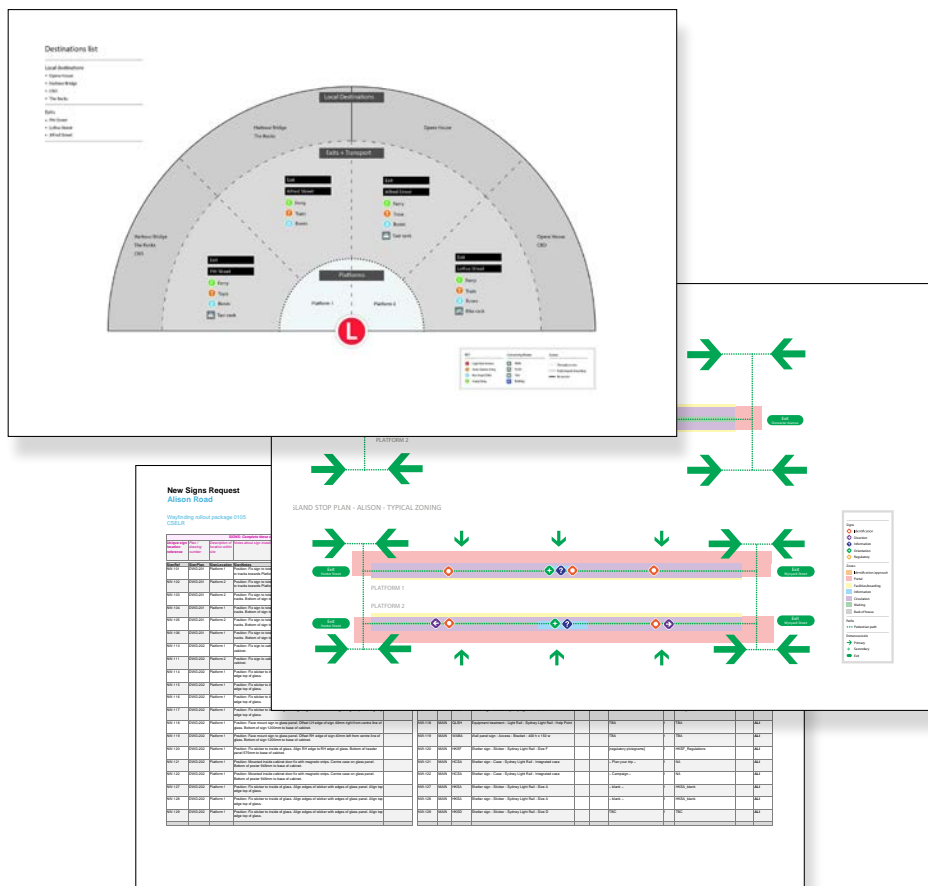


Figure 198. TfNSW signage templates

### 6.7.7 Examples of Wayfinding on Platforms



**Figure 199.** Stop name and direction of travel sign placed in canopy structure (IWLRL, Wentworth Park)



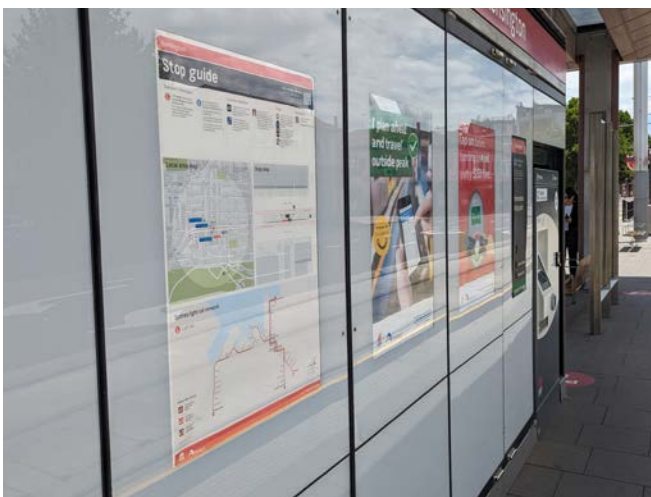
**Figure 200.** Conditions of entry sign integrated into multi use totem (PLR, Telopea)



**Figure 201.** Free standing Mode ID and information blade (NLR, Newcastle Beach)



**Figure 202.** Stop name signs attached to multi-use totem (PLR, Telopea)



**Figure 203.** Poster cases integrated within services cabinet (CSELR, Kensington)



**Figure 204.** Mode ID attached to multi-use totem (CSELR, Royal Randwick)

## 6.8 Lighting Design

### 6.8.1 Lighting Design Strategy

#### Principles

Lighting design should create an opportunity to engage the local environment of the stops. Emphasis should be placed on seamless and elegant integration of the various illuminated elements with the stop architectural components.

Lighting is a key determinant of public perceptions of security. Customer research shows warmer light promotes feelings of safety, instead of cooler white light.

Light fittings should become secondary to the illuminated built form, allowing for the various architectural features to be highlighted through the precise application of light. A coherent visual hierarchy creates long distance impact views and assists users to successfully navigate the stops.

Combined multi-use poles eliminate the need for totem integrated lighting at stops and allow for far greater spacings.

