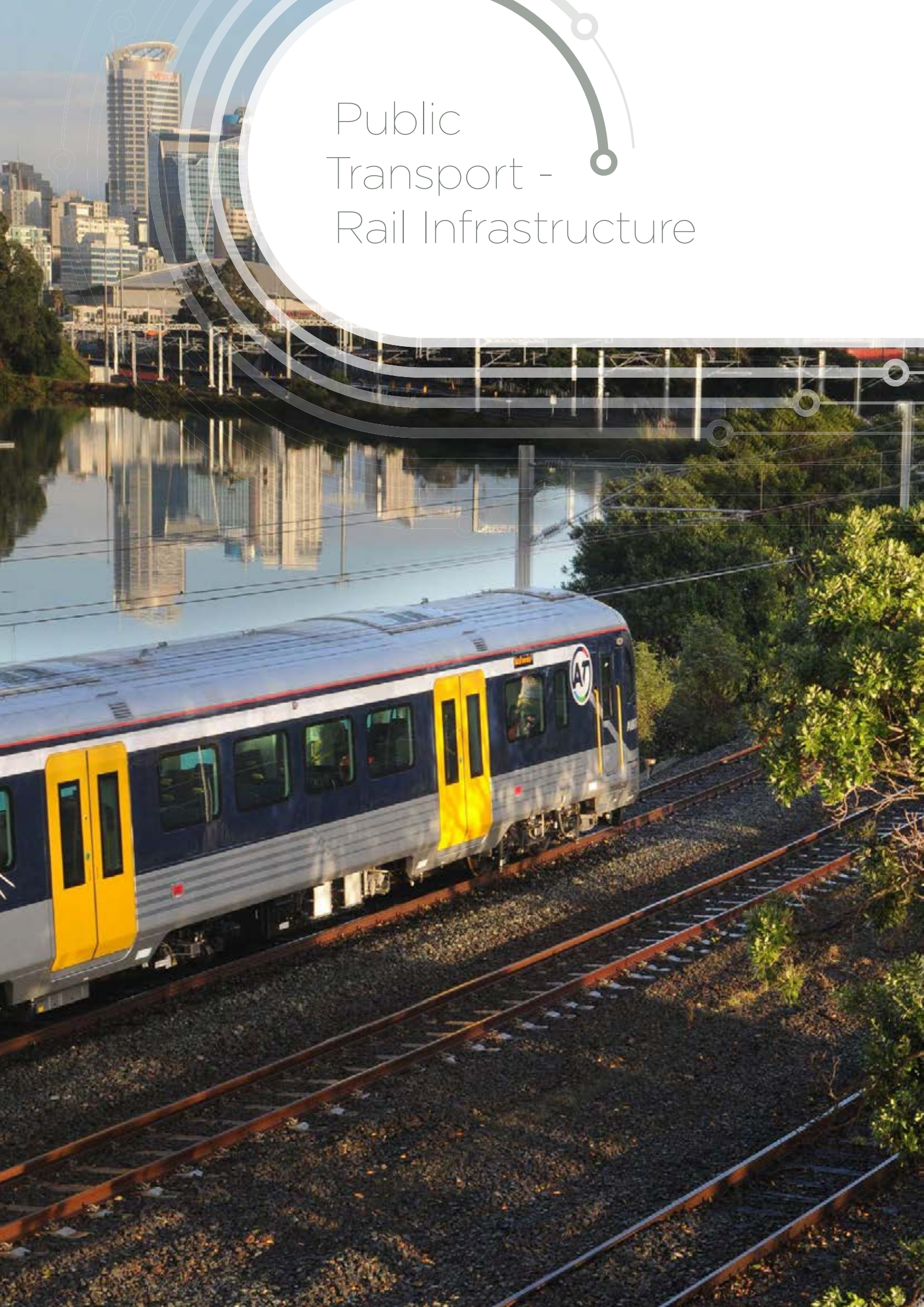
# Public Transport - Rail Infrastructure



# In this chapter

# 01 Introduction

**PURPOSE**

The purpose of this chapter is to define the way that passenger capacity, functionality and operability are to be achieved in rail station design to meet customer expectations.

**PUBLIC GATEWAYS**

Stations are the public gateways to the Auckland rail network. The way in which they are designed and presented influences the behaviour on, and the perception of, the rail system for both passengers and staff. The quality of station design can raise the level of confidence in the rail system as a whole and with it an increase in patronage and revenue.

**SCOPE**

This manual consolidates New Zealand rail and building standards, adopts international best practice in the absence of applicable local standards, and provides space planning guidelines for stations and station precincts, including:

- architecture and urban integration
- public areas within stations
- platforms
- passenger flow
- passenger facilities
- ticketing facilities
- secondary revenue
- operational staff accommodation/back-of-house facilities
- signage and wayfinding.

**DESIGN**

Stations must be designed to specifically respond to the needs of form, function and personality. The functionality is set out in this document. Form is determined by the relationship of the operational and architectural elements of the buildings in their setting. Personality is directly derived from visual expression and customer experiences of the materials, spatial composition and the context within which they have been used.

**OPERATE YEAR ROUND**

Stations on the Auckland rail network must be designed to operate 365 days per year. All planned maintenance activities for stations must be carried out either during off-peak operational hours where this does not interfere with station operations, or within limited non-traffic hours overnight.

**OWNERSHIP**

Stations must be assumed to be owned, operated and maintained by Auckland Transport or agents acting on behalf of AT.

## 1.1 Sustainability

**QUADRUPLE BOTTOM LINE**

Station design must adopt a quadruple bottom line sustainability approach that encompasses economic, environmental, social and cultural objectives and outcomes. Consideration of sustainable outcomes for the project must be an integral part of the station designs, in line with the Auckland Transport Sustainability Framework.

**CONSIDER IMPACTS**

In support of the over-arching goal to conserve and enhance the natural environment, station designs must minimise their carbon footprint, considering the impacts of the construction approach, the embodied energy of materials and ongoing operational energy and water use.

**RESOURCE EFFICIENCY**

The stations must be designed for resource efficiency, adopting the five principles of designing out waste, as detailed by the UK's Waste Resource Action Programme. They must be designed for:

- reuse and recovery
- off-site construction
- materials optimisation
- waste efficient procurement
- deconstruction and flexibility.

**GREEN STAR**

The station design must contribute to the overall project target, where applicable, of attaining an "Excellent" rating from Infrastructure Sustainability Council of Australia's (ISCA) Infrastructure Sustainability (IS) rating tool or a Green Star rating from the New Zealand Green Building Council.

## 1.2 Design principles

The following design principles should be used to determine the appropriate design response for all stations on the Auckland Transport rail network.

| | |
|---|---|
| **Delightful** | Authentic, genuinely sensitive and intelligent in design of form, space, proportion, craft and detail. |
| **Durable** | Finishes that are easy to maintain and will age gracefully without the need for early replacement. |
| **Enduring** | Relevant across lifespans of many generations; representative of its time and of a high quality. |
| **Engaging** | Reflect and respond to diverse community values and encourage positive interaction. |
| **Enjoyable** | Create a desire to experience and delight in the journey rather than just pass though. |
| **Functional** | Well-planned station footprints that optimize passenger comfort, satisfaction and safety. Using attractive and maintainable materials that offer the optimum balance between capital and whole-of-life cost. |
| **Maintainable** | Capable of being inspected, monitored, cleaned, serviced, and replaced as necessary without untoward disruption to station operations and, where practicable, being capable of being undertaken during normal operating hours. |
| **Operable** | Capable of being operated efficiently with the minimum human intervention under normal and disrupted operating conditions. |
| **Safe, clear** | Safe and secure spaces that avoid hidden and difficult to monitor areas and that include good visual links and strong passive surveillance with clear signage. |
| **Seamless** | A cohesive and linked network that is easy to understand and navigate and does not rely on signage to determine what must be intuitive use of public space; integrating different transport modes, providing direct connections and easy transitions. |
| **Site responsive** | Respond to specific local landscape, topography and orientation. |
| **Socially responsive** | Support and encourage communities, connecting nearby facilities, incorporating shops, art, recreation spaces. |
| **Sustainable** | Promote positive environmental, social, cultural and economic values; achieve recurrent cost savings. |
| **Universally inclusive** | Main access routes are obvious and accessible to all members of the community, whether able bodied or mobility impaired, without barriers of differentiation. |
| **Valuing heritage** | Respond to history, memory, understanding of and continuity with the past. |
| **Walkable** | Support pedestrian links across transport corridors, pathways and usable public urban realm space around major roads and railway reservations. |

## 1.3 Terminology

Terminology used and/or applied in this manual is defined as follows:

| | |
|---|---|
| **A surface station facility** | A station where less than 50% of the platform length for the width of the track and platform is decked over by solid structure. |
| **CPTED** | Crime prevention through environmental design. |
| **Degraded operation** | A reduced level of service invoked by equipment outage or malfunction, staff shortage or procedures becoming inadequate as a knock-on effect of one or several deficient system elements. |
| **Designer** | A person who plans the appearance, physical characteristics, spatial planning or workings of the station and precinct environment. |
| **Emergency situation** | An unforeseen or unplanned event that has life threatening or extreme loss implications and requires immediate attention. |
| **Escalator comb** | The comb plate is defined as the location where the moving steps disappear under the stationary solid comb plates, at both the top and bottom of the escalator. |
| **Fruin level of service** | A concept used in the design of places of public assembly. It utilises a typical body ellipse to represent the space occupied by a person without touching another. |
| **Mana whenua** | The rights and responsibilities an iwi or hapu holds over their ancestral lands. |
| **Normal operation** | The condition under which the rail station and rail network is designed to operate. This includes peaks, e.g. rush hours and troughs in demand. |
| **Platform** | The pavement accessible to the public between the headwall and tailwall of a station. |
| **Sub-surface station facility** | A station where more than 50% of the platform length for the width of the track and platform is decked over by solid structure. |
| **Underground station facility** | A station where all track and platform facilities are located in solid structures below ground. |

# 02 Station context and urban integration

PRINCIPLE

Stations must be designed with reference to their particular setting and their function in within the wider transport network.

## 2.1 Design for the urban context

CLEAR PRESENCE

Station entrance buildings must establish a clear rail transport presence and identity within each station precinct, using built form, massing and materials without relying on excessive station signage to announce its location.

SIGNAGE

Clear directional signage to the station must be provided from the primary and secondary pedestrian and vehicle routes surrounding the station. Externally, station entrances must convey sufficient information on train services and opening times to inform the unfamiliar traveller. Clear directional signage and local area maps must be provided at the station entrances, informing passengers of adjacent bus, ferry and taxi facilities. It must provide direction to points of interest within the precinct.

PEDESTRIAN CAPACITY

Existing footpaths and pedestrian crossings near the station entrances must be assessed for pedestrian capacity and traffic impacts. Where required, this must be improved in conjunction with other initiatives within the station precinct.

**Figure 1** Proposed Aotea Station entrance

**LANDSCAPE FEATURES**

Station precincts must be designed with hard and soft landscape features that reflect the quality, material finishes and character of the precinct within which they are placed. Surface finishes around station entrances must fall away from the entrance to help prevent water ingress into the station.

**FRONTAGE**

The station buildings above ground (other than entrances) must present, wherever possible, active frontages to surrounding pedestrian routes. The station entrance design must maximise transparency so that passengers can see and be seen to and from the point of entry.

**PERSONAL SAFETY**

The immediate precinct outside of station entrances must be designed from a personal safety perspective, in line with crime prevention through environmental design (CPTED) requirements. They must:

- be lit to a high level of illumination and distribution uniformity
- avoid creating obstructions,
- avoid concealed and difficult to monitor spaces, and
- be provided with 100% coverage through CCTV monitoring from the station control centre, ATOC, Kiwirail, Transdev and other locations.

**EASY ACCESS**

Near the station entry, drop kerbs must be provided for mobility impaired access. In addition, canopy protection around the station entrance and to adjacent bus stops is required.

**EASY ACCESS**

The station entrance must be provided to include as a minimum:

- Two bus parking spaces for the operation of rail replacement bus services
- An emergency vehicle parking space
- Refuse truck/station maintenance vehicle bay
- Two taxi pick-up bays
- Three drop off and pick up five-minute parking bays.

**MAINTENANCE ACCESS**

Each station must have a dedicated after-hours entry/exit for non-public purposes giving access for maintainers. Station and ancillary buildings must be provided with defined access routes suitable for installation, maintenance, removal and replacement of equipment. Such access routes must be designed taking into account the expected frequency of use, i.e. infrequent uses may allow use of access routes which are normally closed.

**COMMERCIAL DEVELOPMENT**

Stations must be designed to permit commercial development opportunities for spaces above and beside the station footprint and take account of planned developments nearby. Space proofing for additional structure must be provided within the station to support commercial development. Consider sequencing and crash deck protection of the station facility to enable commercial development. Construction at the station must have the least impact upon the operational station environment and operational timetable.

## 2.2 Transport connectivity

### INTERCHANGE


The station precinct must provide efficient connectivity between transport modes to actively encourage public transport use by adopting the following principles:

- Minimise interchange time and distance between transport modes by designing direct, safe and well-signed linkages with intuitive wayfinding between the station entrances and other transport modes near the station.
- Minimise conflicts between modes within and around the interchange, considering efficient layout of bus route groupings and efficient wayfinding to, from and around the interchange.
- Plan for customers with destinations in and around the station in addition to those passengers transferring.

### MODAL HIERARCHY


Provision for access can be prioritised into a modal hierarchy. The access hierarchy determines the proximity and level of amenity of access to the station and facilities, and is the key component in considering the planning layout of a station. The Auckland Transport mode hierarchy is:

- Pedestrians
- Cyclists
- Public transport
- Drop off/pick up/taxis
- Private vehicles.

### CYCLE PARKING


Station designs must provide for cycle parking facilities in line with Auckland Transport policy and cycle demand evaluation for the station location. Cycle parking facilities must be provided near station entrances to facilitate cyclists transferring to rail. Cycle parking areas at stations must, where possible, be located in clearly defined open areas within sight of the station entrance and in clear view of passengers and staff to provide for good passive surveillance. The areas must be well lit and be included within the station CCTV surveillance system.

The cycle parking must be supported by associated design features such as signage and lighting to promote their use and should adhere to CPTED principles. All stations must be evaluated for the provision of e-bike charging facilities as part of the cycle parking provision. Routes to lifts must be provided, to take passengers with cycles to platforms. Routes to stairs must be fitted with cycle wheel channels to permit cyclists to access changes in level.

# 03 Types of stations and their requirements

**PURPOSE**

This section describes the default minimum level of station facilities expected at each of the five station types, unless the specific station design brief stipulates otherwise.

**FIVE TYPES**

To define design requirements in relation to size and complexity of the facility, Auckland Transport established five generic station categories:

- Type 1: An unstaffed rural, suburban or urban station.
- Type 2: A staffed rural suburban or urban station.
- Type 3: A city centre or regional centre transport interchange hub.
- Type 4: A city centre destination station.
- Type 5: A multi-modal park and ride facility.

**SUBSURFACE STATIONS**

Subsurface or underground stations must be staffed, so cannot be Type 1. They have special requirements beyond the norm. See section 3.7.

## 3.1 Requirements for all stations

A number of requirements apply to all stations, regardless of their type, as outlined below.

Public areas of the station must be illuminated to an average of 160 lux.

**PARKING**

The following parking needs to be provided:

- Two rail replacement bus parking bays.
- One maintenance vehicle parking bay shared with refuse truck bay.
- An emergency vehicle parking bay (Type 5 stations must have two bays).

**DROP-OFF BAYS**

There should be drop-off and pick-up 5-minute waiting restricted vehicle parking bays with drop kerbs for mobility impaired access.

- Type 1: 2 bays
- Type 2: 2 bays
- Type 3: 4 bays
- Type 4: 4 bays
- Type 5: 8 bays.

**CYCLE PARKING**

Cycle parking must be provided.

- Type 1: 20+ cycles
- Type 2: 20+ cycles
- Type 3: 40 cycles
- Type 4: 60 cycles
- Type 5: 60-100 cycles.

**CCTV**

For operational, safety and security purposes the station and area outside the station must be provided with CCTV camera coverage monitored from control room(s) and other locations. This would normally include the bus replacement bay areas, and other station facilities. This monitoring may include Computer Vision to detect persons falling on the tracks, vandalism or tagging. Monitors may be used to provide visibility along platforms for train and station crews, particularly where visibility is obstructed on platforms by passenger numbers or otherwise."

**SIGNAGE**

Station name sign, direction signage to and from the station. Type 5 must include hours of opening too.

**MAP**

A station location map must be displayed.

**CLOCK**

There must be a large illuminated station analogue clock as a symbol of punctuality.

**ACCESS**

Access from the station entrance or footbridge to the platform must be via a combination of a stair, a 26-person heavy duty machineroomless lift, or pedestrian ramp not exceeding a gradient of 1:20.

There must be a means of closing the station to public access after hours, linked to AT's security system.

**PUBLIC TOILETS**

Public toilets must be provided within the paid concourse areas. They must be of vandal resistant design, door-less entry arrangements and provide male, female, baby change and mobility-impaired facilities. The scale of the provision of toilets is set by the anticipated passenger volumes. Toilet numbers for passengers and staff must be calculated using NZBC G1 AS1 requirements.

**DRINKING FOUNTAINS**

For staffed stations, fresh drinking water fountains must be provided within the paid concourse areas. Fountains must be of vandal resistant design, include a bottle tap, a direct drinking nozzle with hygienic shroud, and drainage.

**RUBBISH BINS**

Rubbish and recycling bins, storage and disposal must be provided at all stations with access to road-based collection points. The location of rubbish and recycling bins in below-ground locations must be subject to CPTED and fire engineering risk assessments.

**PLATFORM**

Straight level platforms of 150m length and a minimum of 9.6m wide (island) 4.5m wide (side platform) must be provided. Platforms must be future proofed with potential extensions up to 225m long.

**PLATFORM CANOPY**

The platform canopy must extend the full platform width, protecting the lift, stair and/or ramp entry point at platform level. The minimum canopy lengths are:

- Type 1: 1 carriage*
- Type 2: 1 carriage
- Type 3: 2 carriages
- Type 4: 4 carriages
- Type 5: 4 carriages.

* See section 8 for train specifications.

**PLATFORM SEATING**

Platform seating must be provided for each platform face.

- Type 1: 20 passengers
- Type 2: 20 passengers
- Type 3: 40 passengers
- Type 4: 60 passengers
- Type 5: 60 passengers.

**CUSTOMER HELP POINTS**

At least one seat placed next to carriage 2 and carriage 5 of the six-carriage train must be provided for mobility impaired access to the level floor position in the train. These seats must have customer help points. All stations other than Type 1 must also have a help point at the lift arrival and departure points and one next to the gateline. All customer help points must have CCTV coverage such that when a help point is activated, the operator answering the call point can see the person making the call and the surrounding area.

**CUSTOMER INFORMATION**

Variable customer information for train movements must be provided, as detailed under each station type.

**PUBLIC ADDRESS SYSTEM**

There must be an audible public address system for all public areas of the station. It must meet defined audibility room acoustics speech transmission index (RASTI) levels. For Type 5 stations, the area served must include the car park too.

**WI-FI CONNECTIVITY**

Except for Type 1 stations, Wi-Fi/mobile telephone connectivity must be provided throughout all public areas within the station.

**TICKETING**

Each station must have a HOP card reader, journey validator, HOP card top up and ticket purchase machine or facility.

**STAFF FACILITIES**

Except for Type 1 stations, sufficient staff accommodation must be provided for the staffing levels anticipated to operate each station on each shift. Accommodation for staff must be close to the station concourse and public entrances.

Typically, each station must be considered for providing the following:


- a customer service centre/ticket office
- a secure accounting room and cash storage facility
- a station control/fire control room (sub-surface/ underground stations)
- a staff mess room
- a first aid room
- a station meeting/briefing room
- a station office
- a police office
- a station wet store for cleaning materials
- a station dry store for office materials
- a male staff toilet
- a female staff toilet
- male and female staff locker rooms.

**STORAGE FACILITIES**

Sufficient storage facilities must be included at each level within each station to respond to the functional needs of the operating station and the needs of the maintainers.

Typically, storage space must be created in the following locations:

- Customer service centre at entrance/concourse level: for paper and customer care items.
- Retail service store, at entrance/concourse level: for stores related to retail activities.

- Escalator equipment store, adjacent to the head or base of escalators: to store spare escalator treads and combs
- Cleaning store, at a location with ready access to all levels in the station: including provision for charging (ventilation and power), filling and emptying (water and drainage) the electrically powered ride-on cleaning machine.
- Maintenance access store, at a location with ready access to all levels in the station.
- Storage, power and communications for 'Intelligent Transport Systems' equipment, such Uninterruptible Power Supplies (UPS), servers and so on needed for the station.

**MAINTENANCE ACCESS**

Station entrances or an agreed alternative access must be provided for authorised entry by maintenance staff, maintaining the railway or maintaining the station or railway systems on the station e.g. in station equipment rooms. This access should be linked to AT's Security system to enable access to be recorded and managed

**EMERGENCY ACCESS**

Dedicated emergency services access to the station control/ fire control room that is independent of the station entrances and fire rated to continue to operate during an emergency incident must be provided.