Street lighting outreach arms may be employed when integrated with the overhead wiring poles to achieve compliance with the lighting technical parameters in the respective lighting standard. Power supply to emanate from the stop distribution board.

The integration of architectural feature lighting can be achieved in a number of ways, however selection of the type of lighting has significant consequences.

Use of up-lighting of canopy soffits for example is inherently linked to the minimum height of the canopy. Due to vandalism concerns, no fittings are to be mounted lower than 2.5m AFFL. In order to achieve a uniform distribution of light on the soffit of a canopy, a minimum distance between the fitting and the canopy soffit must be maintained.

#### Functional Lighting Requirements

- Stop functional lighting is to be integrated with street/ track lighting for maximised distribution, minimised poles, and uniform lighting levels;
- Lighting design is to be undertaken in accordance with AS/NZS 1158.1.1 and AS/NZS 1158.3.1 Section 3: Lighting technical parameters, calculation fields and computer methodologies for Category V and Category P lighting schemes respectively; and
- For lighting at Stops, combined multi-use poles are to be adopted.

#### Architectural Lighting Requirements

- Architectural lighting is to be used on light rail stops to enhance the customer experience at the stops; and
- Material consideration in up-lighting is critical to ensure the specular level of the material does not result in excessive reflection or glare. Recessed lighting may be selected rather than up-lighting because the clearance dimensions adversely raise the canopy height.

#### Event Lighting Requirements

- Event lighting should be accommodated in select light rail platforms/ event platforms through dynamic or coloured lighting or lit advertising or events promotion.

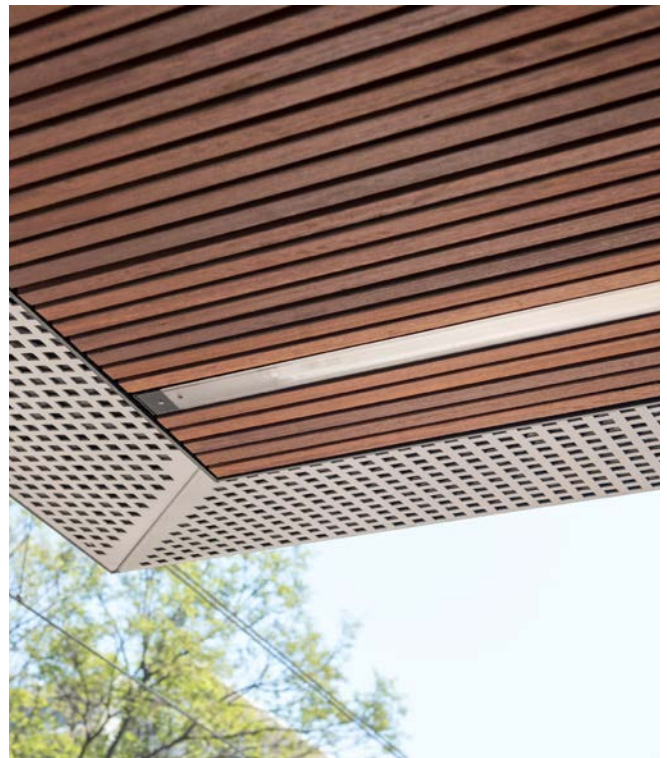


Figure 205. Integrated lighting in canopy soffit (IWLR)

## 6.9 Public Art

### Principles

Public art at stops can achieve multiple objectives for a light rail project and bring community and customer benefits including:

- Enliven the travel experience for customers;
- Acknowledge cultural, community values or heritage values, often satisfying planning approval requirements;
- Enhance the stop precinct and bring delight to the community;
- Reduce vandalism;
- Contribute to meeting Transport’s stretch RAP targets; and
- Support creative industries and enhance the Agency’s reputation.

Public artworks must be durable, easy to maintain, physically safe, socially appropriate, well integrated into the overall design, can also a functional building element, and match the budget and program. Light rail projects will often have a line-wide art strategy with repeating elements such as artworks on wind screens at stops and individual artworks for special locations.

Public art in transport environments is not a late add-on. Devising the strategy, scoping, budgeting, curating, commissioning, making and installing public art is a long process that starts in the project planning phase and requires dedicated specialist management.

Refer to Transport’s guide Public Art for Capital Projects, Transport’s Aboriginal Art Strategy and Create NSW’s Public Art Tool kit.



**Figure 206.** Artwork integrated into the stop canopy (IWLR, Fish Market)



**Figure 207.** Artwork provides interest and deters graffiti (IWLR, Leichhardt North)



**Figure 208.** Public art enhances civic spaces and marks gateway to the stop (IWLR, Hawthorne)



**Figure 209.** Public art using low maintenance materials (IWLR, Waratah Mills)

## 6.10 Bike Storage

### Principles

One way to improve the catchment of light rail stops beyond walking distance is to make cycling more attractive. Bike parking is one way to increase the appeal of cycling to and from light rail stops.

Bicycle parking is commonly provided as bicycle racks or hoops near the stop entry in segregated corridors, as seen in the Inner West light rail project. For island stops in road environments or side platform stops in civic locations, bicycle hoops on footpaths will become Council assets and their location and type needs to be coordinated with Council.

Depending on the location, a larger scale solution for longer term or more secure parking may be a requirement at a terminus or high patronage stop. Examples could be a bicycle locker or shed. A bicycle 'shed' could be a standalone structure or incorporated into other Transport assets or buildings in a convenient location.

Refer to Transport's Bike Parking at Transport Interchanges Standard for more requirements and details on bicycle parking.

### Requirements

- Bicycle racks or hoops are not permitted on light rail platforms or approach ramps for public safety and operational reasons;
- The number of bicycle parking spaces will have been determined by a combination of data, demand modelling and active transport policies;
- A bicycle shed could be a generic product or project specific architectural design depending on the context;
- Project specific bicycle sheds usually at terminus stops will be part of a co-ordinated suite of well designed architectural buildings such as substations and drivers' facilities, requiring similar materials and forms, and include safety features and good lighting;
- Designated bicycle crossings of the light rail tracks to access bicycle parking should be designed at a 90 degree angle and signposted to warn cyclists of the associated hazard of bicycle wheels getting stuck in the track gaps; and
- Rail gap filler products are being developed and could be considered in future projects for bicycle crossings.



**Figure 210.** Bicycle shed at terminus stop (CSELR, Juniors Kingsford)



**Figure 211.** Bicycle hoops at stop entry (IWLRL, Dulwich Grove)



**Figure 212.** Bicycle hoops in footpath near stop (NLR, Crowns Street)



**Figure 213.** Bicycle hoops paired with benches (IWLRL, Waratah Mills)

## 6.11 Access and Maintenance

### 6.11.1 Strategy

#### Principles

The design of light rail stops must satisfy access, maintenance and operational requirements.

A thorough understanding of the light rail stop operational and maintenance processes is necessary to avoid extra cost and negative impacts to the customer journey.

Regular inspection, cleaning and maintenance of the asset is expected to be performed by the operator. TfNSW encourages the designer to engage with the operator (or shadow operator) at an early stage to avoid potential redesign.

Each design component is typically associated with an access and maintenance process to which the design must respond.

#### Designing for Maintenance Requirements

- The design is to respond to maintenance tasks in an appropriate manner with consideration of handling processes, access frequency, associated requirements of tools, equipment and specialist certification;
- The design is to consider maintenance and replacement strategies with light tasks being able to be performed whilst the light rail is operational;
- When developing the light rail stop design, the designer is to be aware of the potential impacts and constraints to custom product procurement, replacement and any associated specialist requirements; and
- Components and materials with special cleaning requirements and sensitivity to aggressive chemical cleaning agents are to be identified and discussed with the maintainer prior to implementation.

#### Safety Requirements

Light rail stops are sophisticated infrastructure elements which frequently require maintainer access.

- Operator and maintainer safety considerations are to be implemented throughout the design process;
- In addition to safety related legislation, requirements and standards the designers are to consider the human factors of the operator and maintainer; and
- Regular design safety reviews must be conducted and appropriately documented in order to ensure safety issues relating to access, maintenance and operation of the light rail.

Occasionally the maintainer must access components at height, in the vicinity of high voltage, close to moving vehicles in inclement weather or all of the above.

- In support of safety management systems the design must consider and implement appropriate safety systems such as, but not limited to, fall restraint, temporary guard rails and signage; and
- To avoid negative visual impacts, safety support systems must be considered in the design at an early stage.





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## Key Learnings

Designers work hard to find a solution in the best interests of all. Previous projects have shared insights to help future teams understand the real world trade-offs and implications of early planning decisions.

**Figure 214.** Circular Quay Stop (CSELR)

Design is a co-operative activity. Beyond the idealised rhetoric of early planning stages, design and delivery in the real world is a contested arena for space and time requiring negotiation, trade-offs and creative, practical solutions. The design contest for space exists at all scales - street corridors, precincts, on platforms and the industrial design of elements; and below the surface with utilities, trees and drainage.

Below are examples of light rail stops with key learnings on how this balancing process influenced built outcomes, both positive and negative. The common thread is the benefits of including spatial design and delivery expertise in the planning and contractual stages when key decisions such as route choice and stop location are locked into the project.

## 7.1 Underground elements determining stop levels impact precinct integration and customer access

### Location: QVB Stop (CSELR)

#### Background

During planning, the stop was located for proximity to key destinations such as Pitt St mall, the QVB building, and the Town Hall precinct bus interchange. Another consideration was spacing between adjacent light rail stops. In detailed design the stop siting was complicated by the relatively high track level set by clearances over the pedestrian walkway under the Market and George Street road junction. The potential for footpath regradings were limited by the heritage QVB building and other shop entrances.

#### Implications

Despite design efforts, the stop platforms were unable to be fully level with the surrounding footpaths. The implication was parts of the stop required level transitions with low retaining walls, steps and the associated TGSIs and balustrading.