**RETAIL FACILITIES**

Where retail facilities are installed, retail units must be provided with a 60 amp three-phase power supply, water supply, ventilation, fire safety systems connections (with connecting link to main station fire panel), ventilation, drainage and telecommunication connections. A designated toilet for use by retail tenants must be provided within the station public toilets suite.

**DIGITAL ADVERTISING**

Stations must include sites for digital advertising. (For Type 1 stations, these do not have to be provided, but sites for digital advertising must still be highlighted for consideration.)

## 3.2 Station Type 1

**DESCRIPTION**

A Type 1 station is an unstaffed rural, suburban or urban station. They have relatively low patronage, but have the potential to grow over time. This potential growth must be factored into the station design.

**CUSTOMER INFORMATION**

Platform customer information must be provided in one prominent location at platform level. It must show:

- the time of day,
- the next train departure and
- a summary of the next three train movements on each platform face.

**FUTURE PROOFING**

Space planning must include future proofing for locating a gateline, including a manual pass gate, next to the station entrance, with space to erect a protecting canopy.

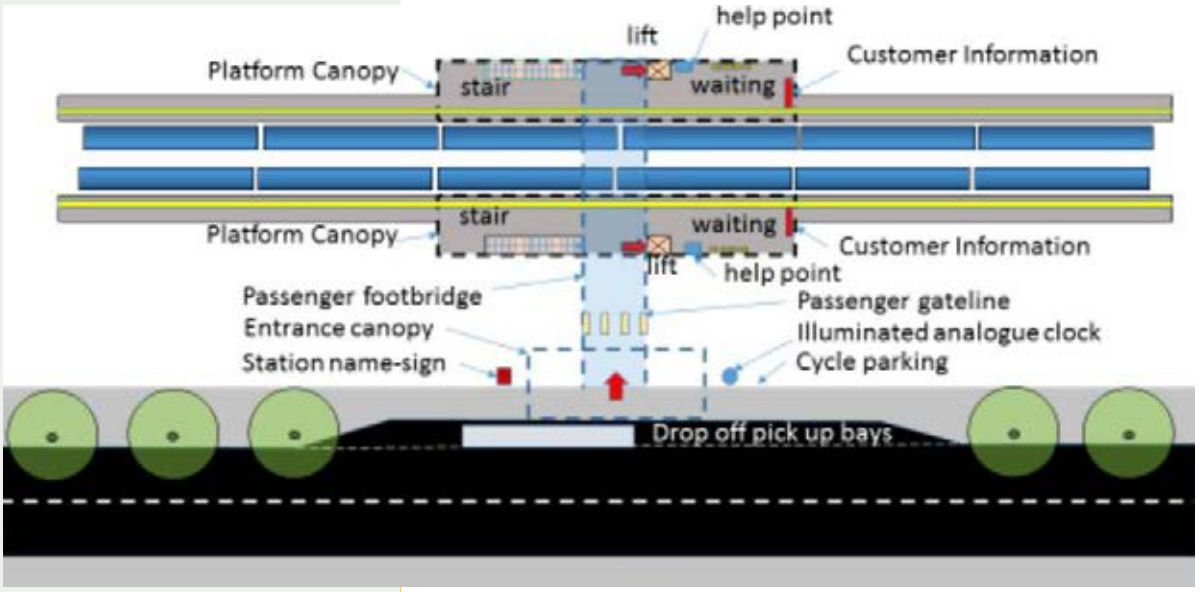



**Figure 2** Typical Type 1 station layout plan, side platform

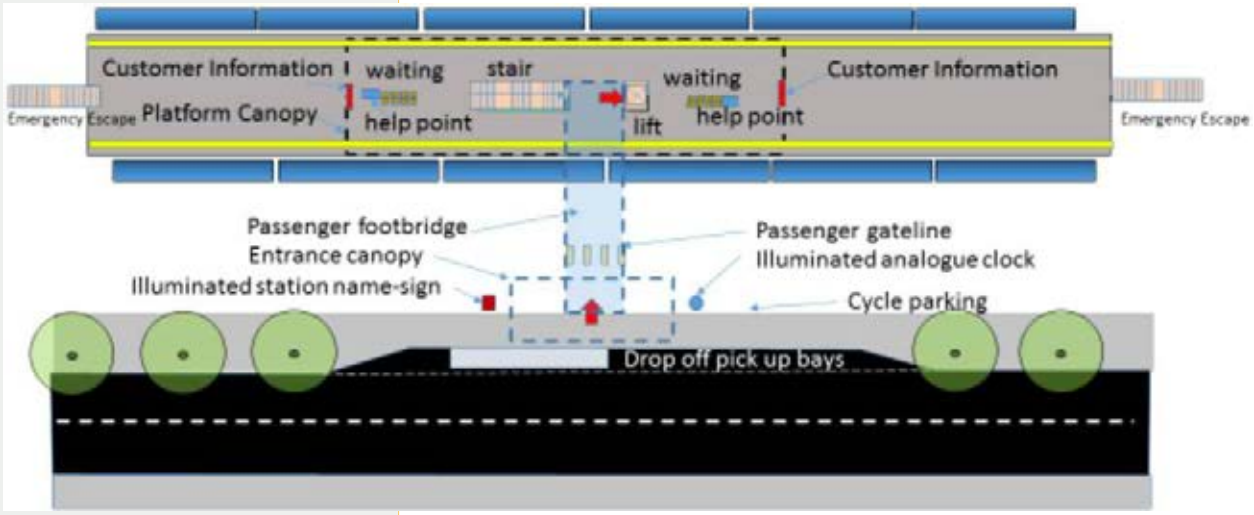



**Figure 3** Typical Type 1 station layout plan, island platform

## 3.3 Station Type 2

**DESCRIPTION**

A Type 2 station is a staffed rural, suburban or urban station. They have a higher patronage than the Type 1 station and need better passenger facilities.

**GATELINE**

The ticket hall must have a station gateline with a wide gate for mobility impaired and a manual gate wide enough to accommodate the widest piece of operational maintenance equipment.

**CUSTOMER SERVICE CENTRE**

Provide a customer service centre with a single ticket window each side of the station gateline and capable of operating the gateline from a seated position within. The customer service centre must have an integral kitchenette, store room, mess area and unisex staff toilet facility with full mobility impaired facilities. The ticket windows must each incorporate a speech transfer system with induction loops for audible speech each side of the window and a cash transfer tray for ticketing transactions. The glass must be anti-ballistic glazing in a secure frame.

**CUSTOMER INFORMATION**

Platform customer information must be provided for train movements at the entrance to the platform and on each platform face at one third intervals along the platform. It must show:

- the time of day,
- the next train departure and
- a summary of the next three train movements.

In addition, there must be a customer information summary display in the ticket hall with the same information.

**POLICE OFFICE**

There should be a station police office located next to the customer service centre, with direct views out onto the concourse area.

**RETAIL**

Consider providing retail opportunities to enhance the customer experience and increase the degree of personal security during normal station operating hours. The station retail facility for multi-purpose use must face the unpaid side of the gateline and the external street facade.

**ATM**

A cash machine must be provided.

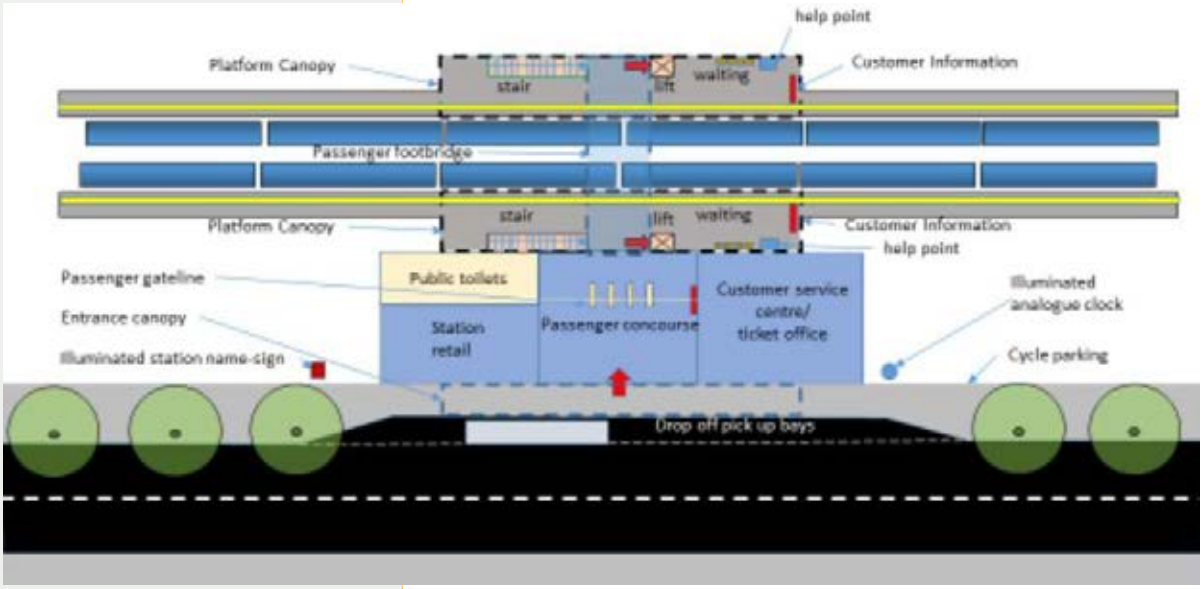



**Figure 4** Typical Type 2 station layout plan, side platform

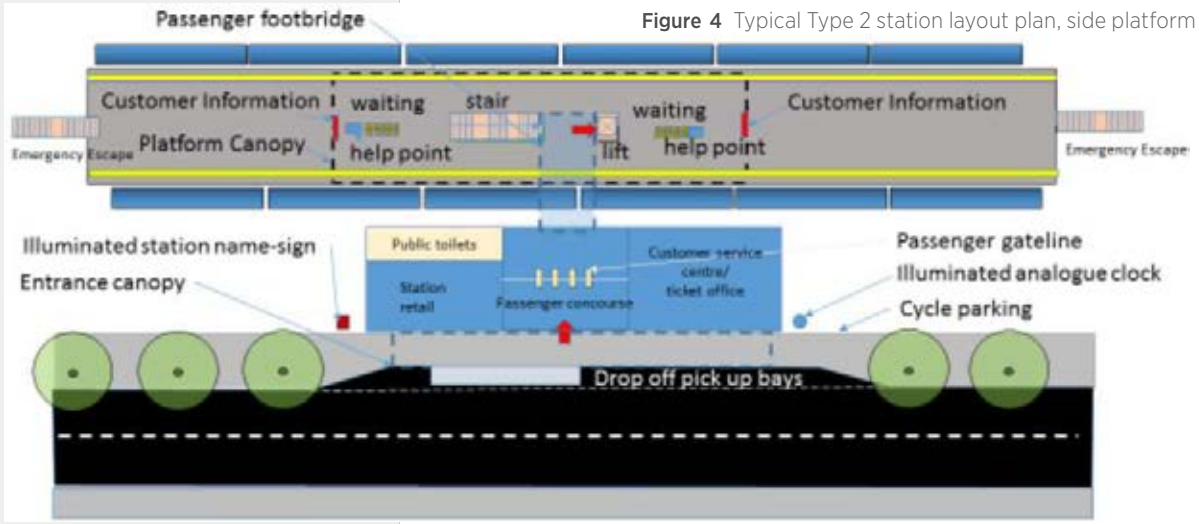



**Figure 5** Typical Type 2 station layout plan, island platform

## 3.4 Station Type 3

**DESCRIPTION**

A Type 3 station is a high-quality, well-lit regional or city centre interchange hub where the primary function is to promote interchange between bus, ferry, heavy and light rail services to provide the maximum benefit to the customer choice and distribution through the public transport network. These stations are by their nature busy interchanges with passengers both boarding and alighting rail services in significant numbers. These are staffed stations for the full operational day and the level of customer facilities required is higher than those at a Type 2 station both in quantity and breadth of provision.

**BUS BAYS**

Provide integrated bus/rail interchange bus bays sufficient for all interchange hub and spoke interconnecting bus services, complete with connecting footways, continuous canopy protection between bus stop locations and rail station entrance canopy.

**TAXI BAYS**

Four taxi pick up/drop off bays must be provided outside the station.

**GATELINE**

The ticket hall must have a station gateline with a wide gate for mobility impaired and a manual gate wide enough to accommodate the widest piece of operational maintenance equipment.

**CUSTOMER SERVICE CENTRE**

Provide a customer service centre with three ticket windows facing the unpaid side of the gateline and one facing the paid side. Staff must be able to operate the gateline from a seated position within. The customer service centre must have an integral kitchenette, store room, mess area and unisex staff toilet facility with full mobility impaired facilities. The ticket windows must each incorporate a speech transfer system with induction loops for audible speech each side of the window and a cash transfer tray for ticketing transactions. The glass must be anti-ballistic glazing in a secure frame.

**CUSTOMER INFORMATION**

Platform customer information must be provided for train movements at the entrance to the platform and on each platform face at one third intervals along the platform. It must show:

- the time of day,
- the next train departure,
- a summary of the next three train movements, and
- operational notices.


The ticket hall customer information summary must display rail and interconnecting bus movements. It must show:

- the time of day,
- all train movements at platform level for the next 20 minutes
- all bus movements at street level for the next 20 minutes.

**STATION MANAGEMENT**

Provide station management offices and support accommodation, station cleaning and support accommodation, station storage and maintenance accommodation.

**CCTV**

The area outside the station must have full CCTV coverage.

**POLICE OFFICE**

There should be a station police office located next to the customer service centre, with direct views out onto the concourse area.

**RETAIL FACILITIES**

It would be normal to see extensive retail facilities at these stations that include simple food and beverage provision through to small but well stocked metro-style supermarkets. Station retail facilities must face into the rail unpaid space and outward into the area at street level.

**ATM**

A cash machine must be provided.

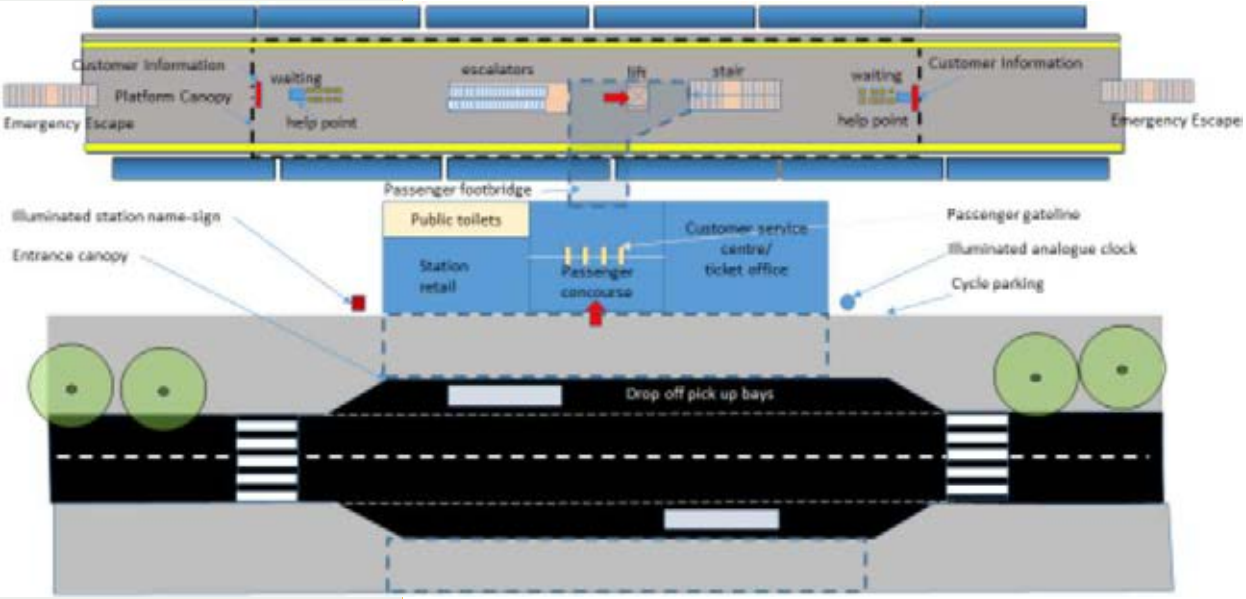



**Figure 6** Typical Type 3 station layout

## 3.5 Station Type 4

**DESCRIPTION**

A Type 4 station is a high-quality, well-lit city centre destination facility where the primary function is to cater for large passenger volumes arriving into the city centre in the weekday morning peak period and departing the city centre in the evening peak period.

While the station dwell time is relatively short, the passenger volumes are such that space planning of the station interiors, vertical circulation and platform widths must take customer safety and comfort into account.

**TAXI BAYS**

Three taxi pick up/ drop off bays must be provided outside the station.

**GATELINE**

The ticket hall must have a station gateline with a wide gate for mobility impaired and a manual gate wide enough to accommodate the widest piece of operational maintenance equipment.

**CUSTOMER SERVICE CENTRE**

Provide a customer service centre with three ticket windows facing the unpaid side of the gateline and one facing the paid side. Staff must be able to operate the gateline from a seated position within. The customer service centre must have an integral kitchenette, store room, mess area and unisex staff toilet

facility with full mobility impaired facilities. The ticket windows must each incorporate a speech transfer system with induction loops for audible speech each side of the window and a cash transfer tray for ticketing transactions. The glass must be anti-ballistic glazing in a secure frame.

In addition to the ticketing facility, an open counter customer information centre must be provided next to the ticket office on the unpaid side of the gateline for four working positions to provide customer assistance.

### CUSTOMER INFORMATION

Platform customer information must be provided for train movements at the entrance to the platform and on each platform face at one third intervals along the platform. It must show:

- the time of day,
- the next train departure,
- a summary of the next three train movements, and
- operational notices.

A customer information summary display in the ticket hall must show:

- the current time
- all train movements at platform level
- the next three movements in each direction.

### POLICE OFFICE

There should be a station police office located next to the customer service centre, with direct views out onto the concourse area.

### RETAIL FACILITIES

It would be normal to see extensive retail facilities at these stations that include simple food and beverage provision through to small, but well -stocked metro style supermarkets. In city centre locations, the retail facilities can be considered as attractions in their own right for lunchtime patronage and in the evening associated with city centre events. Each retail unit must be provided with water, drainage, a 60 amp three-phase power supply and a communications supply to maintain flexibility for future letting. Station retail facilities must face into the rail interchange unpaid space and outward into the integrated bus interchange area at street level.

### ATM

A cash machine must be provided.

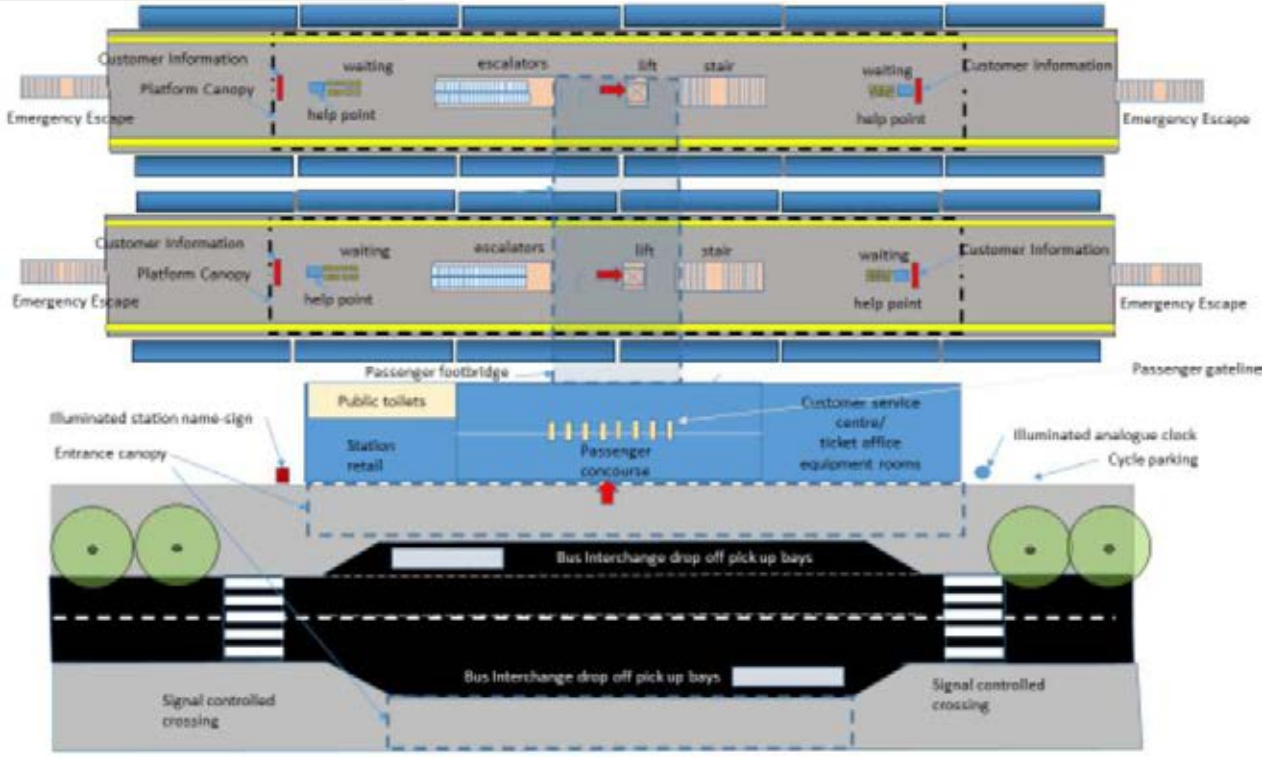



**Figure 7** Typical Type 4 station layout

## 3.6 Station Type 5

**DESCRIPTION**

A Type 5 station is a park and ride facility where the entire focus of the station is dedicated to the efficient movement of passengers from the well-lit, safe car parking into a well-lit simple station environment that is designed to cater for large peak period boarding and alighting.