Figure 215. Level transition was not possible due to underground elements

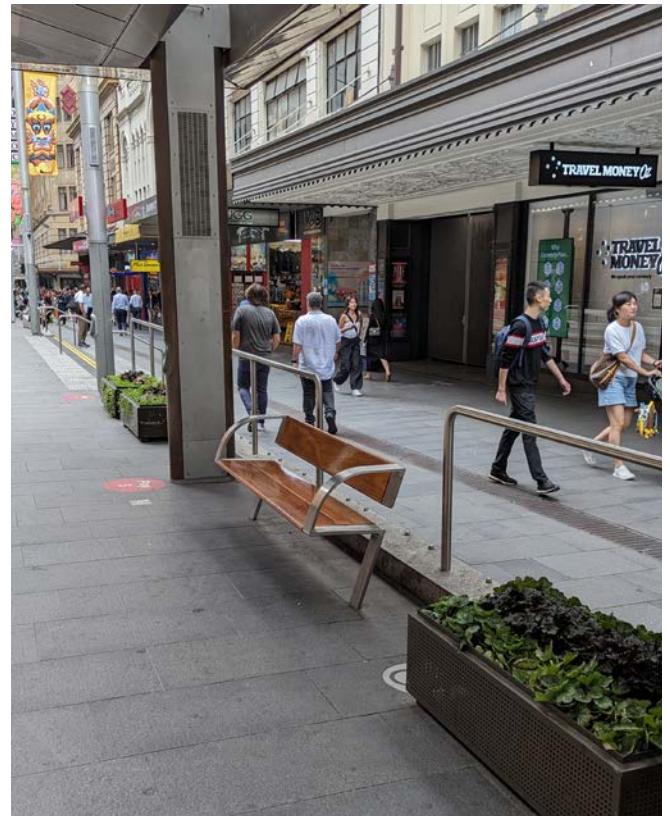


Figure 216. Low retaining wall and balustrades on platform

## 7.2 Site topography determining stop levels impact precinct integration and customer access

### Location: Haymarket Stop (CSELR)

#### Background

During planning, the stop was located in this area for proximity to the Railway Square bus interchange, Central Station and regional coach hub. However, Eddy Avenue in this location has both a cross fall and longitudinal fall. The exact siting of the stop was limited by the short block length between Pitt Street and George Street, and the track geometry and levels.

#### Implications

The longitudinal fall along the stop resulted in a canopy that was relatively high at the lower end of the platform. On the southern side, the light rail platform could not follow the relatively steeply falling footpath, requiring retaining along the back of the platform, balustrading, steps and limited access to the platform and steps at some points. On the northern side, the bus roadway had to be raised to match the island platform level, requiring retaining and a structural barrier along the footpath.



**Figure 217.** While not a positive footpath outcome, earlier design attention to the barrier wall could have integrated public art or seating



**Figure 218.** Raised stop level required extra steps, ramps and balustrades to existing footpath

## 7.3 Tailor standardised stop architecture to the urban context

### Location: City Centres (CSELR)

#### Background

Customer and business requirements assumed long canopies at each stop on both inbound and outbound sides. Also assumed was support from Councils for dedicated passenger waiting spaces with lots of seating, information and weather protection. Stop specific context considerations such as building frontages and activities, heritage façades and shop awnings was not considered early.

#### Implications

Councils and other stakeholders were not universally supportive of large structures in a city centre that may impact other citizens, footpaths, building owners and tenants. Stop canopies in the city centre stops needed to be tailored in both width and length to the site context and waiting passenger demand. At the QVB stop, the smallest canopy compliant with DDA requirements was the negotiated solution.



**Figure 219.** Smaller canopy adjacent to heritage landmark building with awnings (CSELR, QVB)



**Figure 220.** Canopy tailored to tight urban context (CSELR, Wynyard)

## 7.4 Stop access affected by major roads, intersections and severance from key destinations

### Location: Juniors Kingsford stop (CSELR)

#### Background

The stop was located next to the Nine Ways junction and planned as a bus interchange. The junction was reconfigured but remained a complex intersection marking the edge of the town centre. Catchment planning assumed the northern end of the Kingsford town centre was served by the Kingsford stop and the southern end by the Kingsford Juniors stop.

#### Implications

Despite efforts to improve the intersection for pedestrians, passengers walking between the stop and the town centre must cross wide arterial roads in staged crossings. Despite attractive landscaping and architecture, the stop looks and feels a long way from the town centre.



**Figure 221.** Sketch analysis of customer experience to and from stop during stop design showing multiple road crossings



**Figure 222.** Panorama image of built outcome showing multiple crossings to stop

## 7.5 Island stop accessed only from one end

### Location: Kingsford stop (CSELR)

#### Background

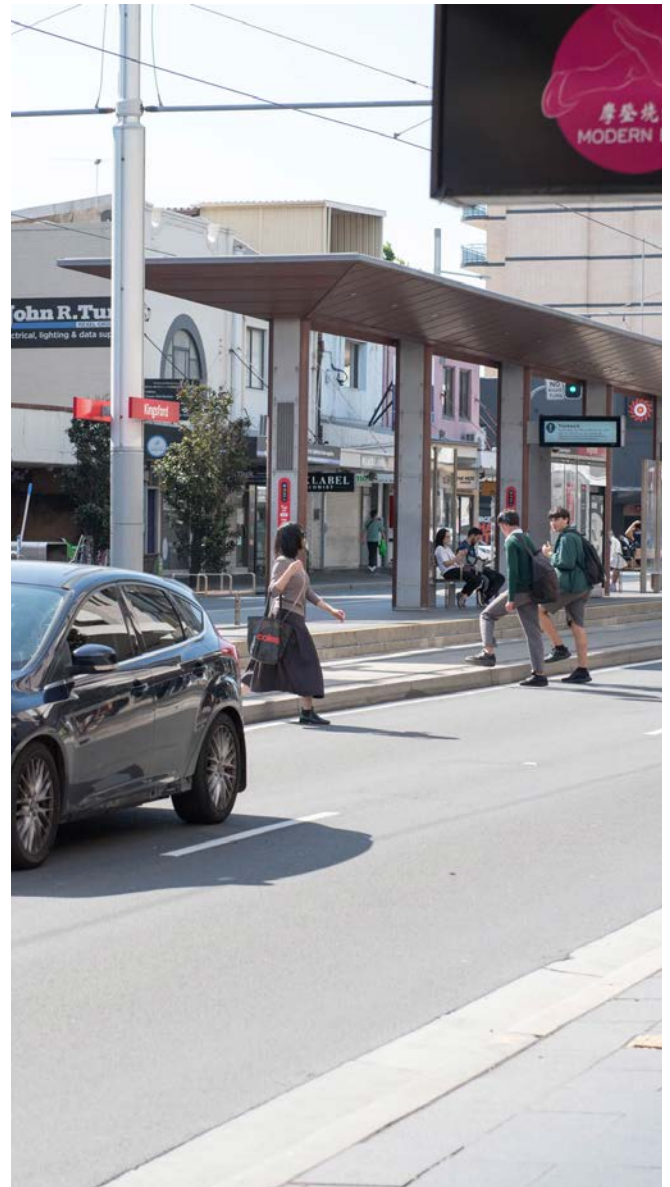
The stop was located to serve the Kingsford town centre however was located in the block with access only from the north end via a signalled junction. After project approval, Council closed Meeks Street for a town square at the southern end of the stop.

#### Implications

People in the heart of the town centre must walk more than 150m past the stop to access the stop from the northern end only. As Anzac Parade is dual lanes, adding a new pedestrian signalled crossing to the southern end of the stop was too close to the existing signalled junction.



**Figure 223.** Balustraded end of platform rather than long walkway to next junction



**Figure 224.** Customers cross the road rather than walking to the other end of the platform

## 7.6 Tailor standardised stop layout to the urban context

### Location: UNSW High St stop (CSELR)

#### Background

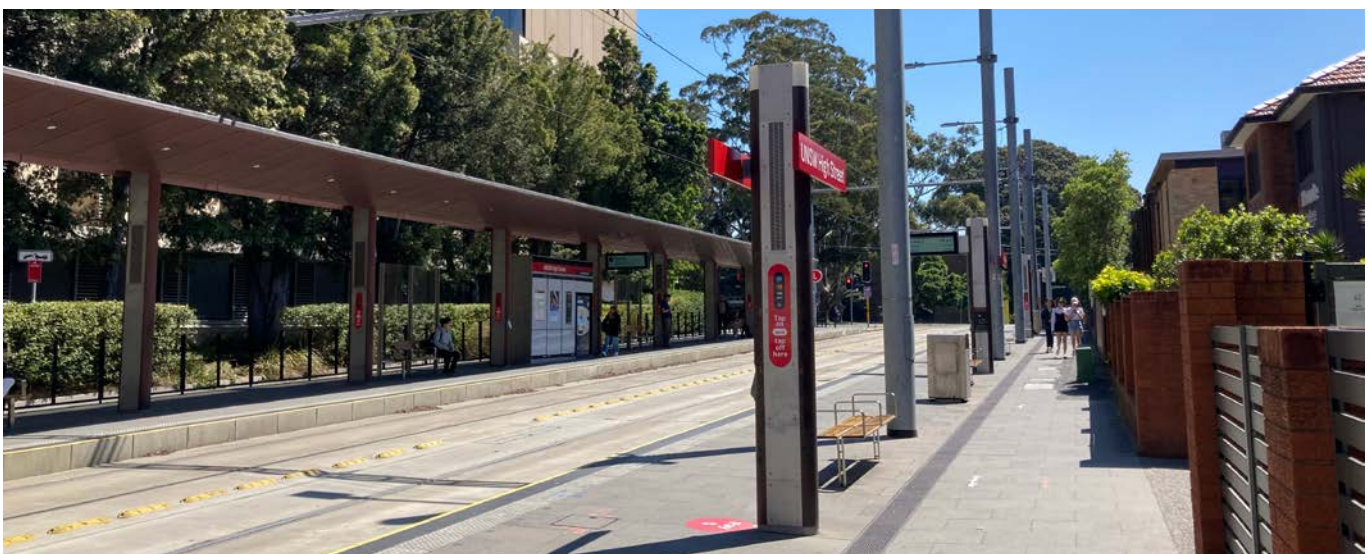
The stop was located in a spatially confined street reserve next to the University of New South Wales High Street gate. Existing residential and university properties limited the corridor at this point yet planning required the retention of bus routes through the stop. Mature trees on university property were adjacent to the stop.

#### Implications

For the short extent of this block, shared running with buses through the stop had to be negotiated. Road travel lanes were minimised. On the north side platform with very low boarding demand, the stop platform and footpath were fully integrated so public access dimensions could be met. This enabled minimal property boundary changes and the retention of major trees, providing shading and beauty from day one of light rail service opening.