These facilities will typically be staffed for their operating period and provide a similar level of retail and customer facility to that of a Type 3 station.

**SAFETY**

Safety and security in the car parking and mode transfer facilities is paramount if customers are to trust the park and ride facility provided.

Integrated parking facilities must be near the station entrance, with all footpaths clear of obstruction, providing straight-line routes to and from the station entry and provide clear supervision from staffed positions and 100% CCTV coverage.

All park and ride parking locations must be lit to an average of 100 lux throughout o promote the safe and secure environment.

**CAR PARKING**

Typically car parking facilities must be evaluated in 500 car park modules – the first 500 at ground level and subsequent 500 blocks being in multi-storey use of the car park footprint.

Car parking locations must be configured so that the morning peak arrivals and evening peak departures do not create traffic conflicts with the bus stops or with the primary routes across the distributor roads between the station entrance and the parking areas.

**BUS BAYS**

Integrated bus/rail interchange bus bays sufficient for all interchange hub and spoke interconnecting bus services to the park and ride, must be provided, complete with connecting footways and continuous canopy protection between bus stop locations and rail station entrance.

**TAXI BAYS**

Four taxi bays must be provided outside the station.

**GATELINE**

The ticket hall must have a station gateline with a wide gate for mobility impaired and a manual gate wide enough to accommodate the widest piece of operational maintenance equipment.

**CUSTOMER SERVICE CENTRE**

Provide a customer service centre with three ticket windows facing the unpaid side of the gateline and one facing the paid side. Staff must be able to operate the gateline from a seated position within. The customer service centre must have an integral kitchenette, store room, mess area and male and female staff toilet facilities with full mobility impaired facilities.

**CUSTOMER INFORMATION**

Platform customer information must be provided for train movements at the entrance to the platform and on each platform face at one third intervals along the platform. It must show:

- the time of day,
- the next train departure,
- a summary of the next three train movements, and
- operational notices.

The ticket hall customer information summary must display rail and interconnecting bus movements. It must show:

- the time of day,
- all train movements at platform level for the next 20 minutes
- all bus movements at street level for the next 20 minutes.

**STATION MANAGEMENT**

Provide station management offices and support accommodation, station cleaning and support accommodation, station storage and maintenance accommodation.

**POLICE OFFICE**

There should be a station police office located next to the customer service centre, with direct views out onto the concourse area.

**RETAIL**

Station retail facilities must face into the rail interchange unpaid space and outward into the integrated bus interchange area at street level. Retail design must be for multi-purpose and include metro-style supermarket, provision for food and beverage preparation, as well as other travel-related uses facing the unpaid side of the gateline and the external street facade.

Other facilities that could be considered for inclusion in the park and ride are:

- Warrant of fitness and car valet services
- Child care facilities,
- Doctor's surgery.

ATM

A cash machine must be provided.

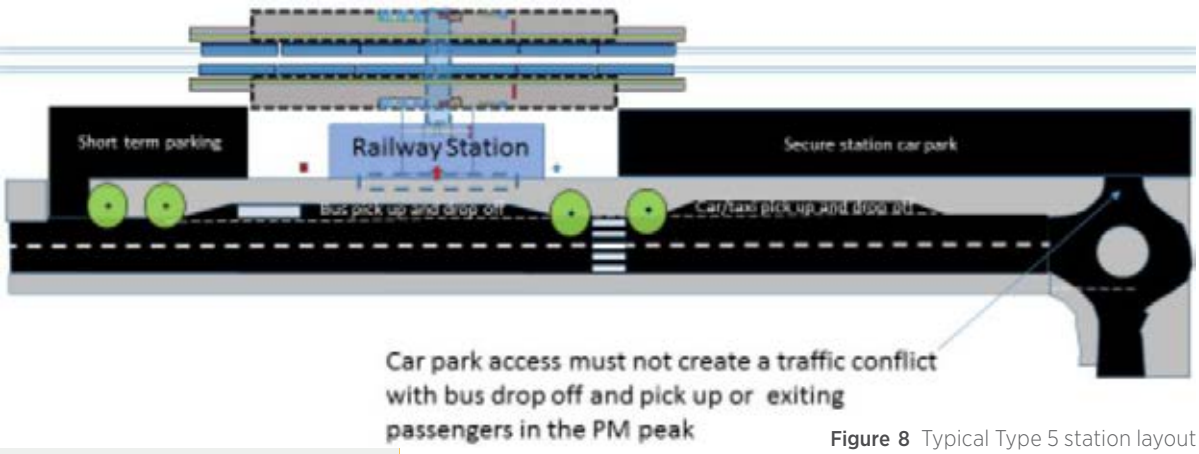



**Figure 8** Typical Type 5 station layout

## 3.7 Subsurface and underground stations

SPECIAL REQUIREMENTS

Subsurface and underground stations require specific emergency escapes, operational systems, materials choice, ventilation and fire engineering design consideration in excess of those provided for surface stations.

VENTILATION OUTLETS

Careful location of ventilation outlets, emergency escape stair locations, intervention stair access and the need to maintain access to all operational equipment day or night to enable railway maintenance. Proximity of extract ventilation outlets to adjacent properties and sensitivity to noise generated by the operation of these facilities must be taken into account for their location. Location of ventilation inlets need to consider adjacent properties and proximity to clean air supply. They should not be near chimneys or emergency generation exhaust.

SAFETY

In addition to the above, a sub-surface or underground rail facility must be designed to include the following safety features:

- A station control and fire/incident control facility (preferably next to the customer service centre to enable common staffing and shared facilities). This facility may be unstaffed during normal operations and the station controlled remotely from the Auckland Transport group station control room, but becomes the local incident control centre when required to do so.
- Tunnel and ventilation systems for subsurface or underground smoke removal and additional emergency escapes.
- Materials selection with low flame spread, low smoke, non-toxic emissions, that keep fire load to a minimum.
- Additional fire control measures and provision for emergency services intervention.
- Connection to Auckland Transport's SCADA system to enable automated, local and remote management and control of the station and its facilities during normal operations and emergencies.

UNDERGROUND RETAIL

Retail facilities within underground station environments introduce specific fire engineering risks. Solutions to address these risks often reduce the viability of retail facilities. In the absence of a fire engineering assessment, the default position, is that no retail facility must be located in an underground location beyond the gateline position.

TABLE 1 OVERVIEW OF FEATURES REQUIRED AT DIFFERENT STATION TYPES

| REQUIREMENT | TYPE 1 | TYPE 2 | TYPE 3 | TYPE 4 | TYPE 5 |
|---|---|---|---|---|---|
| Well lit | ✓ | ✓ | ✓ | ✓ | ✓ |
| 100% CCTV coverage of station, monitored remotely | ✓ | ✓ | ✗ | ✗ | ✗ |
| 100% CCTV coverage of area outside station | ✗ | ✗ | ✓ | ✓ | ✓ |
| Straight level platforms 150 x 9.6m (island) or x 4.5m (side platform), future proofed to extend to 225m | ✓ | ✓ | ✓ | ✓ | ✓ |
| Access to the platform must be via a combination of a stair, a 26-person heavy duty lift or pedestrian ramp | ✓ | ✓ | ✓ | ✓ | ✓ |
| A means of closing the station to public access after hours | ✓ | ✓ | ✓ | ✓ | ✓ |
| Platform canopy extending the full platform width for at least X carriage length | X=1 | X=1 | X=2 | X=4 | X=4 |
| Platform seating for at least X passengers for each platform face, with at least one seat placed adjacent to carriage 2 and carriage 5 for mobility impaired access. | X=20 | x=20 | x=40 | x=60 | x=60 |
| Customer help points at the seats provided at carriage 2 and 5 | ✓ | ✓ | ✓ | ✓ | ✓ |
| Customer help point at the lift and next to the gateline. | ✗ | ✗ | ✓ | ✓ | ✓ |
| Variable customer information for train movements | ✓ | ✓ | ✓ | ✓ | ✓ |
| Customer service centre | ✗ | ✗ | ✓ | ✓ | ✓ |
| Staff facilities | ✗ | ✓ | ✓ | ✓ | ✓ |
| Storage | ✗ | ✓ | ✓ | ✓ | ✓ |
| Maintenance access | ✓ | ✓ | ✓ | ✓ | ✓ |
| Emergency access | ✓ | ✓ | ✓ | ✓ | ✓ |
| Retail opportunities | ✗ | Consider | Consider | ✓ | ✓ |
| Rubbish bins | ✓ | ✓ | ✓ | ✓ | ✓ |
| Drinking fountains | ✗ | ✓ | ✓ | ✓ | ✓ |
| Public toilets | ✓ | ✓ | ✓ | ✓ | ✓ |
| Digital advertising | Highlight site | ✓ | ✓ | ✓ | ✓ |
| **OUTSIDE** | **TYPE 1** | **TYPE 2** | **TYPE 3** | **TYPE 4** | **TYPE 5** |
| Two rail replacement bus parking bays | ✓ | ✓ | ✓ | ✓ | ✓ |
| Emergency vehicle parking bay | One | One | One | One | Two |
| One maintenance vehicle parking bay shared with refuse truck bay | ✓ | ✓ | ✓ | ✓ | ✓ |
| Drop off and pick up 5-minute waiting restricted vehicle parking bays with drop kerbs for mobility impaired access | Two | Two | Four | Four | Eight |
| Taxi pick up/ drop off bays | ✗ | ✗ | Four | Three | Four |
| Cycle parking | 20+ | 20+ | 40 | 60 | 60-100 |
| Station name sign, direction signage to and from the station | ✓ | ✓ | ✓ | ✓ | ✓ |
| Station location map | ✓ | ✓ | ✓ | ✓ | ✓ |
| Large illuminated station analogue clock as a symbol of punctuality | ✓ | ✓ | ✓ | ✓ | ✓ |

# 04 Spatial design for staffed stations

**PRINCIPLE**

The spatial organisation of the station must recognise the hierarchy of customer needs. For example, passengers entering the station must be presented with the time of day, the required train departure information, an automatic teller machine (ATM), the means of obtaining a ticket, retail opportunities, the ticket gateline/HOP card validator and clear directions to the departure platform.

**ENTRANCE CAPACITY**

Where stations have more than one entrance the combined entrance capacity for the station, including any entrance to platform circulation routes, must be designed to accommodate an additional 20% of passenger demand volumes to that shown in the patronage forecasts. This is to accommodate potential unequal loading of any entrance.

**RETAIL FACILITIES**

Station entrances must be designed to accommodate viable station retail and vending machine locations that do not obstruct passenger circulation. The design of these facilities must include step-free access for servicing and re-stocking.

**VENDING MACHINES**

Locations for commercially viable vending machines that do not obstruct passenger flows must be identified within the stations. Power supplies for vending machines must be provided in the locations identified.

**DISPLAYS**

The spatial design of public areas must include for the placement of displays, viewing distances, accumulation spaces and passenger circulation routes.

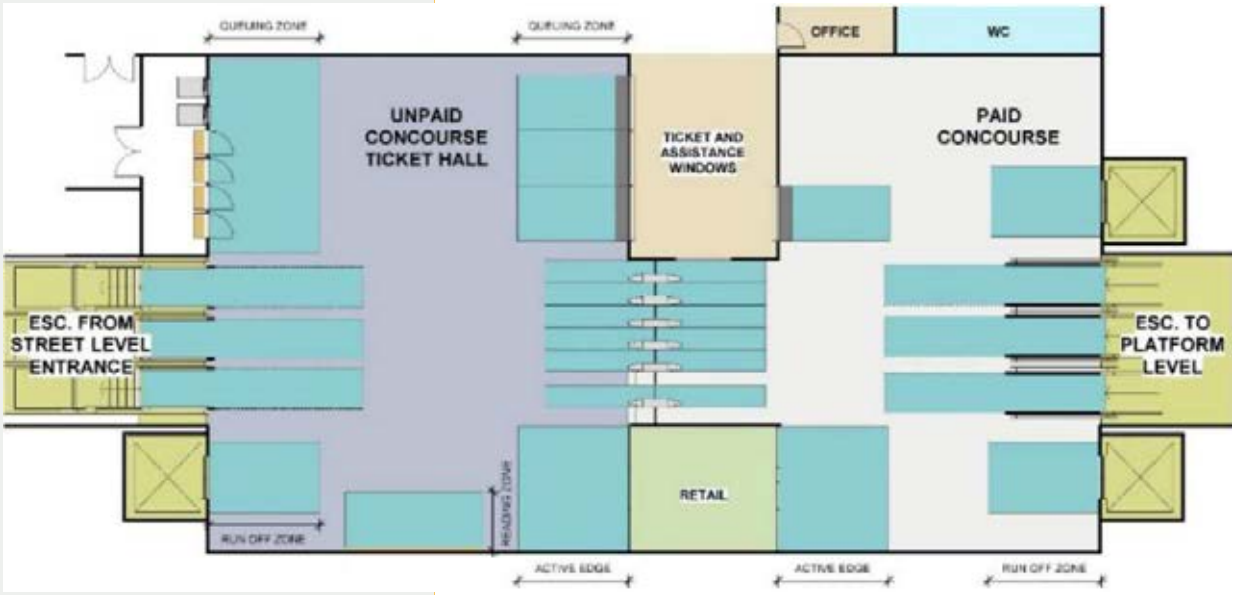



**Figure 9** Typical arrangement of concourse elements for a staffed station location

**HEADROOM**

Sufficient headroom must be maintained in all areas of the station.

Clear headroom within public areas at stations must generally not be less than 3.5m and must be designed with sufficient height to express the architectural quality of the three-dimensional space.

Minimum headroom of 3.5m for up to 200m2 of floor area must be provided, with an additional height of 500mm for every further 250m2, up to a maximum height of 7m.

Clear headroom to localised isolated obstructions must not be less than 2.5m and must take into account the requirements for customer information boards, equipment, signage, lighting and mechanical plant suspended from above.

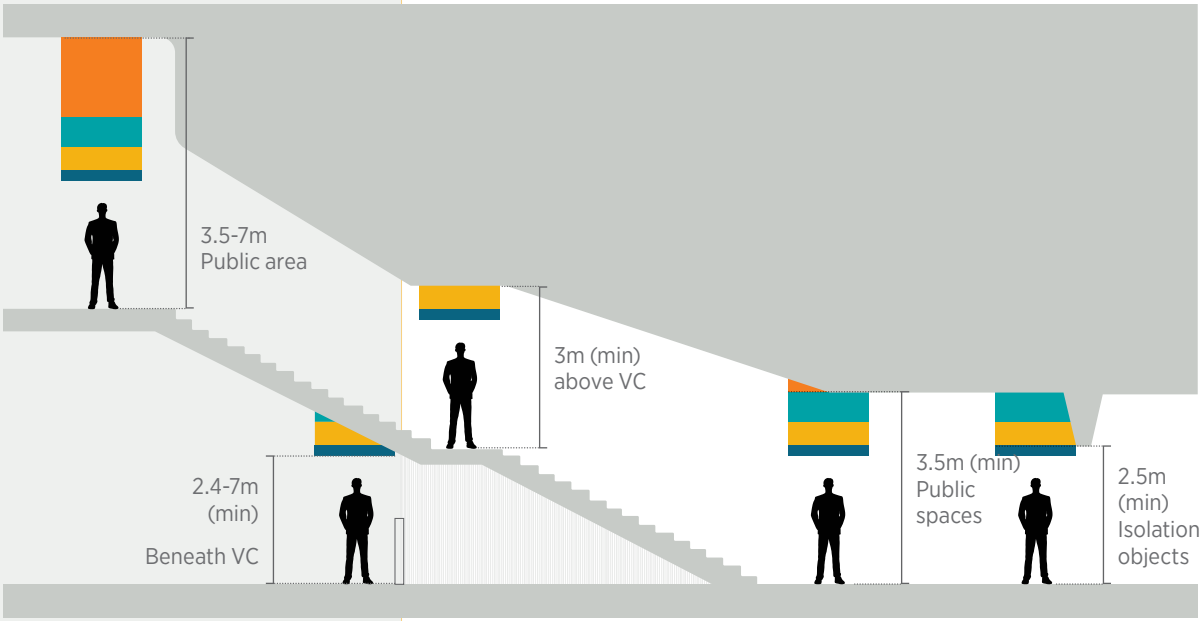



**Figure 10** Headroom beneath obstructions

# 05 Station entrances and concourses

**IMPORTANCE**

Station entrances and concourses are typically the busiest spaces in a station footprint and their design needs to recognise the important part that they play in establishing the customer environment for the rail experience.

**IMPORTANCE**

These spaces must be designed with generous headroom. This, as expressed through the external form of the building, will serve to heighten the presence of the station within the precinct.

**FLOOR AREA**

Station entrances must be designed for generous floor areas and where passenger congestion must be avoided by adopting international benchmarks for space planning around key functional elements. Space must be provided for retail units to activate the surrounding street and the internal station environment as an integral part of the customer service provision of facilities.

## CROWD MANAGEMENT

Note that the station entrance is also the location where passengers are held away from the platform environment during periods of train service disruption as part of the station crowd management plan.

## TRANSPARENCY AND LIGHT

Maximum transparency is desirable within the entrance building, as this enhances the personal security of those using both the internal and external space. The external envelope transparency and the consistently high levels of artificial lighting at 160 lux required within the station should be fully exploited in the design, increasing the prominence of the entrance building in the local environment during the hours of darkness.

## COMMERCIAL DEVELOPMENT

Station entrance locations must be evaluated for commercial development above and beside the entrance building as an integral part of the design. Sufficient additional structure must be designed within the station footprint to carry future loads for development, to be constructed at the same time or at a later date. Integral crash decks must be designed for stations where the commercial development may follow the construction of the station, thus enabling the station to operate safely while further development take place.

## FACILITIES


Station entrances/concourses must be designed to contain:

- A clearly identifiable station entrance threshold, protected by a roof structure that prevents wind-driven rain from entering.
- Either HOP card travel validators and/or a ticket gateline of sufficient capacity with sufficient run off/approach distances to meet passenger demand in the average minute in the peak five minutes of the peak operating hour of the day, including provision for gates under repair to a ratio of one gate in a gateline of 10 gates and two gates for gatelines over 10 gates in size. Where no gates have been proposed, the station entrance should be sized and future proofed for future ticket control gatelines. The sizing should be for a minimum of 3 automatic gates and 1 manual gate.
- A wide gate for mobility impaired use in each gateline. A 1.2m wide lockable manual gate must be provided at each gateline to enable passenger use in the event of gateline failure. Where access for maintenance is reliant upon moving equipment through the gateline, the manual gate must be increased in width to accommodate the largest element of maintenance equipment.
- Ticket machines for ticket issue sufficient for passenger demand with a space planning allowance for passenger queues that will not obstruct primary passenger flows.
- Main variable customer information display boards with train departure information and sufficient space to accommodate dwell cones for passengers viewing the information without impacting on passenger routes through the station.
- Digital commercial advertising at appropriate locations that do not detract from the architectural character of the building.
- Travel notices and printed train departure timetables.
- A station location map showing adjacent streets, sites of local interest, and local bus, taxi, light rail and ferry facilities as applicable to the location.

- Seating for at least eight passengers.
- At staffed locations, a secure customer service centre must be provided in a location that serves both sides of the ticket gateline (at the boundary of paid and unpaid concourse areas) with clear visibility of the adjacent public spaces. Where clear visibility of station areas is not available, monitors may be used to provide visibility. The number of positions within the secure customer service centre must be based upon 2% of the average peak 15-minute flow of passengers at the station and an average transaction time for each passenger, based on current operating data. The secure customer service centre must incorporate a staff mess and unisex staff toilet within the secure perimeter to enable staff to use these facilities without leaving the secure perimeter of the centre.
- A police office with access and clear views to the main public concourse.

SECTION 3 See also default typical station facilities in section 3.

06

# Platforms

PURPOSE

This section outlines the requirements for station platforms.

PRINCIPLE

Station platforms must be designed to permit the safe and orderly movement of passengers during normal, disrupted and emergency incident conditions. They must be uncluttered, free from unnecessary obstructions and maintain clear visibility along their length.

UNDERGROUND

All underground station platforms must be futureproofed for a 300mm wide zone to install platform edge door screens.

## 6.1 Platform access

IMPORTANCE

The position of platform access along the platform length has a disproportionate impact on the overall design of the station facility. The location of the platform entry also has a significant bearing on the performance of the station during peak operations, when passengers queuing to enter or leave the station conflict with boarding and alighting movements to and from trains, leading to passenger congestion and potential train service delays. The location of the entrance/egress point also has a significant impact on the design for emergency escape.