**Figure 225.** Stop layout enabled retention of major trees and minimal change to the university



**Figure 226.** Stop layout on northern side enabled minimal change to residential properties

## 7.7 Stop scope should include precinct integration and paths to meet desire lines for customers

### Location: Hawthorne stop (IWLRL) and Randwick Racecourse (CSELRL)

#### Background

The Hawthorne stop is located in parkland on the edge of Leichhardt. The project scope included only one path to connect to one street footpath. A similar situation occurred at the Randwick Racecourse stop.

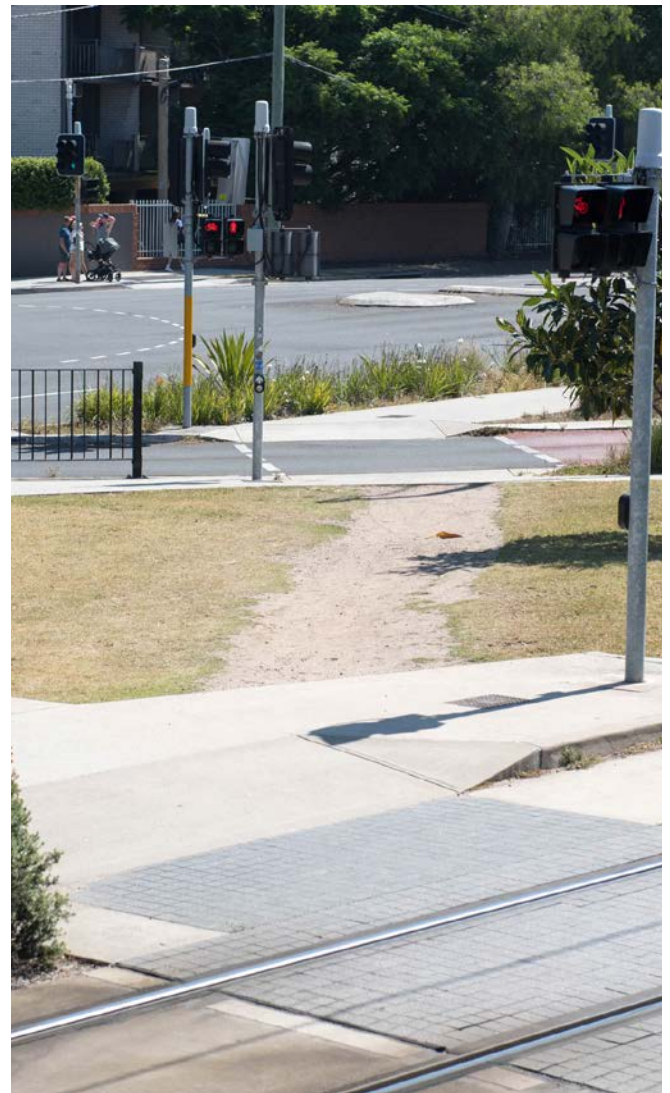
#### Implications

At the Hawthorne stop, the one path was well executed, however the precinct analysis missed the major desire line from the south. People walking to the stop or crossing the tracks from the south follow the desire line straight across the park, marked strongly with a worn track.

Similarly at the Randwick Racecourse stop, a direct path was missing between the road crossing and the stop causing a worn track to quickly develop.



**Figure 227.** Customers walking along desire line to stop



**Figure 228.** Worn track created by unmet desire line between crossing and stop

## 7.8 A limited materials palette applied line wide preferable to complicated variety

### Location: All Stops (PLR)

#### Background

The successful tender design proposed three palettes of different materials and colours for stops along the route as the ‘place’ response.

#### Implications

A wide range of materials and colours complicates the maintenance and cleaning regime and triples the spare parts requirements for the operator. Thematic differences are unlikely to be appreciated by the public and instead, diminish a consistent line wide identity.

The Design Review Panel advised contextual integration, site specific urban design and landscaping are the more enduring place responses and rejected the multi-palette proposal.

A single palette with the same material and colour was used line wide.

### Initial Concept Drawing for Multiple Palettes



Figure 229. Multiple palettes of materials for various areas are unnecessary and not supported on a single project

## 7.9 Heritage integration requires more design attention and site-specific solutions

### Location: Dundas stop (PLR)

#### Background

The heritage listed Dundas rail station building was to be integrated into the new light rail stop. The contracted design proposal was to locate a standard three bay canopy centrally on the stop and adjacent to the heritage building.

#### Implications

The Design Review Panel advised the heritage building and stop canopy were incompatible forms in such close proximity.

The stop canopy was split into a double and single canopy and located at either end of the building together with the totems, creating a respectful curtilage around the heritage building.

The need for a site specific solution should have been identified earlier in the design process before contract execution.



**Figure 230.** Aerial showing split canopy solution next to heritage station building



**Figure 231.** Heritage station framed by the two stop canopies

## 7.10 Island platform used to maximise footpath space in spatially confined street

### Location: Civic, Crown St and Queens Wharf stops (NLR)

#### Background

The stop was located in a spatially confined street with narrow footpaths. Originally side platforms were proposed to simply the track design however the amount of road space required would result in narrow footpaths & multiple barriers to public facing streets, due to a traffic lane required on either side of the stop.

#### Implications

Designs were changed to incorporate island platforms to ensure footpath space was maximised. The island typology ensured the physical stop infrastructure did not create a barrier in the street.



Figure 232. Island typology ensured the stop did not create a barrier in the street.



Figure 233. Island typology maximised footpath space on either side of the road

## 7.11 Ensure the power supply is confirmed early in the design phase of a project

### Location: All stops (NLR)

#### Background

Originally the light rail was to be powered by overhead wires. Towards the end of the project there was a positive change to introduce super charges at stops to remove the need for power lines & the associated structures. The stops structures had to be redesigned, with some negative impacts with additional cabinetry.

#### Implications

Additional structures were required to the stops, which were able to be incorporated into the canopy structure. Additional traction power boxes were required and were located in the middle of the roadway, as the stop cabinetry could not accommodate the additional boxes. The boxes were painted charcoal to reduce visual impact, however this is not ideal and would have been better consolidated into the stop cabinetry.



**Figure 234.** Additional structures were required late in the project having a visual impact on the street environment

## 7.12 Ensure the systems package is reviewed early to ensure the colour matches the station colour palette

### Location: All island stops (NLR)

#### Background

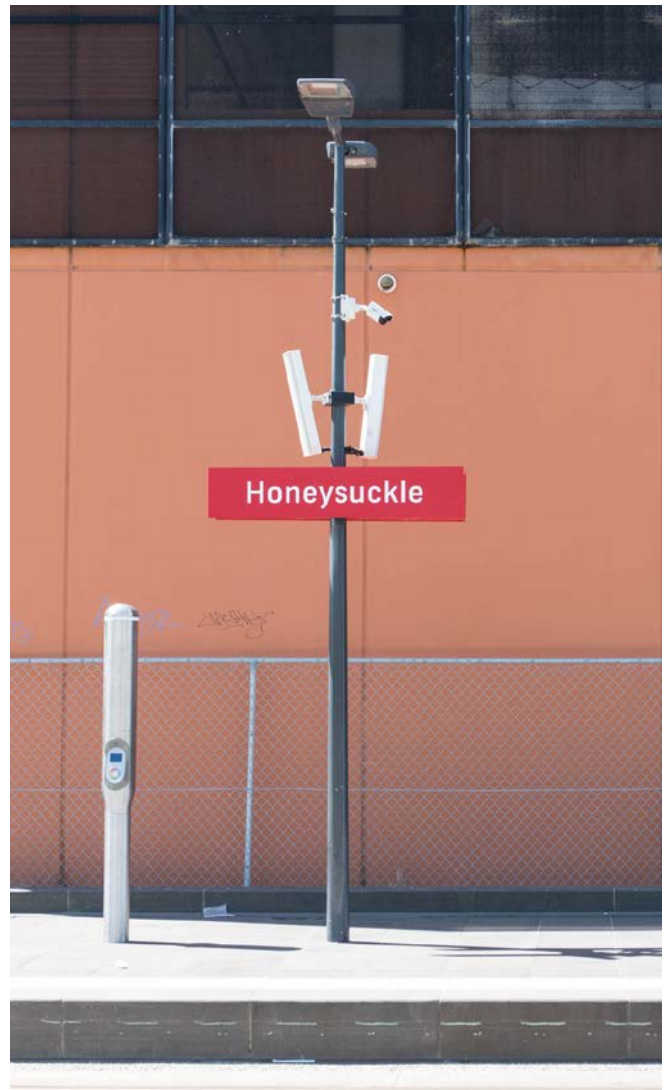
The station speakers and CCTV cameras were ordered prior to product review by the design team.

#### Implications

The speakers and cameras should have been charcoal colour to match the light pole colour. Systems have long lead times, so change is difficult later in the project timeline.



**Figure 235.** Off colour and oversized speakers fixed to light pole



**Figure 236.** Late systems package led to cluttered poles on platform

## 7.13 Lesson: Maintenance is key to fulfilling landscape design intentions

### Location: Various Stops

#### Background

Where landscaping is a requirement at stops, it is often assumed that many low planting garden beds at design stage will deliver attractive, long term greenery.

Where landscaping is verdant and well maintained, customers like the appearance, the urban heat island effect can be somewhat moderated and the local ecology benefits.

However, when low planting is neglected, the barren, weedy or litter filled garden beds can have a ‘broken windows’ effect at the stop. The visual effect is noticeable to customers and the community. Transport’s reputation as a responsible contributor to successful places can be diminished.

#### Implications

Garden beds in medians near light rail tracks or roads can be difficult for the Transport operator’s landscape contractors to maintain. Neglected landscaped medians can be a worse visual outcome than the paved equivalent. Consider very low maintenance species or design alternatives.

Landscape design should take into account Transport operators’ maintenance capabilities and safe work practices during early stages of detailed design.

Older operator contracts based on garden-free assumptions may need updating with more performance criteria and compliance checks on landscaping components. At long term intervals, garden beds will require more intervention than weeding or pruning, such as soil and plant replacement.



**Figure 237.** Barren garden bed at stop



**Figure 238.** Weedy or overgrown gardens diminish the experience and reputation for Transport

## 7.14 Lesson: Green micro-infrastructure on stops is inefficient and burdensome to maintain compared to large scale installations.