ACCESS:
MIDDLE OF PLATFORM

A station with its access to the platform in the central third of the platform length has the advantage of providing an even distribution of passengers along the train length from the centre outwards.

This configuration does, however, introduce a potential emergency evacuation issue where a train fire could prevent movement along the platform to the normal egress point, creating a dead end. Consider providing emergency escape points at each end of the platform. Conduct a careful fire engineering review of radiated heat and smoke behaviour in the context of the platform width that could, under certain circumstances, permit passengers at the platform end to pass the location of a train fire on the far side of the platform. This aspect of the design must be fully risk assessed and will be subject to fire authority acceptance. The Passenger Information Displays can be linked to the emergency evacuation system to provide instruction on which exit route to take in an emergency

ACCESS:
END OF PLATFORM

A station with end of platform access can cause passenger bunching at one end of the platform when boarding and alighting, leaving the rest of the platform relatively lightly occupied. This can cause congestion and conflict with passengers going the other way. If a train fire occur near the station entrance, passengers on the remaining platform length would need to rely upon an escape at the opposite end of the platform from the main access point or a fire engineering approach, as above.

ACCESS:
SIDE OF PLATFORM

Side platforms can generally offer a relatively easy access and egress within locally widened platform areas. Emergency escape routes from the back of the platform area to a place of safety is also relatively easy to configure within the design. However, side platforms are less efficient in the use of platform space and require duplication of vertical circulation components.

ACCESS:
ISLAND PLATFORM

Island platforms that have been risk assessed and require emergency escape routes independent of the main access and egress routes, must be provided with escape bridges. These must have sufficient escape capacity across the tracks, as train services may still run during the emergency.

## 6.2 Platform seating

SEATING


Platform seating must be evenly distributed along the platform length and accommodate 5% of the normal maximum departing passenger volume during the average minute in the peak 15-minute period for each platform face. On island platforms, seating must be located in the centre of the width of the platform waiting area and integrated with other platform fittings such as signage and help points. Seating must not be located at pinch points in platform circulation, adjacent to main entry exit positions, or where they will disrupt passengers' primary desire line through the space.

One set of seats on each of the platform faces must be specifically located in the centre of coach 2 and 5 of a six-carriage set. (This is the location of mobility impaired access points to train carriages.) Each such set of seats must be next to a passenger help point.

## 6.3 Platform dimensions

**LENGTH**

Platforms must have an operational length of 150m and must be designed to accommodate six-carriage length electrical multiple unit trains. The design for all new platforms must include the assessment for future proofing for nine-carriage length (225m) long platforms for implementation at a future date.

**STRAIGHT**

To keep platform gaps within acceptable dimensions, platforms must be designed to be straight, unless platform curvature is unavoidable as a result of horizontal track alignment. In the event that platform curvature is absolutely unavoidable, the curve radius within the platform length must not be less than 600m.

**LEVEL**

Where possible, platforms must be designed to be level along their length. In the event that a platform gradient is unavoidable, a constant gradient not exceeding 1% can be permitted. No vertical curves is allowed within the platform length.

**TRANSVERSE FALL**

Platforms must incorporate a transverse fall of 1 in 100 away from the platform edge to the back wall or centreline of an island platform. All platforms must include drainage points evenly spaced along the platform to help with cleaning.

**WIDTH**

Operational platform lengths must be at least 3m wide from the platform edge to any extended obstruction. Isolated obstructions (isolated columns, etc.) may intrude not closer than 2.5m from the platform edge. Platform widths for all platforms must be determined by passenger space planning criteria and level of service requirements for the average minute in the peak 15-minute period of the peak operating hour in the future design year Auckland Transport determined for the project. This space planning must be validated by dynamic moving agent passenger modelling tools before settling on the platform widths designed for the station.

**PASSENGER BUNCHING**

Platforms must be designed for disproportionate passenger bunching in the busiest part of the platform. This must be achieved by designing for 35% of the passenger demand to occupy the busiest 25% of the platform length. Boarding and alighting profiles must be adopted from the operating plan.

## 6.4 Accommodating passenger volumes

**CAPACITY**

All station platform designs must be sensitivity tested for capacity to 20% above the passenger demand levels agreed for use in station designs. The purpose of this sensitivity test is to define which elements of station infrastructure are likely to fail first and to enable preparation of contingency and station management plans to accommodate growth beyond the life of the project.

All station layouts must be designed for the simultaneous arrival of trains in each direction and the passenger surges this creates in circulation and vertical circulation elements.

All vertical circulation capacity to and from platforms provided by escalators must be designed to accommodate one escalator being out of commission for prolonged maintenance during normal peak operating periods at each station. Sufficient resilience must be designed for the capacity of vertical circulation to operate under this condition accepting the reduction in the level of service to Fruin level D under these conditions, with prolonged platform clearance times possible.

The design of platforms and vertical circulation elements to and from platforms must accommodate boarding and alighting passenger volumes from two simultaneous train arrivals in the peak 15-minute period of the peak operating hour in the design year, achieve a Fruin level of service C on the platform, and clear all alighting passengers from the platform area in under 2.5 minutes.

## DISRUPTION

During train service disruption, platforms must be designed to accommodate passenger demand to a density of no worse than Fruin level of service D in any area accommodating the additional passenger volume. Passenger congestion for disruption beyond one missed headway and for special events affecting passenger volumes at the station must be managed with the station management plan.

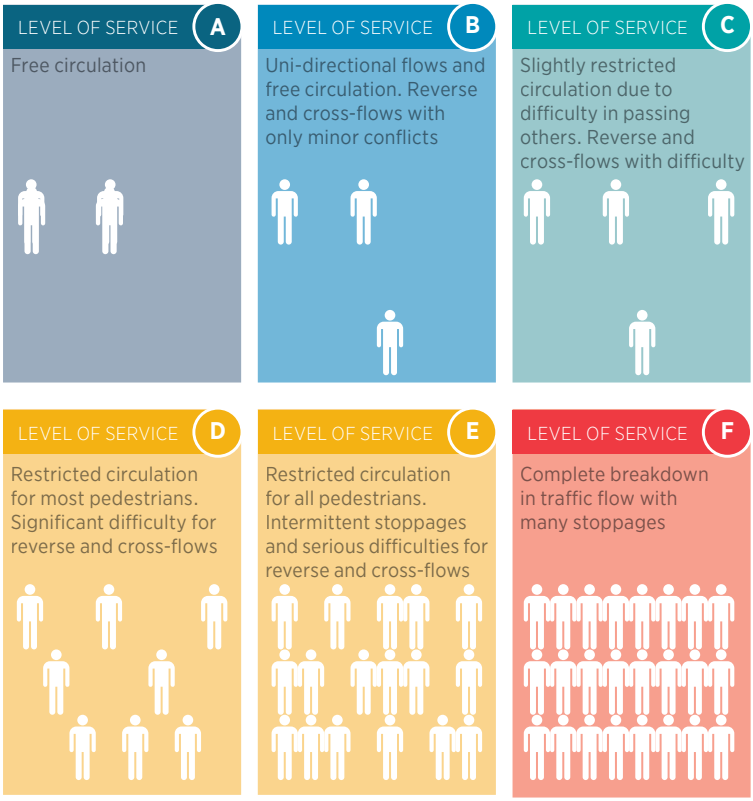



**Figure 11** Fruin levels of service

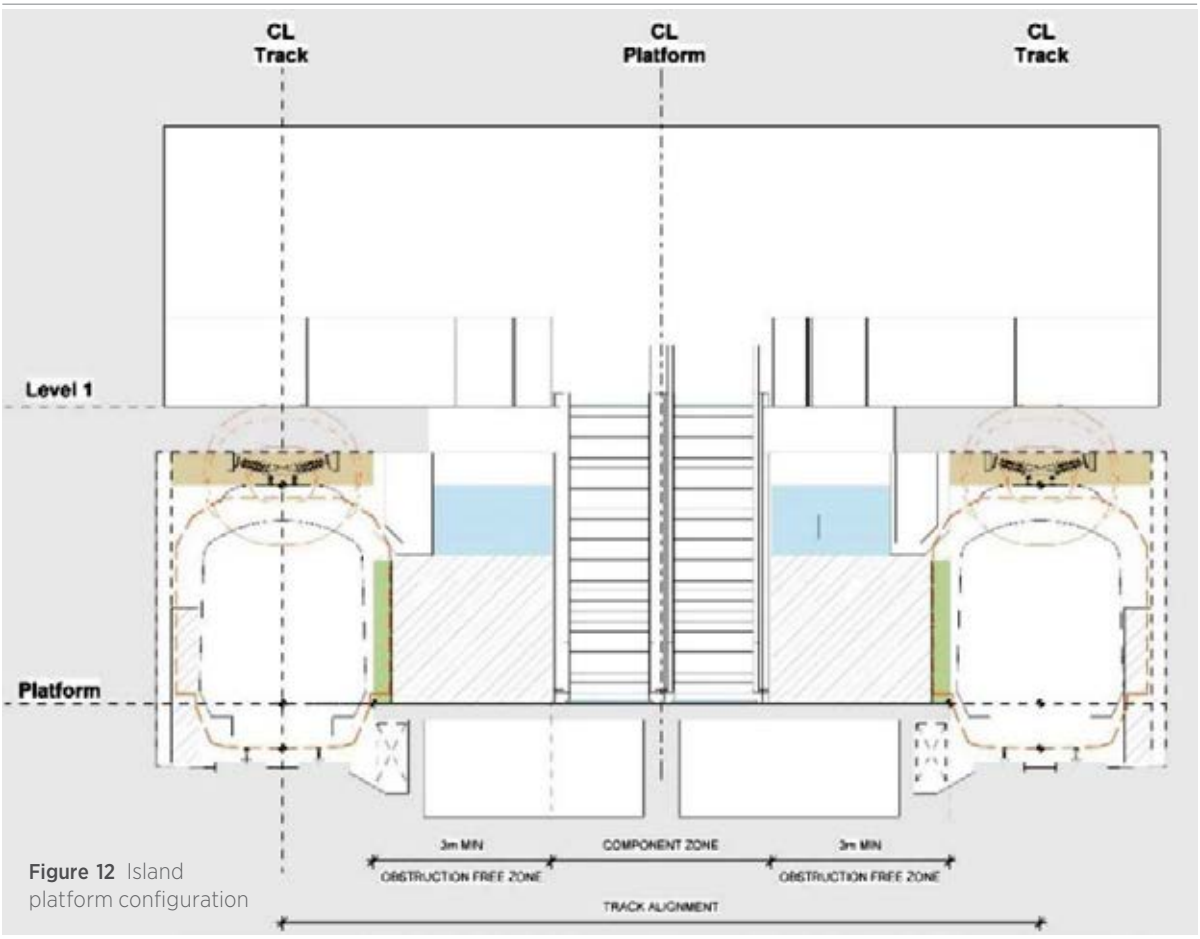



**Figure 12** Island platform configuration

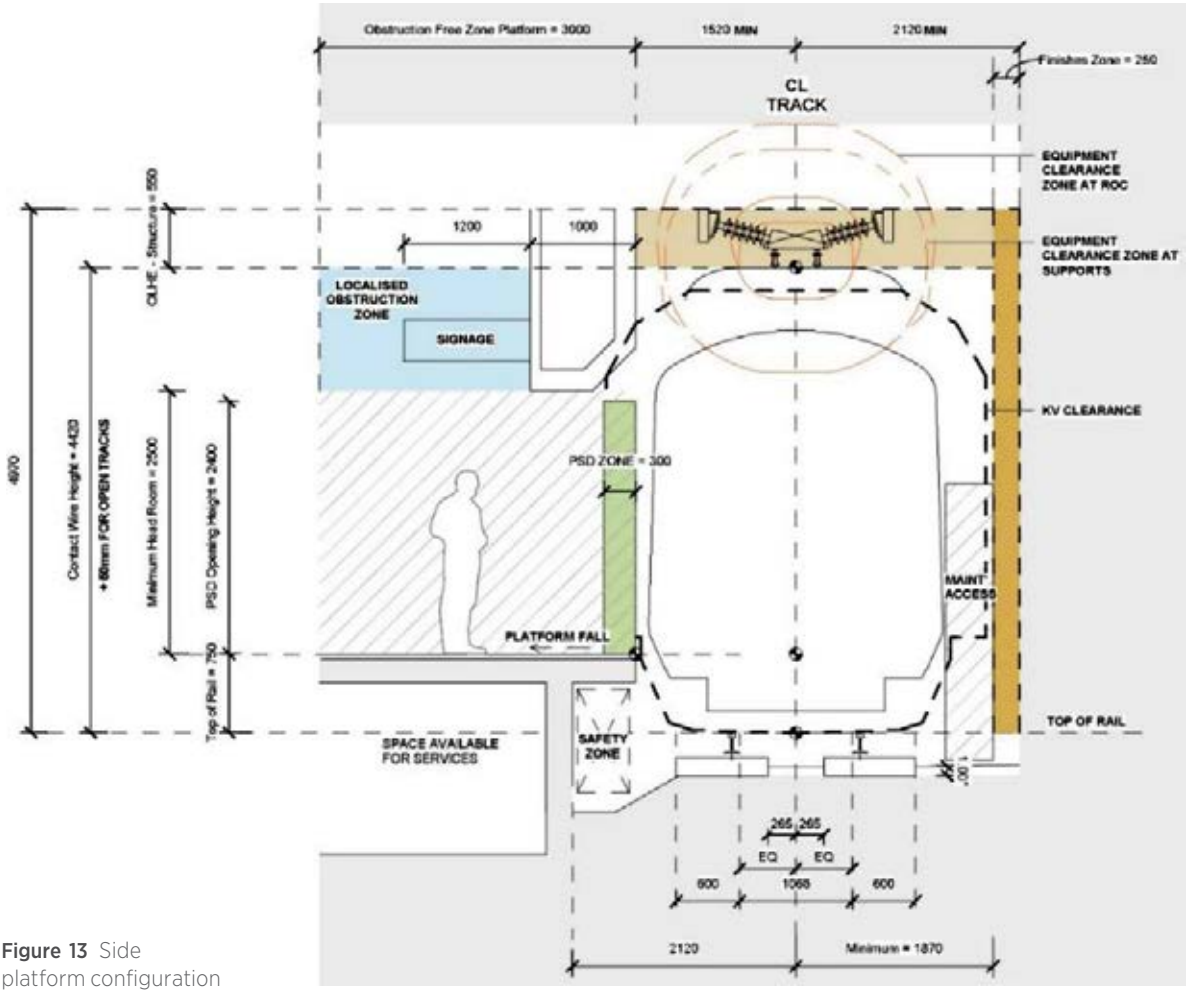



**Figure 13** Side platform configuration

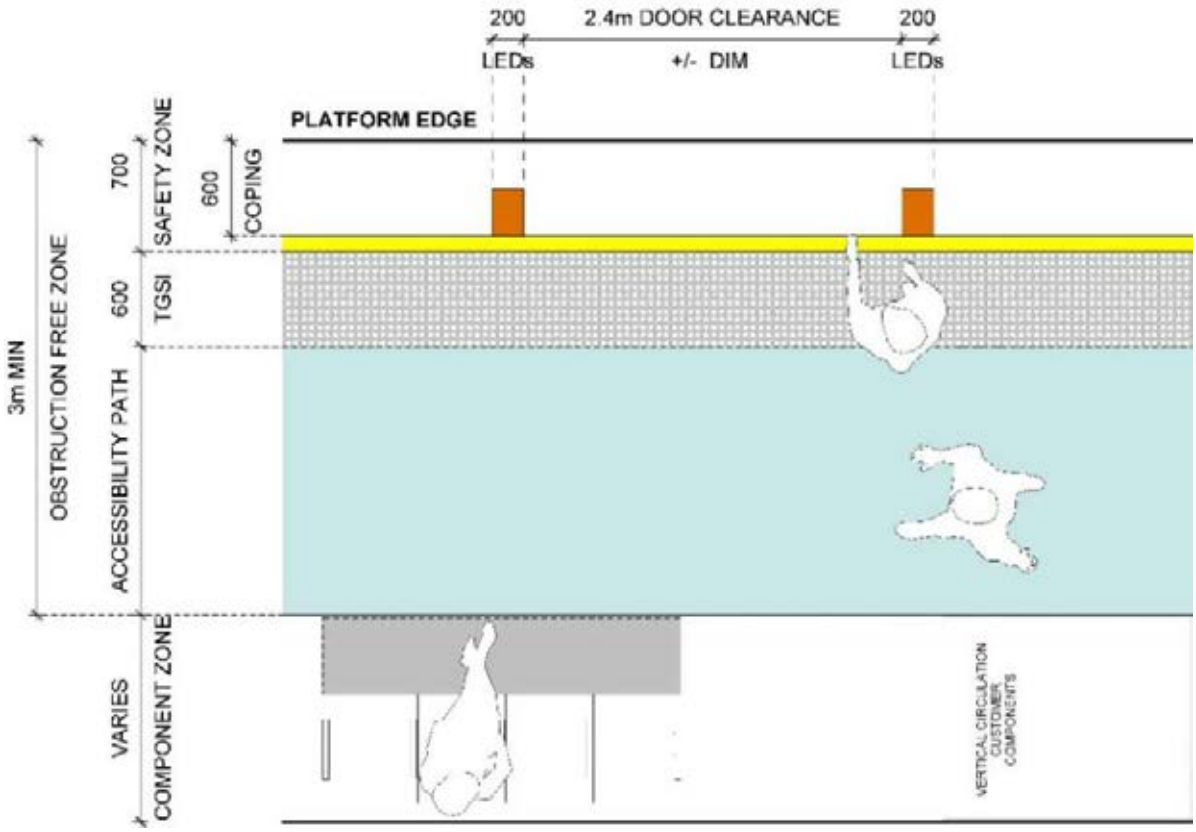



**Figure 14** Typical platform edge plan

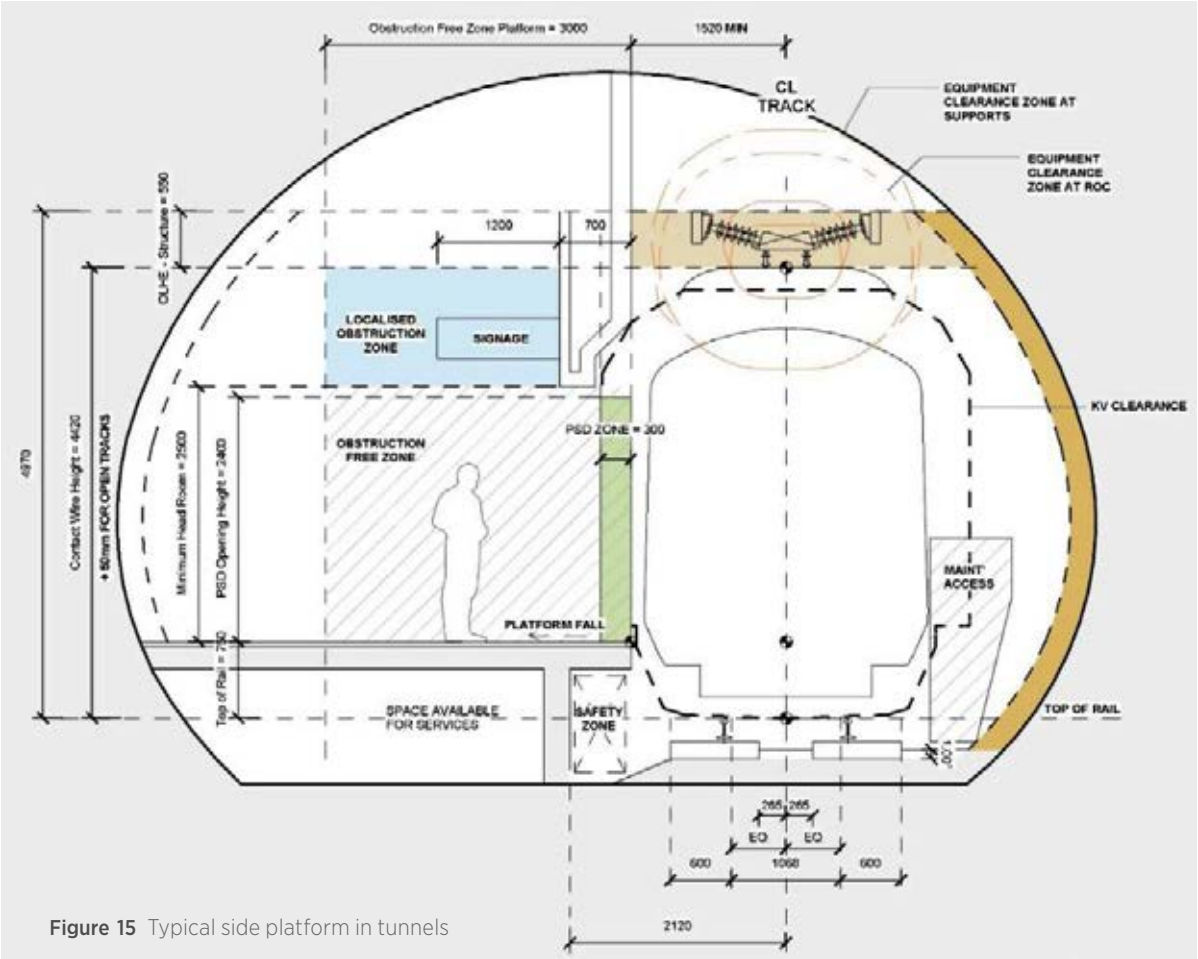



**Figure 15** Typical side platform in tunnels

# 07 Integration of engineering and operational elements

**PRINCIPLE**

All station components must be designed to accommodate engineering and operational elements and allowing access for maintenance, while maintaining appealing aesthetic standards.

Station, tunnel and building structures must be designed to accommodate the electrical, mechanical and railway systems equipment needed for railway and station operations.

The station designs must be integrated with operational systems, including signalling, traction supplies, train radio systems and operational radio systems operated within the station and within the adjacent tunnels and shafts.

Consider construction and maintenance tolerances when determining the clearance requirements for all station fitout components and support systems. This must include consideration of the appropriate space requirements, adjacency requirements, interface requirements, servicing requirements and replacement plans.

## 7.1 Platforms

The stations on the Auckland rail network must be designed to accommodate six-carriage length electrical multiple unit trains with an operational platform length requirement of 150m. In addition, all platforms must be planned and future space proofed for 225m length to allow for 9 carriage trains in the future.

**ROLLING STOCK**

Auckland Transport currently uses electric multiple unit (EMU) trains from Spanish manufacturer Construcciones y Auxiliar de Ferrocarriles (CAF). These trains are designed to operate in either three-car or six-car sets.

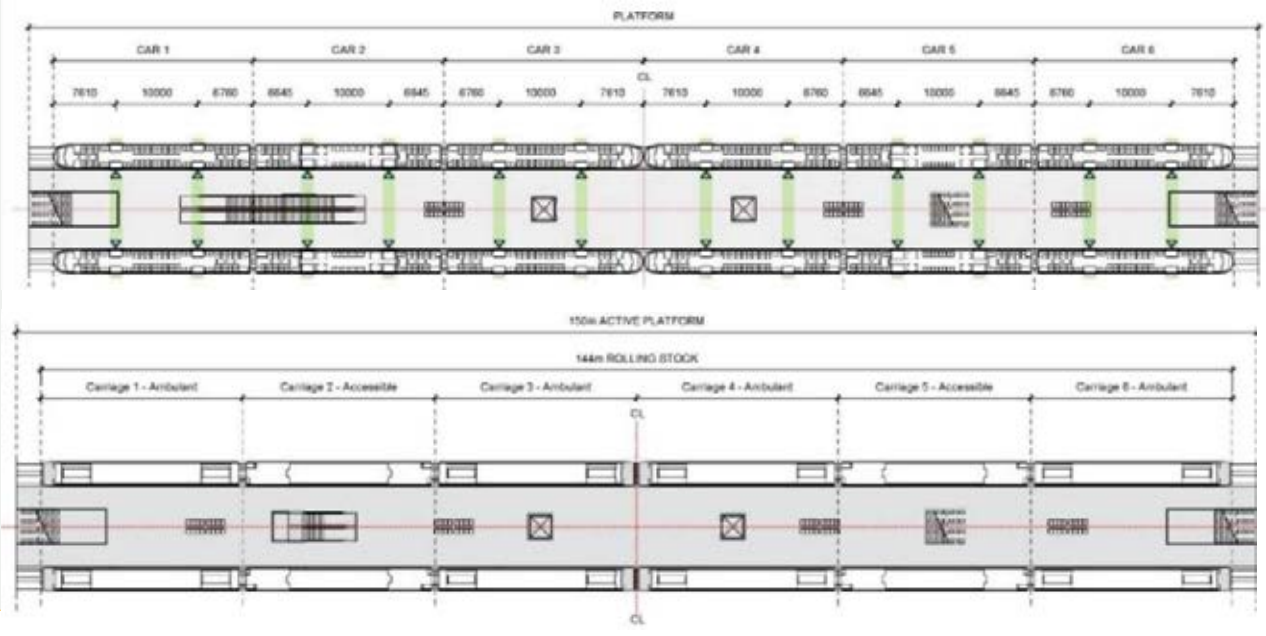



**Figure 16** CAF class morning EMU rolling stock

**STOP BOARDS**

The station platform train stop boards must be positioned to locate stopped trains as close as possible to the station entry/ exit and platform canopy protection points

**MOBILITY IMPAIRED ACCESS**

Carriages 2 and 5 within each six-carriage train have floors adjusted for level mobility impaired access.

**HEADWALL AND TAILWALL**

Platforms must be designed to provide gated headwall and tailwall spaces to non-public access spaces beyond.

**CLEARANCES**

Provide adequate clearances for the rolling stock operated on the line to ensure compatibility between trains and all structural elements, platforms, linings, fittings, advertising and finishes. The appropriate stepping and clearance distances must be provided at the platform edge between train doors and platform surface.

**ANTI-SUICIDE PIT**

Station platforms must be designed to accommodate a fall back “anti-suicide pit”. The platform edge and copings must be cantilevered or of a similar design to accommodate a void underneath that falls away from the railway.

**PLATFORM EDGE DOOR SCREENS**

Note that provision for future platform edge door screens must include the space proofing for the additional ventilation/ cooling and associated plant, supplies, ducts and equipment throughout the station.

**PASSENGER TRAIN FREQUENCY**

The maximum passenger train frequency to be accommodated at stations must be established from the operational train plan and stopping patterns for the line of route in order to determine platform boarding and alighting frequency rates for passengers during normal, disrupted and emergency incident conditions. The link line passenger flows on trains either side of the station must also be assessed to enable evacuation loadings to be assessed from trains along the route.

**FREIGHT TRAINS**

The number, type and frequency of freight trains passing through the station must be assessed along with nature of the goods being transported in order to assess the fire engineering requirements that could impact upon the station design and the safe evacuation of passengers.

## 7.2 Finishes

**INTEGRATION**

Station components and finishes must be designed to accommodate and be fully integrated with mechanical, electrical, communication, line-wide systems, drainage, and fire safety systems. Co-ordinated designs of all floor, ceiling and wall penetrations for switches, vents, light fittings, loudspeakers etc. must be prepared to control the overall appearance of the surface finishes with respect to services outlets.

**BUILDING TOLERANCES**

Station components and finishes must be designed with adequate building tolerances to be accommodated within the final station structure. Secondary cladding system support rails may be considered suitable for cast-in fixings, however preference must be given to on-site drilled fixings unless otherwise agreed.

DISGUISE

The preference is for all systems to be suitably disguised from public view or contained within architecturally finished enclosures that allow the necessary maintenance access, while presenting an acceptable aesthetic appearance. Special care must be taken to detail elements that can be viewed from above, e.g. when using escalators or lifts.

DUCTS AND PIPES

All ducts, risers, pipes and cables for all of the respective systems must be space-proofed within the station envelope, with sufficient allowance for spacing to avoid system interference and to facilitate access and maintenance.

ACCESS PANELS

Within public areas, fully integrated lockable, hinged access panels must be provided in lining systems, including ceiling panels, wall and floor finishes where frequent maintenance access to services is required. This will include access to the inside faces of external station structural walls for inspections and repairs to leaks in underground structures.

## 7.3 Access

Emergency access/egress and maintenance access must be included in the design of all station elements. In particular, the access needed to inspect, maintain and replace trackside components in adjacent tunnels, tracks and operational areas must be included within the designs of platforms and the spaces at the ends of platforms, taking into account the possibility of using rail-based access as an alternative method of access.

RAMS

The design of stations must incorporate the concept of Reliability, Availability, Maintainability and Safety (RAMS). Selection of all systems and system components must consider the service life of all systems, system reliability and resilience, and the installation methods to ensure that the system is suitable for the application, safe and maintainable.

Specification of materials, plant and equipment will be undertaken with a RAMS framework consistent with the application of EN50126.

# 08 Station signage and wayfinding

PRINCIPLE

A common approach to station branding, signage and wayfinding must be applied to all stations to accord with Auckland Transport's requirements on the wider Auckland rail network. An overall rail identity must be adopted for all stations, with common design themes, a common approach to spatial organisation, a common palette of materials, a common selection of modular components and a consistent application of clearly identifiable elements in the public realm. A familiar feeling of spatial hierarchy at all stations must be achieved where common elements such as seating, signage, customer information and finishes can be expected to be found in the same operational location at each station.

**INDIVIDUAL IDENTITIES**

Individual station identities must be expressed within each station entrance and the wider station precinct, reflecting local materials and architectural forms, while maintaining a modular approach to common components that are applied along the route.

**LEGIBILITY**

Character heights of all directional signage and customer information displays must be designed to give legibility of the written text within the viewing cone established for each location. Internationally recognised pictograms must be used to assist in passenger navigation through the station.

**SIGNAGE MANUAL**

All signage must comply with the Auckland Transport Signage and Branding Manual guidelines.

**INTEGRATION**

Designers must interface and coordinate with bus and ferry operators to ensure railway station signage will be appropriately located and coordinate the following information:

- Route number, destinations
- Timetable information
- Location maps,
- Operator information and telephone numbers.

**TE ARANGA**

Te Aranga design principles must be embraced within the station designs to reflect the cultural history and significance of each station location, in accordance with principles to be agreed as part of the Mana Whenua engagement process. Local iwi must be consulted before commencement of station designs to ascertain the local narratives that could be satisfactorily embraced within the design in partnership with the participating iwi. For example the station designs may express the historical context by integrating art and cultural references within the station design form, spatial composition and component parts as a fully integrated aspect of the design solution, avoiding application of superficial motifs and colours.

**PUBLIC ART**

Locations for the incorporation of public art within the stations must be identified at reference design stage and detailed into the fabric of the building as an integral contribution to the station identity and customer experience.

## 8.1 Design approach

PRINCIPLE

A comprehensive signage design is required for each station that complements the wayfinding strategy to be developed for each station. A detailed station signage requirements package must be developed for each station and approved by Auckland Transport.

Station signage design must:

- Establish cohesive reference points, placing signage a common levels throughout to reduce visual clutter and aid identification and wayfinding.
- Establish principles of visual hierarchy to aid cognition.
- Employ the principle of progressive disclosure of information to minimise disruption to pedestrian flow and aid interpretation, cognition and movement.
- Not be excessive at entrances and in public spaces.
- Consider all user types, including the disabled.

FAST AND SLOW SPACE

The way in which the signage and wayfinding strategy is developed for each station must take account of the fast and slow space concept within the station circulation. Signage and wayfinding designs must reflect the clarity required for each space.

DECISION POINTS

Each decision point must be identified within the station layout and assessed for signage and wayfinding requirements. Where the spatial composition is obvious and intuitive, the extent of signage can be minimised. Where the spatial composition is necessarily complex, signage must provide clear direction.

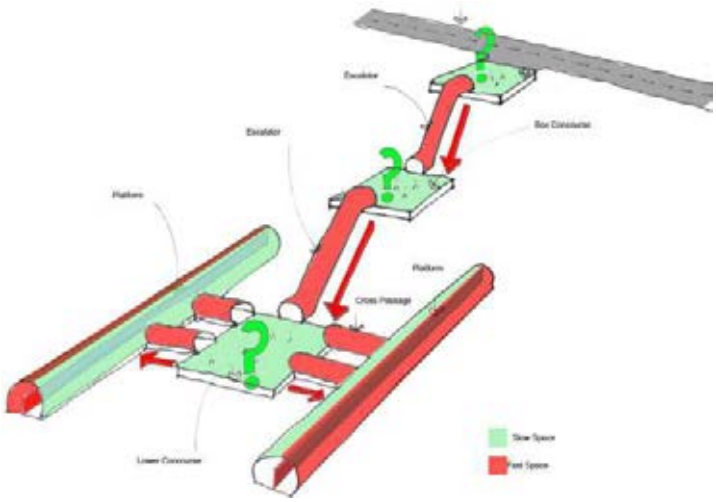


**Figure 17** Fast and slow spaces concept– identification of key wayfinding decision points from street to platform

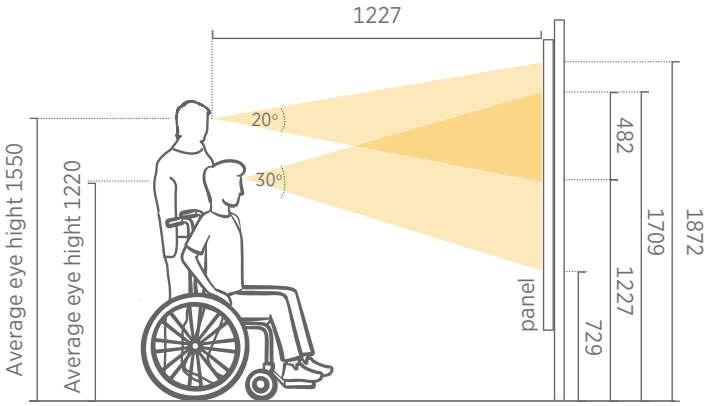



**Figure 18** Example of optimum visibility, total comfortable viewing zones to passenger information (e.g. maps, timetables) not directional signage

ALL AREAS



Signage types for consideration in all areas must include:

- Ceiling mounted
- Wall mounted
- Free standing
- Electronic/dynamic
- Temporary signage
- Static illuminated and non-illuminated
- Major/minor signs
- Station name sign local station identifier and transit system identifier
- Directional signage
- Directional signage to local places of interest (local area map
- Customer information
- Switchable signage.

## 8.2 Minimum signage provision

As a minimum, stations must be provided with sufficient space to provide passengers with the following information within each area of the station.

OUTSIDE


Outside the station entrance, provide for:

- Station name sign
- Station opening times
- Auckland Transport identity and branding
- Station clock
- Directional signage to other transport modes
- Directional signage to local places of interest
- Local area map.

STATION ENTRANCE

At the station entrance and unpaid station concourse, provide for:

- Main departure digital variable information display for all departing services for the next 15 minutes in each direction, giving time of departure, principle destination and primary intermediate station stops by name.
- Digital clock on all variable information displays
- Printed timetable and operational information boards
- Disrupted service notice board
- Station opening hours
- Fare structure, HOP card data and excess fares policy
- Legal notices board
- Digital commercial advertising boards
- Directional signage to exits, emergency exits, mobility impaired lift and platforms.
- Signage to direct passengers carrying bicycles and other large items to use the appropriate lifts and inform them of station policy regarding cycles and large items during peak times.

## ON ROUTES

On routes through the station, changes in direction or other decision points, provide for:

- Summary departure variable train information displays.
- Directional signage
- Commercial advertising

## ON PLATFORMS

Along each platform, provide for:

- Digital variable train information board displays at one third spacing along the platform with first second and third train departure giving time to expected arrival in minutes, final destination, intermediate stops and route.
- Digital clock within the variable information board.
- Platform name signs must be provided on platform back wall, trackside wall (underground stations) and centre of island platform at 23m intervals along the platform, to coincide with the centre of each carriage stop position.
- Subject to the commercial viability, digital commercial advertising on the trackside far wall must be integrated within the finishes zone.
- Directional signage to normal and emergency exits and lift access for mobility impaired.
- Customer help points.
- Platform ends, (adjacent to front and back train driver's doors)
- Digital clock with hours, minutes, seconds and countdown clock for departure.
- Legal notices about trespass on railways.
- Monitors may be provided to give train crew and others visibility of platforms.

## PLATFORM HEADWALLS

The following must be provided at platform headwalls or platform ends, adjacent to front and back train driver's doors:

- Legal notices regarding trespass on railways.
- Digital clock with countdown function to help drivers with departure accuracy.

## UNIVERSAL ACCESS

The following must be provided to assist universal access:

- Where inductive loops are fitted, these must be indicated by a sign with the international symbol for inductive loops.
- Service information must be made available in at least two different forms, e.g. embossed characters, Braille or by audible talking signs.
- The international symbol of access must be displayed on the exterior of the station at a height of 1500mm at each accessible entrance location.
- The international symbol of deafness must be displayed at a height of 1400mm to 1700mm on the exterior of any facility or room indicating that an assistive hearing device is available in that facility or room.
- Drop-off and pick-up bays for mobility impaired customers, signed as No Parking and identified for use by passengers.
- Braille and high contrast tactile print signage must be placed on doors. However, if the door is always open, the signage must be on hinge side of entrance.

- Braille and high contrast tactile print signage for numbers on stair landing hand rails to identify number of floors.
- Braille maps must be provided at the station entrances, describing the station layout for passengers with impaired vision. Braille identification must be applied to:
  - Lift controls
  - Customer help point call buttons
  - Statutory signage. (See NZS 4121 Access and Mobility for further information.)

Wayfinding and signs must be as per the Wayfinding and Signage Design Guide.

## 8.3 Variable information signage

**PRINCIPLE**

Variable real-time information displays and directional signage must be provided in areas of the station to assist in efficient passenger navigation of the internal spaces under normal, disrupted and emergency incident conditions.

Real-time information must be provided to advise passengers at all key decision locations within the stations. This information must consist of audible public address announcements, variable information displays. Switchable signage must be incorporated where passenger management techniques must be implemented.

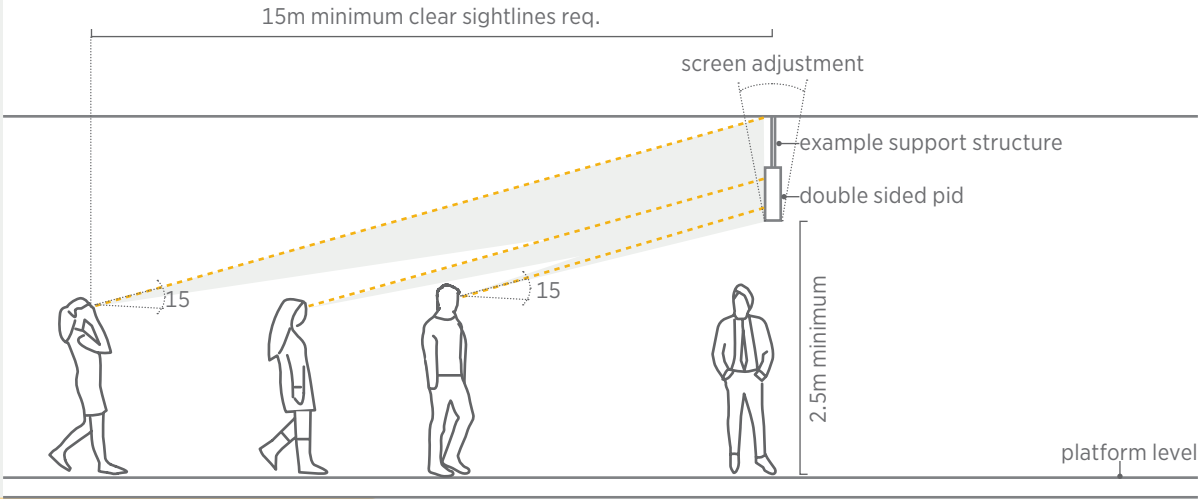
**SINGLE CONTROL**

All customer information systems must be controlled by AT's technology systems. This will allow the appropriate team to manage the display,

**LOCATION**

The location of passenger information displays (PIDs) must allow sufficient space to accommodate dwell cones for passengers viewing the information without impacting on passenger routes through the station. Pay attention to the pause time that passengers need to read the contents of the displays and ensure that these locations do not obstruct the primary flows of passengers though the station spaces. PIDs must not be located above gate lines, at major thoroughfares where passengers stopping to read the information will block the passenger flow through the space.

**Figure 19** PID location diagram.



# 09 Acoustics

**PRINCIPLE**

Passengers must be provided with a comfortable environment with respect to acoustics throughout the stations at all times. Noise levels in stations must be such that customers are able to conduct a conversation without having to shout. All equipment must be developed and maintained to ensure that noise levels are kept to a minimum.

A medium-live acoustic impression is preferred in public spaces to avoid excessive noise build-up during busy periods, support public address intelligibility and retain a sense of spaciousness.

**AMBIENT NOISE**

The acoustic performance of the system must coordinate space, speaker type/positions and finishes to give clear audibility to the appropriate room acoustics speech transmission index (RASTI) levels at all times in all public areas.

The unoccupied internal ambient design noise level must not exceed (inclusive of mechanical plant, but excluding contributions from train movements, PA announcements and alarms):

- Ticket sales and customer service centre areas 45 – 50 dB Laeq NA
- Concourse, circulation routes and platform waiting areas 45 – 55 dB LAeq
- Criteria for other relevant industrial, commercial and retail spaces must be determined with reference to Australian/ New Zealand Standard AS/NZS 2107:2016

**PUBLIC ADDRESS SYSTEM**

All public areas of the stations must be provided with a public address system to support audible communication from pre-recorded systems and real time announcements from the station control room or the group station control room. The system must also accommodate audible warnings for fire and life safety purposes in all areas.

The public address (PA) system in ticket sales, concourse and platform areas must be designed as follows:

- Speech Transmission Index (STI): Greater than 0.5. Note STI ranges between 0.0 and 1.0, where 0.0 is completely unintelligible and 1.0 is perfectly intelligible.
- Sound Pressure Level (SPL): Capable of 85 dB LAeq and automatic gain control to maintain output 10 decibels above the background noise level (LA95).
- Evenness of coverage: +/-2 decibels using a signal of octave band pink noise centred at 4kHz.