### Location: All Projects

#### Background

Suggestions were received from stakeholders for photovoltaic cells on canopy roofs, green roofs or walls to demonstrate sustainability.

Desktop searches showed attractive images of prototypes or pilot programs but they also lacked long term operational evidence.

Investigations showed that the technical realities and projected maintenance burdens during operations outweigh any benefits. Even a few PV solar panels requires a sizeable kit of electrical systems that adds to the service cabinets or permanent light rail corridor land requirements off the platforms. Achieving an ‘off the grid’ stop is an unachievable ideal because stops are required to have an uninterrupted mains power supply.

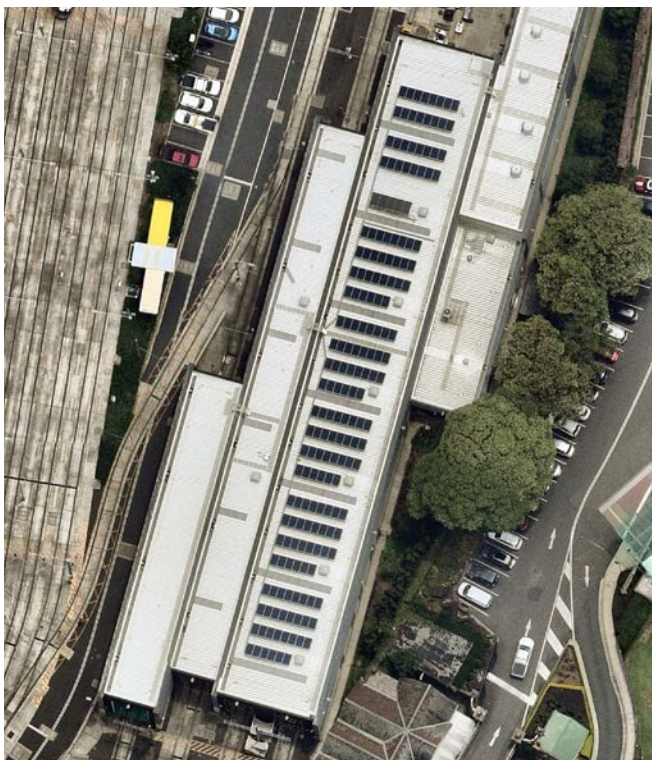
As a comparison, PV panel installations on large assets like depot roofs are typically in the order of 875kW installations, compared to say 50kW generated from 10 stops @ 5kW each with 10 x support kit at each stop.

#### Implications

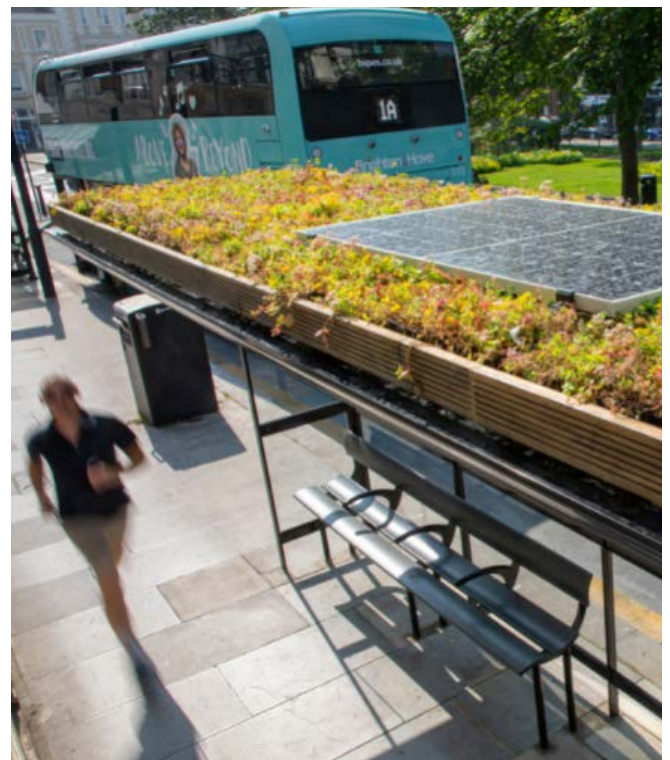
Green micro-infrastructure may be an initially appealing idea but Transport has opportunities for large scale installations with better energy, water and ecological benefits.

Relatively small areas of green roofs or walls spread across dozens of sites have high maintenance requirements that would add specialist skills and costs beyond typical Transport operators’ maintenance and cleaning contracts.

The design and operating focus for micro-assets like light rail stops should be energy efficiency, sustainable materials and beautiful structures offering customer amenity that generate large and direct environmental benefits from increased public transport usage.



**Figure 239.** Major PV system installation on light rail depot roof



**Figure 240.** UK bus stop trial with green roof and single PV panel not recommended in TfNSW light rail stops



Jubilee Park

Jubilee Park



MIND THE GAP WHEN BOARDING



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# Appendices

**Figure 241.** Jubilee Park stop (IWL R)

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**Figure X: Credit**

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April 2024

TfNSW 23.070 ISBN 978-1-922875-98-3