**REVERBERATION TIME**

To support the requirements above, the reverberation time in ticket sales, concourse and platform waiting areas must achieve the medium-live design range in the figure below, relative to room volume.

**OTHER GUIDE**

Criteria for other relevant industrial, commercial and retail spaces must be determined with reference to Australian/New Zealand Standard AS/NZS 2107:2016 Acoustics–Recommended design sound levels and reverberation times for building interiors.

FINISHES

The acoustic performance of the spaces throughout the station will need detailed consideration in terms of the selection of surface materials/finishes. Areas that must be considered in the acoustic design include:

- Platforms – underground, open-cut and at grade station
- Future-proofing – platform areas for platform screen door inclusion, capacity to change material and cladding.
- Concourse paid and unpaid area.
- Station forecourts
- Vertical circulation – Escalators, material insulation
- Mechanical plant rooms

EXTERNAL NOISE EMISSIONS

Mechanical ventilation plant must not exceed applicable designation noise limits or those contained in the Auckland Unitary Plan.

# 10 Vertical movement

REQUIREMENT

Stations on more than one level must have sufficient provision for vertical movement, including that of mobility impaired customers.

VERTICAL MOVEMENT MEAN

Vertical circulation must be based upon the following guidelines:

TABLE 2 MEANS FOR VERTICAL CIRCULATION

| Height change | Means |
|---|---|
| < 0.5 m | Ramp |
| 0.5 - 3 m | Staircase. Minimum of two risers and/or ramp. |
| 3 - 5 m | Staircase or escalator |
| > 5 m | Escalator preferred. Preferred max 15m for each escalator rise. A higher rise must be reviewed with the supplier in terms of reliability, maintenance and availability. |
| >2 m | Lifts must be provided if there is no ramp. |

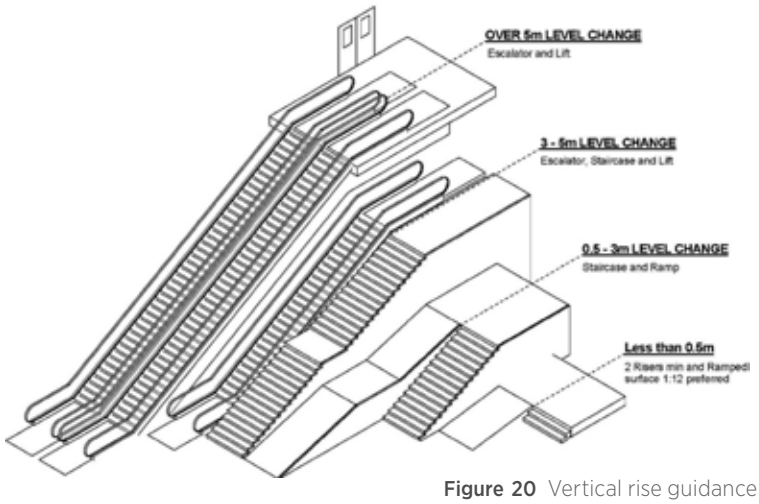



**Figure 20** Vertical rise guidance

## 10.1 Balustrades and handrails

PRINCIPLE

Balustrades and hand railings must incorporate a common component modular design approach across all stations.

HANDRAILS

Handrails must:

- Extend 300mm beyond the top and bottom of the ramp or stair
- Be mounted between 900mm and 1000mm above stair nosings or ramp
- Be positioned 32-50mm from the wall finish
- Be turned down 100mm or fully returned
- Be round and smooth
- Be on a nib to facilitate floor cleaning.
- Be a contrasting colour (tonal contrasts) to their background
- Incorporate a dome tactile warning indicator on top of stair handrail.
- Be capable of resisting crowd loading. (See structural design requirements.)
- Be securely fixed to comply with NZS 4121 (Appendix F–F7).

BALUSTRADES

Balustrades and screens must:

- Have a high degree of visual permeability; and
- Be in accordance with Table 3 below.

TABLE 3 BALUSTRADE AND FENCE HEIGHTS

| Element | Top of balustrade height |
|---|---|
| Bridges over or walkways adjacent to rail corridors within station environments | 1.8m |
| Carpark | 1.2m |
| End of platform and platform balustrade | 1.8m |
| Level crossing | 1.2m |
| Concourses/entrances | 1.8m |

## 10.2 Ramps

Ramps must:

- Be sized in line with patronage demand. See Station Planning requirements
- Be sized to include a minimum a clear width of 1.2m, and preferably 1.5m.
- Provide a level approach from ground to ramp.
- Have uniform slopes.
- Have a continuous slip resistant surface.
- Avoid steeper gradients than 1:14.
- Incorporate handrails on both sides if the gradient is greater than 1:20.

- Include tolerances in the design that set out the maximum gradients to ensure constructed ramps are within absolute gradient limits.
- Include 75mm upstand or low railing where railings have a drop off. Ramps against walls do not require an upstand.
- Have colour contrast tactiles.
- Be designed in accordance with Table 4 below.
- Have balustrading at the top and bottom run. The handrail must project a minimum of 300mm beyond ramping in accordance with Figure 22 below.
- Comply with the requirements for accessible ramps in the NZS 4121 Building Code.

TABLE 4 RAMP REQUIREMENTS

| Element | Requirement |
|---|---|
| Ramp length | 9m maximum |
| Landing | 1.2m, 1.5m preferred |
| Unidirectional minimum width | 1.2m, 1.5m preferred |
| Bidirectional minimum width | 1.6m |
| Maximise rise between landings | 750mm |
| Maximum gradient | 1:12 (as per NZS 4121) |
| Handrail (to project at least 300mm beyond first and last riser) | 800 – 900mm high |

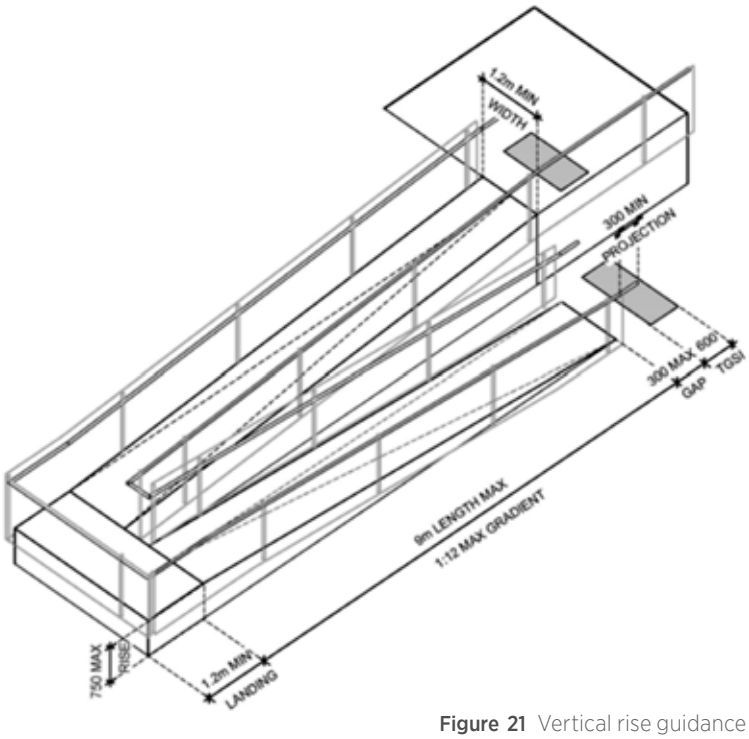



**Figure 21** Vertical rise guidance

## 10.3 Stairs

### PUBLIC STAIRS

Public stairs must:

- Be sized on patronage demand, passenger space planning requirements.
- Have uniform riser heights.
- Not narrow in the direction of exit.
- Not exceed 2.5m total rise in any flight.
- Have an intermediate handrail at the centre of the stairway where stairways exceed 4m in width.
- Have a change in surface treatment with strong colour contrast at nosing, head and foot of steps. (See NZS 4121 8.5.1 Fig 22.)
- Have minimum 30% colour contrast
- Integrate a landing no less than 1.2m (1.5m preferred), including intermediate landings.
- Locate the top riser 300mm back from any return wall.
- Include a slip resistant surface, steps must have a co-efficient of friction of >0.5.
- Have warning handrail tactiles and tactile ground surface indicators (TGSI) as per NZS 4121.
- Have handrails on both sides of the stair. These must not intrude more than 100 mm into the space.
- Include run-off distances as per passenger space planning requirements queuing and runoff distances.
- Comply with the requirements for accessible stairs in the NZ Building Code Clause D, Access Routes and NZS 4121 unless otherwise noted.

### STAIR NOSINGS

Stair nosings must:

- Be non-slip and contrasting colour. Painted nosings are not permitted.
- Be rounded with no sharp or abrupt angles.
- Not project more than 25mm from face of riser.

TABLE 5 PUBLIC STAIR REQUIREMENTS

| Stair element | Requirement |
|---|---|
| Rise | 150mm maximum |
| Going* | 300mm minimum |
| Unidirectional | 900mm clearance between handrails |
| Bidirectional | 1.2m clearance between handrails |
| Landings | 1.2m |
| Risers per flight | 2m |
| Pitch | See NZ Building Code |

* The horizontal dimension from nosing to nosing.

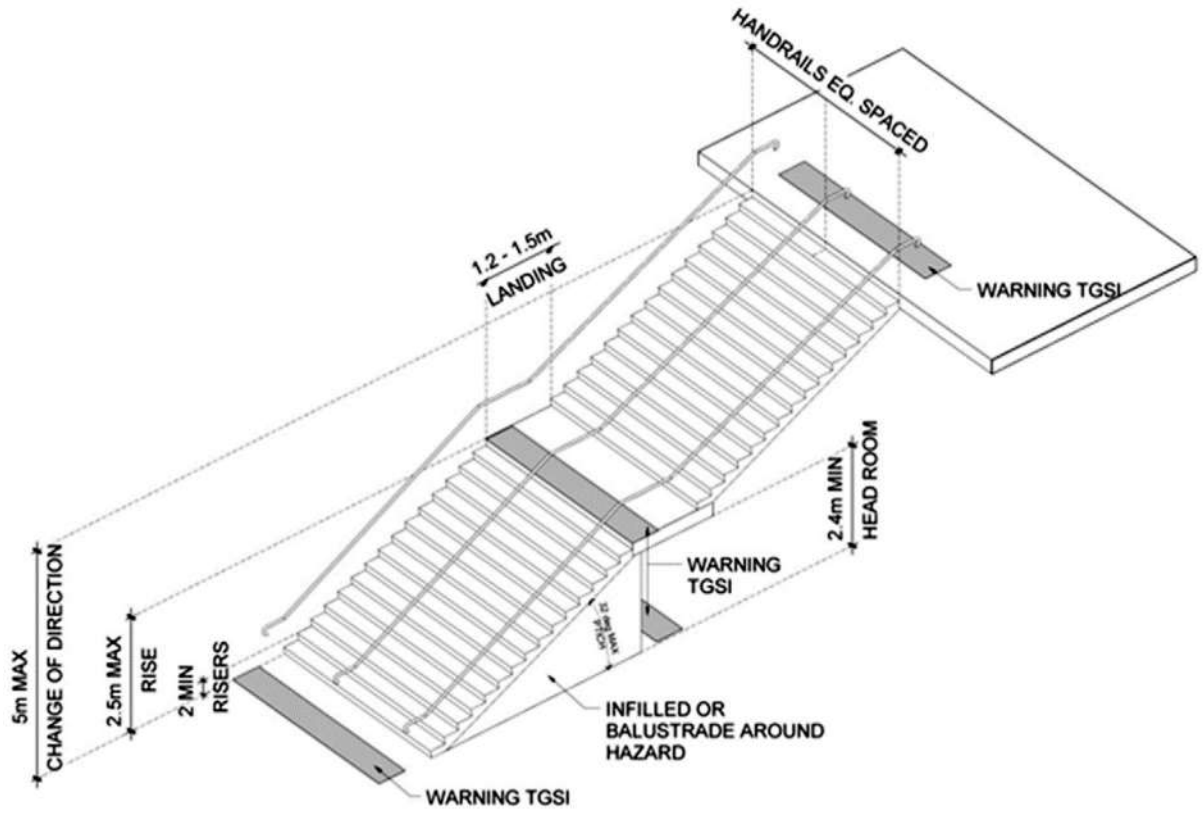



**Figure 22** Public stair requirements

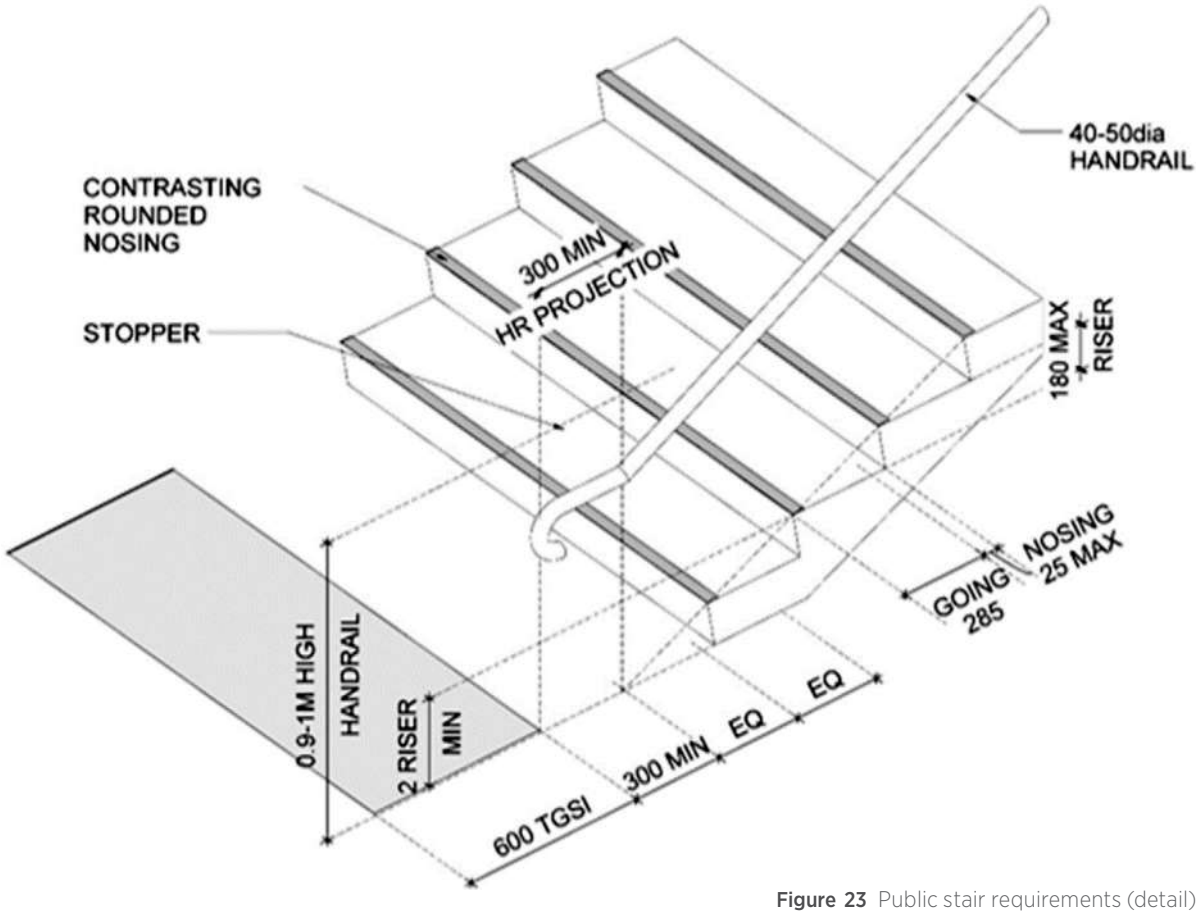



**Figure 23** Public stair requirements (detail)

## EVACUATION STAIRS

Evacuation stairs must:

- Be at least 1100mm wide, measured between wall and inside face of the balustrade. Handrails can be ignored, if they protrude less than 100mm from the wall and balustrade.
- Include fire refuges for mobility impaired passengers.
- Meet the requirements established in NZS 4121 for accessible stairs unless otherwise noted;
- Be in accordance with Table 6 and Figure 25 below.
- Comply with the NZ Building Code.

TABLE 6 FIRE STAIR REQUIREMENTS

| Stair element | Minimum Req. | Preferred | Maximum |
|---|---|---|---|
| Rise | Pitch as NZBC | - | 180 |
| Going | 310mm | - | Pitch as NZBC |
| Pitch | NZBC | - | 37 degrees |
| Risers per flight | 2 | - | 2.5m rise |
| Landing | 1.2m | 1.5m | - |

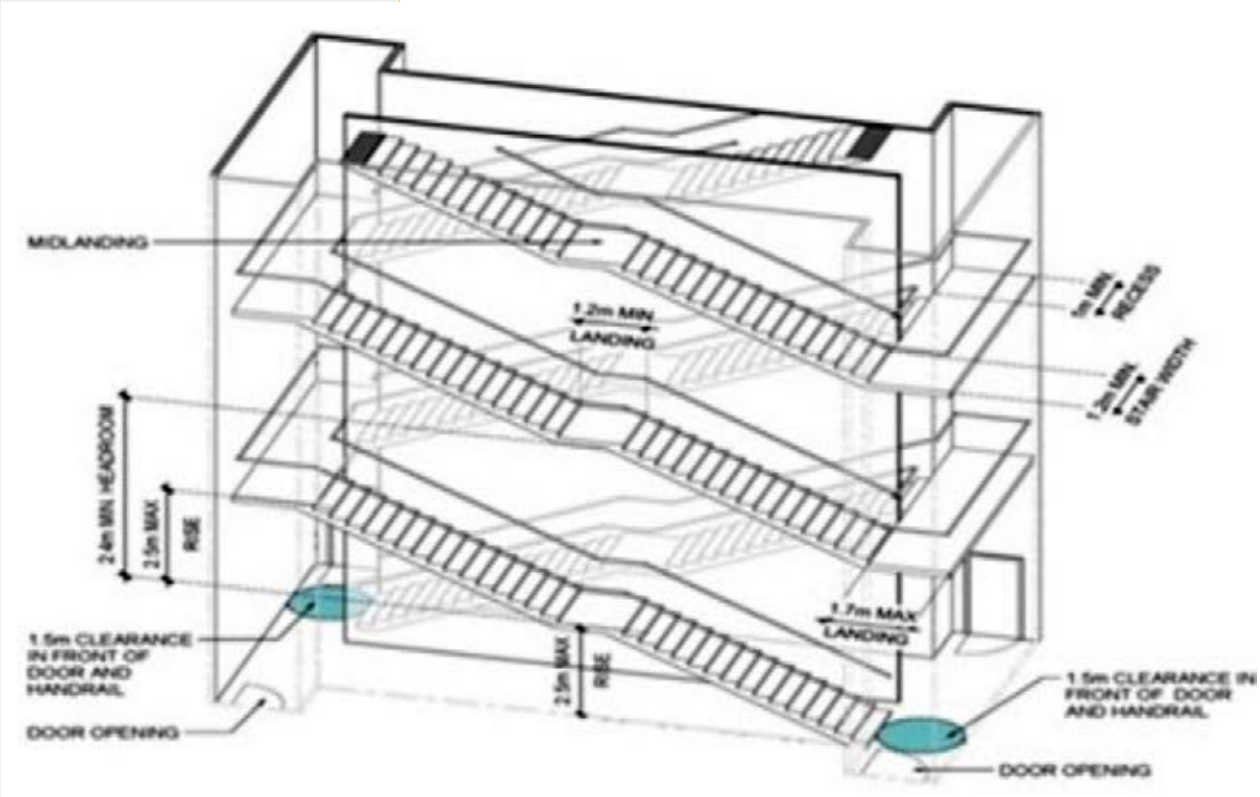



**Figure 24** Egress scissor stair requirements

## 10.4 Escalators

Escalators must:

- Have capacity based on patronage and allowing for redundancy.
- Be of the heavy duty metro type.
- Integrate lighting, speakers and emergency stop and auto-start sensors that allow escalator to stop when it is not in use.
- Be reversible.
- Be weather-proof and provide resistance against water, moisture and fog at exposed stations.

Maintenance structures loads may not carried on the escalator treads or ceiling.

Designers must consider:

- The installation of maintenance equipment.
- Segregation between a working and non-working escalator.
- Location of intermediate escalator support (if required), as they may on be at the centre point of the escalator.

**RAIN**

All escalators must be fully protected from water ingress in protective enclosures, including protection from wind-driven rain. To avoid doubt, the assumed rain path must assume a 45° angle from the edge of any protective roof or canopy and all flooring in the vicinity of the escalator landing must have a slight fall away from the escalator to minimise floor-borne moisture from entering the escalator operational parts.

**REMOTE MONITORING**

Escalators must be fitted with remote monitoring of all operationally critical systems, e.g. motors, stop activation mechanisms, belts and chains, to give advance warning of potential failure and permit preventative maintenance regimes to be enacted. Escalators should monitored by CCTV and be able to be slowed, stopped, started and reversed remotely. This may be by local station staff or off site control room."

**EMERGENCY ESCAPE**

While this is part of emergency escape process this is also when people or objects get  trapped in the escalator.

Where operating, escalators must be considered as part of the emergency escape provisions for the station, they must be capable of slowing, stopping and reversing direction in a fully loaded condition Where stopped escalators must be considered as part of the station escape strategy, a 30 second interval must be taken into account for the slowing down of the escalator to a stopped position to be used as a fixed stair.

Signs should warn people when an escalator is in an energy saver mode and may start or speed up.

**ENERGY SAVING**

All escalators must be capable of operating in energy saving standby mode.

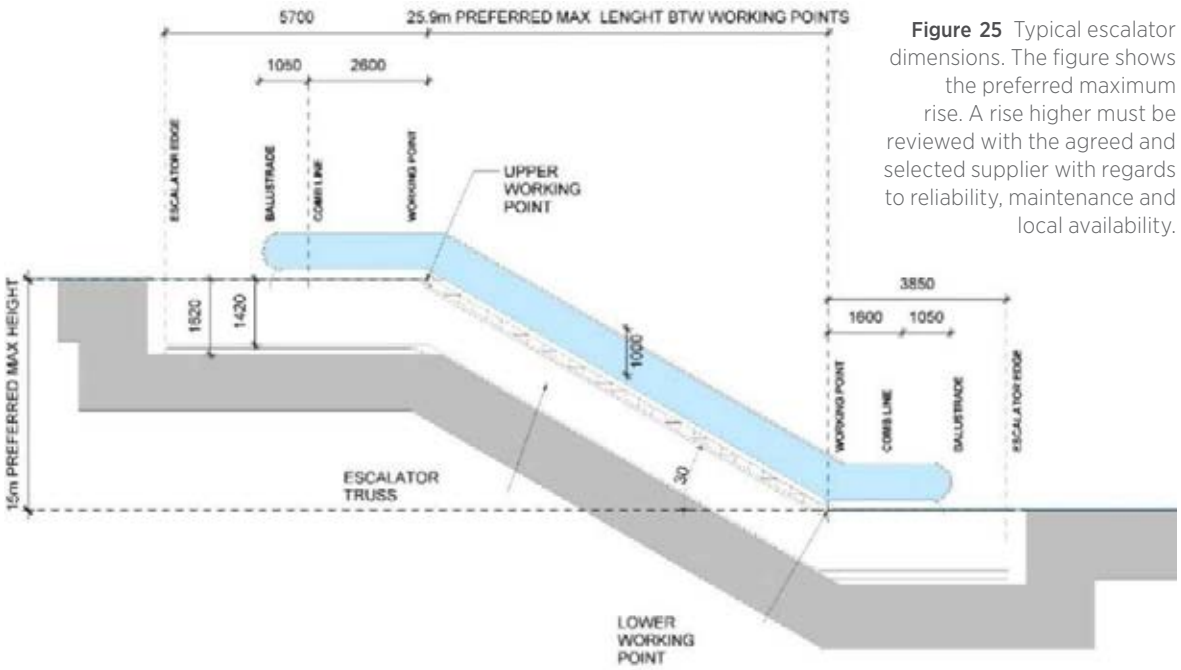



**Figure 25** Typical escalator dimensions. The figure shows the preferred maximum rise. A rise higher must be reviewed with the agreed and selected supplier with regards to reliability, maintenance and local availability.

TABLE 7 ESCALATOR REQUIREMENTS

| Escalator element | Standard |
|---|---|
| Maximum inclination | 30° |
| Minimum tread width | 1m |
| Normal maximum operating capacity | 100 passengers per minute |
| Tread configuration | Four level treads before risers at top and bottom landings |
| Overall width | 1,65m overall including finishes |
| Balustrade type | Vertical glass or stainless steel |
| Balustrade height | 1m |
| Pit truss and depth bottom | Minimum dimensions<br>1,295m truss<br>300mm between truss and pit<br>Overall 1,595m |
| Pit depth top | 1,42m truss<br>200mm between truss and pit<br>Overall 1,62m |
| Truss and finish (diagonal truss) | 1,25m |
| Working point top | 5,7m between working point and escalator box |
| Working point bottom | 3,85m between working point and escalator box |

* The dimension used is the upper limit of the major escalator manufacturers surveyed.

A: Overall three-escalator bank width

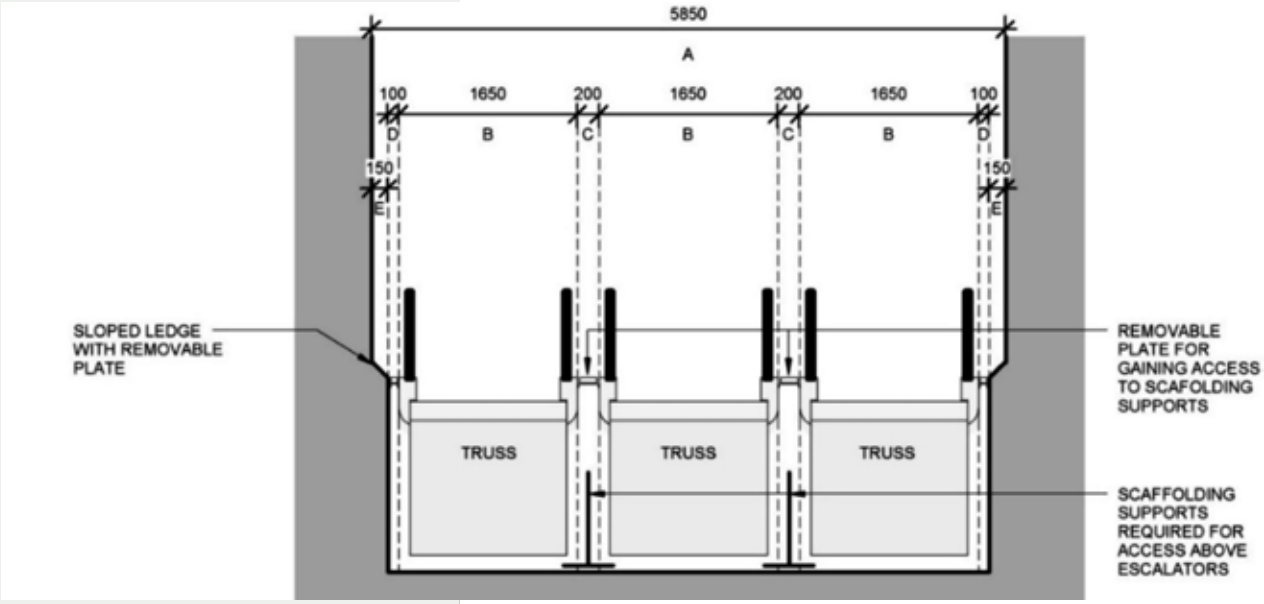



**Figure 26** Typical escalator spacing

B: This dimension is overall the escalator truss and no allowance has been added for a finish that is attached to the side of the truss.

The top s/s plate an allowance of say 30-50mm should be added.

C: Distance between escalators when scaffold support is required

D: Distance between truss and primary structure

E: Distance between truss and wall finish

## 10.5 Lifts


Public access lifts must:

- Lifts to platforms must be on the paid side of the ticket gatelines
- Meet patronage demand
- Have high-quality interior finishes
- Contain glass vision panels where fully glazed is not possible
- Include a CCTV camera fixed in the lift car which provides visibility of the occupants
- Be sized to accommodate standard patient stretchers and mobility scooters
- Provide vandal proof call buttons with LED indication lights
- Allow special needs access via at least one lift
- Have a continuous heavy duty support rail 950-1050mm above the ground with at least 30mm clear finger space from the wall
- Have heavy duty doors clearly colour contrasted with the door surroundings
- Allow raised tactile numbers at least 20mm high on the leading edge of landing doors or architrave entrances, 1350mm above the floor
- Include heavy duty call buttons on both side walls of lift car.
- Have call buttons accessible by both standing and wheelchair seated persons. They must positive movement on actuation, with width and diameter of call buttons at least 20mm
- Include an impervious heavy duty splash back
- Vandal resistant internal finishes
- Floor finish.

- Have 150mm heavy duty stainless steel skirting intended from interior wall finish.
- Refer to island section for further information.

**REMOTE MONITORING**

All lifts must be fitted with remote monitoring of all operationally critical systems, e.g. motors, door activation mechanisms, door edge contacts, sump pumps, to give advance warning of potential failure so that preventative maintenance can be done.

When a lift alarm is activated the responding control room operator must be able to see the lift occupants and the surrounding areas on the CCTV systems. The monitoring should be linked to AT's SCADA system, it may be linked to a lift specialist as well.

**ELECTRICAL**

The designer must include assessment of earth bonding and touch potential electrical requirements for all installations within station areas near the overhead line electrification system.

**ACCESS FOR MAINTENANCE**

Permanent access for maintaining the lift and lift shaft must be designed as an integral part of the lift shaft

All stations must provide an available accessible route between the surface and platform.

No lift door must open directly onto a platform face.

**RAIN**

Lifts must be designed with full protection from wind-driven rain and full protection from water ingress at all landings. Heavy duty etched stainless steel lift thresholds must be designed at all landings and the floor finish within the landing area must prevent water entering the lift shaft at the landing threshold.

**LIFT SHAFT**

Lift shafts must meet durability requirements defined for the main station buildings. Rainwater drainage from the lift shaft roof must be directed outside of the lift shaft to minimise water ingress. Internal lift shaft walls must be flush, with no horizontal ledges.

**SUMP**

All lift pits must be provided with drained sumps fitted with automatic remote monitored detection systems linked to AT's SCADA system, in case water levels exceed design levels.

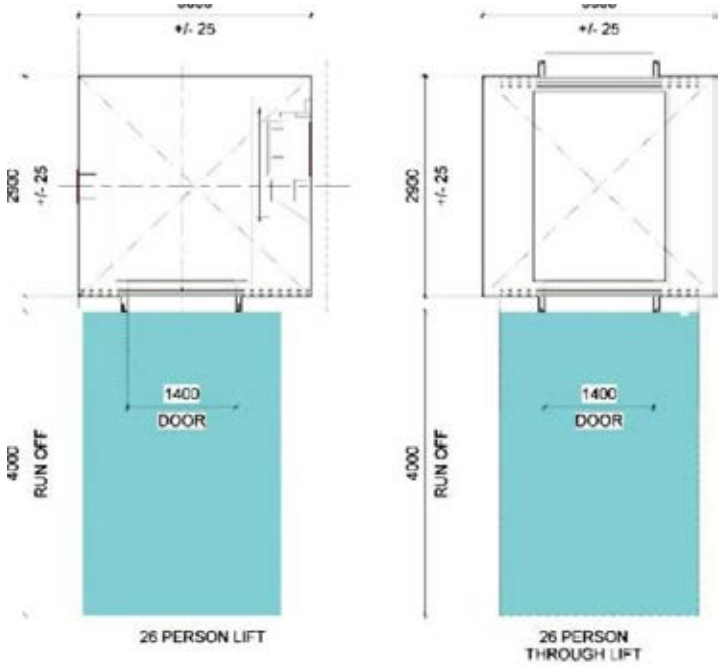



**Figure 27** Passenger lift requirements

TABLE 8 26-PERSON PASSENGER LIFT REQUIREMENTS

| Element | Requirement (typical) |
|---|---|
| Lift shaft – internal | 3.0m wide<br>2.9m deep<br>1.4m door opening |
| Lift car door type | Central opening |
| Lift overrun | 4.5m (measured from last floor served) |
| Lift pit | 2m (measured from first floor served) |
| Emergency egress to lift shaft | Where vertical distance between lift doors is more than 12.2m |

11

# Design for impaired customers

REQUIREMENT

Stations and precincts must be designed following NZS 4121, Design for Access and Mobility – Buildings and Associated Facilities, to provide equitable access for all customers, including users with reduced mobility and other disabilities.


**Figure 28** Passenger types to consider for universal access

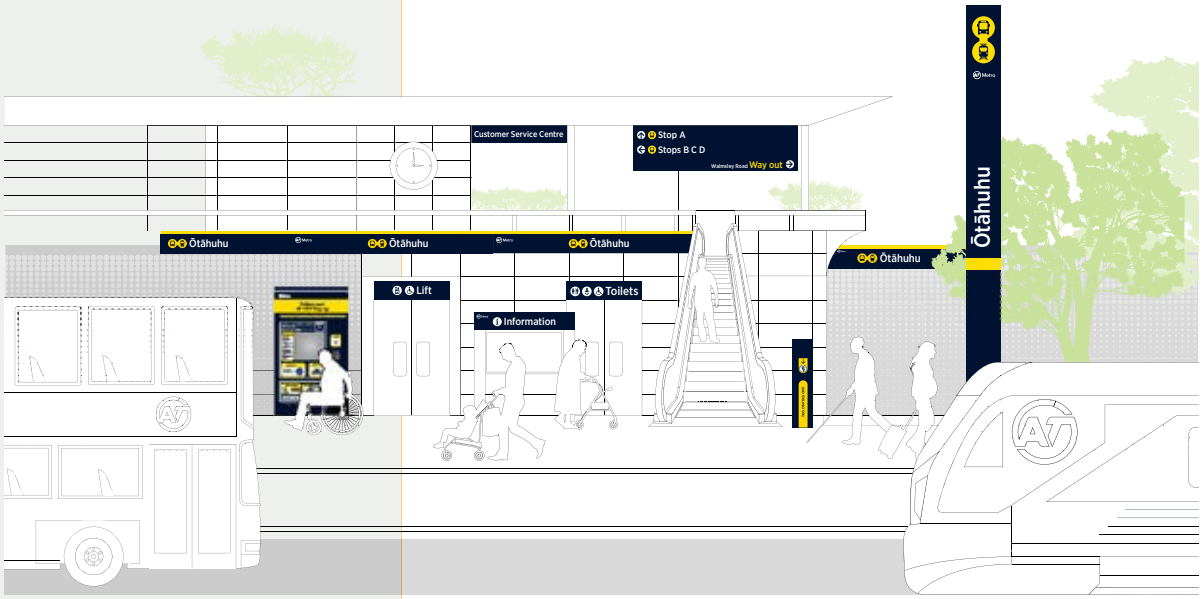
TABLE 9 PASSENGER TYPES AND ACCESS REQUIREMENTS

| Type | Description |
|---|---|
| Reduced mobility passenger type 1 | Reduced sight and hearing |
| Regular ambulant users | People using the network daily |
| Social users | People on cultural and shopping trips |
| Family | Parents/guardians with young children and buggies |
| Tourists | People who may be new to the network |
| Elderly | People who may move slower and may need assistance |
| Reduced mobility type 2 | People using wheelchairs and buggies or encumbered with luggage |

## AREAS

Accessible areas include:

- Accessible routes
- Car parks
- Footpaths, ramps and landing
- Entrances, corridors, doorways and doors
- Stairs
- Lifts
- Toilet facilities
- Places of assembly, entertainment and recreation
- Accessible outdoor areas
- Accessible accommodation




Maintenance and plant areas are not required to be accessible in accordance with NZS 4121. Station staff areas and train crew areas are not required by Auckland Transport to be accessible in accordance with NZS 4121 as all staff working in these areas are required to be able bodied

## OUTSIDE

Accessible passenger pick-up and drop-off points must be available.

## FLOORS

There must be a route of universal access between the surface and platform. Stations must be designed to provide step free access to all public areas from the station precinct, the station entrance through the station to platform level and the boarding of trains.

Tactile surfaces must be provided at the approaches to drop kerbs in pavements, approaches to vertical transport elements and along the platform edge to assist passengers with sight impediments, as per NZ/AS 1428.4 Design for access and mobility Part 4: Tactile indicators.

Clear floor zones and run-offs must be provided in front of station components as defined in passenger space planning requirements.

**TONAL CONTRASTS**

Tonal contrasts between materials and finishes within the public areas of stations must be provided to assist those with sight impediments to ensure that handrails, doorways and junctions between floors and walls are clearly identified. Fittings and fixtures that pose a potential tripping hazard and isolated obstructions in access routes within stations must be avoided.

**BRAILLE MAPS**

Braille maps must be provided at the station entrances describing the station layout for passengers with impaired vision. Braille identification on lift controls and customer help-point call buttons must be provided for passengers with impaired vision.

GIS based devices to aid navigation for passengers with reduced sight are emerging onto the market and where possible these devices must be supported within the station through the provision of systems within the station footprint to transmit location information to those with visual disabilities

**HEARING**

Induction loops must be provided at the customer service centre, at station entrances and at passenger help points to assist passengers with hearing impediments.

**TOILETS**

Public toilets must include male and female toilets for passengers with impaired mobility.

**LIFTS**

Public lifts must be designed to accommodate the loads and size of mobility impaired scooters

Call for aid facilities must be provided in all mobility-impaired toilets, gatelines and in public lifts.

**PASSENGER HELP POINTS**

Passenger help points must be provided at coach 2 and 5 of a six-carriage train along each platform next to the platform seating units and at the approaches to lifts. These help points must be covered by CCTV so that when the help points are activated the responding control room operator must be able to see the help point on the CCTV systems.

# 12 Safety and security

**REQUIREMENT**

Stations must be designed taking into account the need to reduce the safety risks of constructing, operating and maintaining stations so far as reasonably practical.

The design for safety approach must by adoption of a risk management process:

- Minimise the need for high-risk construction or maintenance activities.
- Incorporate provisions for safe access for construction, maintenance and replacement into the design.
- Reduce the need for maintenance interventions by suitable design and specifications
- Ensure passenger safety in the event of individuals falling off platforms.

**RISK REGISTER**

The design for safety approach must include preparation of a risk register at the design stage capable of being used for management of safety by the future constructors and maintainers.

COMPLIANCE

All works must be designed to comply with the current requirements of relevant New Zealand legislation for construction, operation and maintenance, including

- the NZ Building Code,
- NZ Standards,
- Railway Act 2005,
- Health and Safety at Work Act 2015,
- H&S in Employment Act 1992,
- H&S in Employment Regulations 1995, and
- Electricity (Safety) Regulations 2010.

OPERATIONAL SAFETY

The process of assuring adequate railway operational safety for passengers and staff is described elsewhere as it requires a multi-discipline approach covering all disciplines and station elements.

## 12.1 Hazards and risks

RISK ASSESSMENT

Stations must include a comprehensive cross discipline risk assessment at each stage of design development that meets the Auckland Transport risk management process and must include:

- The safe means of access and space planning for all public and staff areas of the station.
- A safe means of access for maintenance equipment, plant and machinery during planned and unplanned maintenance. operations with particular attention to station elements that are in close proximity to the operational rail envelope;
- Recess-free public spaces and cladding systems and avoid designs that could harbour litter and provide possible hiding places.
- Material finishes in all staff and public areas to ensure that risks associated with the operation and maintenance of the station

TABLE 10 STATUTORY APPROVALS FOR HAZARDS AND RISKS

| No. | Description | Requirements for... |
|---|---|---|
| B1 | Structure | Acceptable structural solutions |
| B1/ VM1 | Verification method | Verification of structures |
| B2 | Durability | Durability of structures |
| D1 | Access routes | Access routes into and within building |
| E1 | Surface water | Stormwater infrastructure |
| E2 | External moisture | Protection of buildings from external moisture |
| F4 | Safety from falling | Protection against falling within the stations and above-ground buildings |
| F8 | Signs | Provision of statutory signage |

ELECTRICAL

Station platforms must include a platform insulation zone for future platform screen doors between the traction electrical earth zone and station electrical earth zone as follows:

- The platform substructure floor must be covered with a high-resistance material, (such as high resistance tiles, insulating screed, waterproofing membrane or similar approved) under the platform substructure upper surface.
- The platform return walls (platform ends) must be treated in a similar manner.
- The platform isolation zone must be at least 2.5m wide.
- Any continuous conductive elements, such as handrails, cable conduits, etc., must be made discontinuous via air gap before entry into the platform isolation zone. (See the earthing and bonding requirements.)

The earthing and bonding requirements must be applied to station structures, lifts, escalators addressing the touch potential risks.

## 12.2 Emergencies

REQUIREMENT

Station layouts, the design of station structures, components, systems, finishes and fittings must be designed to satisfy fire and life safety requirements

INCIDENT MANAGEMENT

Stations must be designed to provide sufficient space and complementary systems for the management of incidents and for the safe evacuation of all passengers and staff within the required evacuation time in the event of a fire or other emergency incident in line with the station fire safety strategy.

MATERIALS

All building materials used in a sub-surface location must be non-combustible or fire resistant with low smoke and low toxicity emission levels. In the event that the use of combustible materials cannot be avoided, the quantity must be limited such that the overall density will not constitute a hazard.

INSULATION

Walls, partitions and floors must provide the required levels of insulation as set out in the station fire strategy.

EMERGENCY ACCESS

Emergency services access to the fire control/station control room and intervention stairs and lifts must be independent from the normal station public entrances. Fire control/station control rooms must be fire segregated to provide two-hour fire protection and be designed to continue to operate during a fire incident within the station and be provided with a segregated emergency exit. Even if not all initially fitted with ticket gates, all station evacuation calculations must be undertaken on the basis that ticket gates are installed.

DO NOT ENTER

Sub-surface stations must be fitted with Emergency–Do Not Enter (EDNE) signs at station entrances and above each gate-line. EDNE signs must be operated during an emergency evacuation to deter passengers from entering the station.

## EVACUATION

The means of egress must be sufficient to evacuate the station, in accordance with the following requirements, under an emergency scenario that assumes that a delayed train enters a station on fire during the peak hour.

Sufficient egress routes must be available to evacuate all passengers from the station platform(s) under the egress time criteria to a point of safety.

A point of safety is defined as an enclosed exit that leads to a public way or safe location outside the station or an at-grade point beyond the enclosed station.

The occupant load for the stations must be based on the train load of trains entering the station plus the simultaneous entraining load awaiting trains calculated as per the above passenger modelling requirements.

At multilevel, multiline, or multiplatform stations:

- The maximum occupant load for each platform must be used for calculating the sizes of the means of egress from that platform.
- Additional occupant loads for areas of stations not intended for use by passengers must be determined in accordance with the acceptable solutions of the New Zealand Building Code that are applicable to the intended uses of those areas.
- The additional occupant loads must be used for calculating the sizes of the means of egress from those areas.
- The additional occupant loads for areas of stations not intended for use by passengers may be omitted from the station passenger occupant loads where the non-passenger areas have sufficient number and capacity independent means of egress.

Egress capacity must be provided to evacuate the platform occupant loads:

- From the station platforms in four minutes or less
- To a point of safety in six minutes or less.

These times may be extended based on an engineering analysis prepared by the contractor and reviewed without objection by the principal's representative.

## EVACUATION TIMES

Evacuation times must be calculated in accordance with the methodology and parameters defined in NFPA 130:2017 Sections 5.3.4, 5.3.5, 5.3.7, and 5.3.9.

## ESCALATORS

In calculating egress capacity, one escalator at each level must be considered out of service at each level. For each level, the escalator which has the most adverse effect on egress capacity level must be considered out of service. Escalators running in the direction of egress must be assumed to remain operating. Escalators running reverse to the direction of egress must be capable of being stopped locally and remotely in accordance with the requirements of NFPA 130. Provisions for remote stopping of escalators must be in accordance with the requirements of NFPA 130:2017 Section 5.3.5. If the station fire strategy necessitates that stopped escalators must be able to be restarted in the direction of egress, this functionality must be provided in accordance with the requirements of NFPA 130: 2017 Section 5.3.5.

## 12.3 Security

**REQUIREMENT**

Stations must be designed so as to engender a feeling of safety and security for staff and public moving through all areas. This will create an environment in which passengers and staff feel comfortable and with no perceivable threat to their personal safety, security and wellbeing in line with the requirements set out in the crime prevention through environmental design (CPTED) principles and guidelines. This must be achieved by establishing the infrastructure such that a practical minimum level of active control and supervision is required to achieve the above security objective.

**CCTV**

CCTV will be used to provide a feeling of security and enable AT to manage and respond to events and incidents. The CCTV system will cover all areas that need to be secure and provide quality images that can be used as evidence and be recorded. CCTV will be monitored from control rooms and other locations.

**FOOTPATHS**

Footpaths adjacent to station entrances/secure accommodation must be provided with steel bollards at 1500mm centres to prevent vehicles from mounting the kerbs and used to penetrate the building envelope

**OUTSIDE**

Station facilities and the immediate precinct outside of station entrances must be designed from a personal safety and security perspective, lit to a high level and even distribution of illumination using high quality white light sources with good colour rendition, must avoid obstructions, avoid concealed and difficult to monitor spaces and must be provided with comprehensive coverage of CCTV monitoring from control rooms and other locations.

**ENTRANCES**

Station entrances must be designed to prevent unauthorized access to the railway operational area when the station is closed.

**MAINTENANCE ACCESS**

Remote maintenance access points must be provided with audio/visual links to the station control room and remote release door locks e.g. where access for maintenance is located within shafts remote from the station control room

**KEY LOCKS**

Electronic locks controlled by AT's security system should be provided for doors.

**STAFF FACILITIES**

Staff facilities and active frontages from retail activities within the station must be used to assist in passive security monitoring in addition to CCTV coverage.

**CASH HANDLING**

All rooms used for the handling of cash must be provided with additional security measures such as panic buttons, intruder detection, anti-bandit laminated glazing and three way locking devices on secure doorways. Where possible the location of ticket issuing machines and cash machines must be chosen to permit access from a secure room outside of the public domain for cash removal/refilling.

Further security measures must be developed within station designs in response to ongoing dialogues with the police and security services.

TABLE 11 CPTED DESIGN PRINCIPLES FOR STATION DESIGNS

**Access, movement, sightlines and natural surveillance**

- Provide safe movement, good connections and access along paths, changes of direction or changes in height.
- Entrances to buildings must be safe and accessible without compromising security.
- Avoid sudden or blind corners.
- Views must not be obscured by obstructions that provide hiding places for offenders.
- Pedestrian tunnels/underpasses must have end-to-end visibility.
- Surveillance equipment and help points must be clearly visible and identifiable.
- High-risk activities must be shifted to high trafficked locations and take advantage of natural surveillance within the safe area.
- Reinforce passive surveillance to ensure passengers can see and be seen (for example, glazed lifts).
- Keep columns and other visual obstructions to minimum dimensions.

**Lighting**

- Provide consistently placed, high quality lighting which will not conflict with obstructions or create areas of shadow or excessive contrast to lighting levels.
- Use white light where possible to enhance face recognition and improved visibility.
- Lighting must comply with New Zealand building standards and relevant codes.
- Exterior and interior spaces must be evenly lit to allow for surveillance.
- Maximise natural light through the use of glazing or transparent materials on elevations and skylights.
- Finishes must be utilised to maximise the sense of spaciousness, light and airiness.
- Lighting must not distract or interfere with drivers of trains or other rail vehicles.

**Active routes**

- Public places must encourage social interaction, a mix of uses and allow surveillance so that spaces can be used throughout the day and the evening.
- Pedestrian/ cycling routes must be designed to promote use.
- Pedestrian routes must run alongside vehicular routes and be visible.
- Where buildings are set back from the street the area must be developed to minimise hiding and entrapment spots.
- Routes must be designed along active edges and visible from staff zones where possible.
- Areas accommodating cash transactions must be located in high traffic areas and visible from staff areas.
- Natural access is considered, providing clear entry and exit points and a legible, accessible route through the space.
- The public must be clearly guided from specific entrances and exits.

**Appearance**

- Materials and finishes must be selected based on durability, robustness, high quality and appropriately positioned for routine maintenance and limit incidents of vandalism.
- Provide a high quality attractive environment/asset appreciated by users and broader community.
- Spaces must be detailed in a manner that deters scaling (climbing).
- Consideration must be given to placing higher-quality materials in locations that provide high-quality environments while minimising potential for vandalism.

**Avoiding potential entrapment situations**

- Station and precinct spaces must provide alternative routes or exits and avoid entrapment.
- Signage must warn people of potential entrapment spots and alternative routes.

**Clear ownership**

- Define space ownership to limit vandalism, graffiti and anti-social behaviour.
- Avoid creating “left over spaces” for which no-one (public asset or rail operator) assumes ownership.
- Design spaces to accommodate long-term and continued use fit for its purpose. These include forecourt, unpaid concourse, ticket hall and paid concourse areas.

# 13 Passenger modelling

**REQUIREMENT**

All public areas of each station must be modelled using proprietary dynamic passenger modelling tools. The tool must be agreed with Auckland Transport prior to the use of the tool. Such modelling must provide agent-based simulation of the passenger movements around the station, boarding and alighting from trains, using stairs, lifts and escalators and ticket gatelines. It must output the passenger densities in the public areas and highlight areas of congestion.

**AREAS**

Passenger modelling must include all train platforms, concourses, ticket gate lines, stairs, escalators, lifts, walkways and paid areas, extending to all station entrances and exits.

**SCENARIOS**

Passenger modelling must demonstrate compliance with space planning requirements and safe station operational performance during:

- Normal morning peak period
- Normal afternoon peak period
- Disrupted operations
- Emergency escape.

The scenarios in this section of the design guide must be modelled for each station. Compliance against the appropriate assessment criteria must be demonstrated. Several sensitivity cases are required to provide information for operational planning purposes only.

For the emergency evacuation scenario, the station occupancy, station configuration, modelling assumptions and assessment criteria must be in accordance with the requirements for stations egress assessment.

For each station, sensitivity cases must be modelled for Scenarios A1 and A2 with one escalator out of service at each station level.

TABLE 12 DYNAMIC PASSENGER MODELLING SCENARIOS

| Scenario | Description | Period | Assessment Criteria |
|---|---|---|---|
| A1 | Normal operations | morning 15-minute peak | Normal operations performance criteria |
| A2 | Normal operations | afternoon 15-minute peak | Normal operations performance criteria |
| B | 1x Missed headway on worst case incident line | afternoon 15-minute peak | Disrupted operations performance criteria |
| C | 2x Missed headway on worst case incident line | afternoon 15-minute peak | For information only |
| D | Emergency evacuation of station with 1x incident train | To meet the requirements of stations egress assessment (Section 4.8) | To meet the requirements of stations egress assessment (Section 4.8) |
| E1 | As for A1 with +20% above normal passenger demand levels | morning 15-minute peak | For information only |
| E2 | As for A1 with +20% above normal passenger demand levels | afternoon 15-minute peak | For information only |
| F | As for B with +20% above normal passenger demand levels | afternoon 15-minute peak | For information only |
| G | As for D with +20% above normal passenger demand levels | afternoon 15-minute peak | For information only |

### ASSESSMENT CRITERIA

Station space planning for all boarding and alighting passenger volumes during the average minute in the peak fifteen minutes in the peak operating hour in normal and disrupted operations must achieve the Fruin level of service requirements stated in Table 14.

Station space planning for normal operations must achieve the station access and queuing times criteria stated in Table 13 for all boarding and alighting passenger volumes during the average minute in the peak 15-minutes in the peak operating hour.

### TICKET HALLS, ENTRANCES AND CONCOURSES

In ticket halls and entrances and concourses, maintain

- Fruin level of service C = 0.93m$^2$ per person
- Fruin level of service D = 0.45m$^2$ per person

Assume all primary flows are unobstructed with no cross flows.

Gate line 25 persons per minute per gate/validator.

Calculated for the average minute in the peak five-minute flow 25 persons per minute per gate/validator.

Calculated for the average minute in the peak five-minute flow.

Assuming redundancy of one gate in each gate line with up to 10 gates, two gates for gate lines over 10. One wide aisle gate to be provided in every gate line.

## PASSAGEWAYS AND CORRIDORS

In passageways and corridors, the required levels of service are:

- Two-way: Fruin level of service C = 40 people per minute per metre width.
- One-way: Fruin level of service D = 50 people per minute per metre width.

## PLATFORMS

On platforms with simultaneous train arrivals, the required levels of service are:

- Fruin level of service C = 0.8m2 per person
- Fruin level of service D = 0.45m2 per person

Normal operational space must be assessed on disproportionate loading of 35% of passengers in 25% of the platform length.

Edge effects must be 0.5m at the front and back of the platform face.

## PEAK LOADINGS

Afternoon peak loadings must include for multiple destinations where 30% of passengers arrive and wait for the second train and 10% of passengers arrive and wait for the third train.

## STAIRS AND ESCALATORS

On stairs and escalators, the required levels of service are:

- Two-way flow: Fruin level of service C = 28 persons per minute per metre
- One-way flow: Fruin level of service D = 35 persons per minute per meter
- Escalator: 100 people per minute.

TABLE 13 STATION ACCESS TARGETS

| Maximum... | Time |
|---|---|
| Average access time from entrance to platform (excluding ticket purchase) | 5 minutes |
| Queuing time at entry or exit ticket gates | 10 seconds |
| Queuing time for escalators, other than at platform | 10 seconds |
| Queuing time at escalators departing platform | 30 seconds |
| Clearance time of alighting passengers at platform level from a single train | 90 seconds |
| Clearance time of alighting passengers at platform level from two simultaneously arriving trains | 150 seconds |

## PASSENGER MODELLING PARAMETERS

Passenger modelling must be based on the architectural plans of the stations, accurately dimensioned. When modelling platforms, the edge 0.5m is considered not available for use, to account for edge effects.

All normal and disrupted scenarios must model the morning or afternoon 15-minute peak period, with an additional 15 minute initialisation period to simulate normal operations before the 15 minute peak begins.

Passengers must be modelled with a normally distributed Fruin walking speed distribution with a mean of 1.35m/s, a maximum of 2.05m/s, a minimum of 0.65m/s and a standard deviation of 0.255.

Passengers on escalators must be modelled with a uniform speed of 0.65m/s. Escalators flow rate must be 100 passengers/minute. Ticket gate lines must be modelled with a capacity of 25 persons per minute per gate/validator.

## ASSUMPTIONS

Passenger modelling must assume the following passenger arrival model as described in Functional Requirements for Station Architecture and Urban Integration:

- Passenger entry into the station is uniformly distributed (constant flow rate).
- Passenger entry does not take service pattern into account.
- Normal operations must assume that at the time of train arrival the passengers on the platform is the sum of:
  - 100% of the arriving train (first train)
  - 30% of the following train (second train)
  - 10% of the second following train (third train).
- A one missed headway scenario must assume that at the time of train arrival the passengers on the platform is the sum of:
  - 100% of the missed train (first train)
  - 100% of the following train (second train)
  - 10% of the second following train (third train).
- A two missed headway scenario must assume that at the time of train arrival the passenger number on the platform is the sum of:
  - 100% of the first missed train (first train)
  - 100% of the second missed train (second train)
  - 100% of the second following train (third train).
- Following a missed headway, the number of passengers on trains arriving at a station must account for any additional passengers on trains due to the service disruption.

## PATRONAGE AND PEAK FACTORING

All passenger modelling must use the Auckland Transport APT3 demand forecast model which is derived using a maximum line capacity approach link flows, boarding and alighting numbers and interchange numbers in the morning peak hour. The afternoon peak hour patronage must be assumed to be the reverse position of the morning peak hour patronage, unless survey data can demonstrate that another figure should be used.

The following surge factors must be used to derive passenger flow rates for the peak 15 minutes, 5 minutes and 1 minute from the one-hour patronage:

- The peak 15 minute flow rate = 1 hour flow x 0.28
- The average 1 minute flow in the peak 15 minutes = the peak 15 minute flow divided by 15
- The peak 5 minute flow rate = the peak 15 minute flow x 0.4
- The average 1 minute flow in the peak 5 minutes = the 5 minute flow divided by 5.

Peak factoring has not been defined for major events or off-peak periods.

# 14 Space planning calculations

## REQUIREMENT

All passenger routes within stations must be designed to minimise the number of changes of direction, provide clarity of spatial organisation to enable ease of navigation, avoid conflicting flows and provide intuitive wayfinding without reliance upon excessive signage and customer information displays.

All public spaces must be designed to accommodate the expected passenger volumes in the average minute in the peak 15 minutes of the peak operating hour not below Fruin level of service C in the design year, 30 years from project completion.

TABLE 14 FRUIN LEVELS OF SERVICE

| Level of service | Description | Area for queues per person |
|---|---|---|
| A | Free circulation. | >1.2m$^2$ |
| B | Unidirectional flows and free circulation. Reverse and cross-flows with only minor conflicts. | >0.9m$^2$ |
| C | Slightly restricted circulation due to difficulty in passing others. Reverse and cross-flows with difficulty. | >0.65m$^2$ |
| D | Restricted circulation for most pedestrians. Significant difficulty for reverse and cross-flows. | >0.28m$^2$ |
| E | Restricted circulation for all pedestrians. Intermittent stoppages and serious difficulties for reverse and cross-flows. | >0.19m$^2$ |
| F | Complete breakdown in traffic flow with many stoppages. | <0.19m$^2$ |

## VERTICAL TRANSPORT

Vertical transportation must be designed to be sufficient for expected passenger demand in the average minute in the peak fifteen minutes of the peak operating hour in the project design year and be capable of clearing two simultaneous train arrivals at platform level within 2.5 minutes.

## MODELLING TOOLS

All public areas of stations must be modelled using proprietary dynamic passenger modelling tools such as Steps or Legion for normal morning and afternoon peak periods, disrupted operations and emergency escape scenarios to demonstrate compliance with space planning and safe station operational performance. The completed model must form part of the completed design information for the project and handed to Auckland Transport for future use in modelling changes to the station over its operating life.

TABLE 15

| Station Area | Normal operation average minute in the peak fifteen minute peak. | | Degraded operation 1 missed headway | |
|---|---|---|---|---|
| | Level of service | Area per person people per minute | Level of service | Area per person |
| Ticket hall, forecourt entrances and concourse[1] | C<br>B | 0.93m²<br>1m² | D | 0.45m² |
| Queuing for ticketing | C | 1.8m² | D | 0.45m² |
| **Passageways** | | | | |
| One way | D | 50 ppm | D | 65 ppm |
| Two way | C | 40 ppm | D | 50 ppm |
| **Stairways** | | | | |
| One way | D | 35 ppm | E | 43 ppm |
| Two way | C | 28 ppm | D | 35 ppm |
| **Ramp** | | | | |
| One way | C | 36 ppm | | |
| Two way | C | 45 ppm | | |
| **Escalators** | | | | |
| Operating | C | 100 ppm | | |
| Stopped | C | 55 ppm | | |
| Platforms[2] | C | 0.8m² | D | 0.45m² |

**Note:** All public spaces must generally be designed to accommodate the expected passenger volumes in the average minute in the peak fifteen minutes of the peak operating hour in the design year.

1. Assumes all primary flows are unobstructed with no cross flows.

2. Afternoon peak loadings to include for multiple destinations where 30% of passengers arrive and wait for the second train and 10% of passengers arrive and wait for the third train.

## RUN-OFF DISTANCES

Sufficient run-off distances must be provided to and from lifts, escalators and stairs to enable safe use of vertical circulation and with the appropriate capacity to avoid passenger congestion and conflicting passenger movements.

TABLE 16 RUN-OFF DISTANCES

| Element | Run off/ Queuing (min) | People per minute |
|---|---|---|
| Stair to ticket gateline | 6-10m | N/A |
| Stair to passageway | 4m | N/A |
| Stair at street–to the back of footpath or other circulation zone (i.e. not obstructing or overlapping into circulation area) | 4m | N/A |
| Stair to escalator | 6-10m | Not required |
| Ticket gateline | | Level of service D<br>0.45m$^2$ queuing passengers |
| Ticket gateline at street | 6m | Not required |
| Ticket gateline to platform[1] | 4m | Not required |
| Lift doors to passageway | Length 4m<br>Width 500mm on either side of doors | Not required |
| Passenger information displays[2] | 2m | LoS B |
| Timetable board | 2m | Not required |
| Escalator to ticket gateline | 6m (<4 ticket gates)<br>8-12m (>4 ticket gates) | Not required |
| Escalator to passageway | 6m | Not required |
| Escalator to escalator | 8-12m | Not required |
| Escalator at street | 6m | Not required |
| Escalator switchbacks:<br>1 escalator<br>2 escalators<br>3 escalators<br>4 escalators | <br>6m<br>7.3m<br>8.7m<br>10m | Not required |
| Public passageways the clear circulation zone of the passage (i.e. not obstructing or over-lapping into the circulation area | | 50 ppm LoS C for 1-way flow<br>40 ppm for 2-way flow Los C |
| Retail outlets (active edges) | 4m | |
| Ticket vending machines (dedicated queue zone)[3] | Length 4m<br>Width 2m (1m centres)<br>6 people in queue | 1 per minute transaction |
| Ticket windows[3] | Length 4m<br>Windows 2m module<br>6 people in queue | 2 minutes per transaction |
| Ticket gateline/smart readers[4] | Length 4m<br>Width 2m<br>Centres 1m between machines | 25 people per gate per minute |
| Commercial vending machine and public phone | 0.9 x 1.2m<br>Length 4m<br>Width 1m<br>Centres 1m between machines | Not required |
| Automatic teller machine (ATM) | Length 4m<br>Width 2m<br>Centres 1m between machines<br>6 people in queue | |
| Seating[5] | 500mm | |

**Note:** station elements that are not nominated in this table required 0.9 x 1.2m minimum zone measure from the active face.
1. A fence between the gate lines and platform where gate lines perpendicular to platform edge.
2.10% of 15 minute peak Main information displays in the ticket halls require a queue space equal to the legibility of the board display
3. Maximum wait time: 3 minutes
4. Assuming redundancy of one gate in each ticket gateline with up to 10 gates, two gates for gate-lines over 10. One wide aisle gate to be provided in every ticket gate line.
5. Offset from passageways.

Variable run-off / run-on lengths are dependent on passenger flows as follows:

- Light patronage flow–where flow rate is less than 1000 passengers during the maximum peak hour for entry or exit. The applicable run-off is the minimum length in Table 15.
- Medium patronage flow–where flow rate is between 1000 and 3000 passengers during the maximum peak hour for entry or exit. The applicable run-off is determined by the equation:

$$\text{run-off lenght} = \left( \text{minimum run-off} + \left( \left( \frac{\text{peak hour flow -1000}}{500} \right) \right) \right)$$

Where the minimum run-off is the minimum length shown in Table 15.

Heavy patronage flow–where flow rate is greater than 3000 passengers during the maximum peak hour for entry or exit. The applicable run-off is the maximum length in Table15.

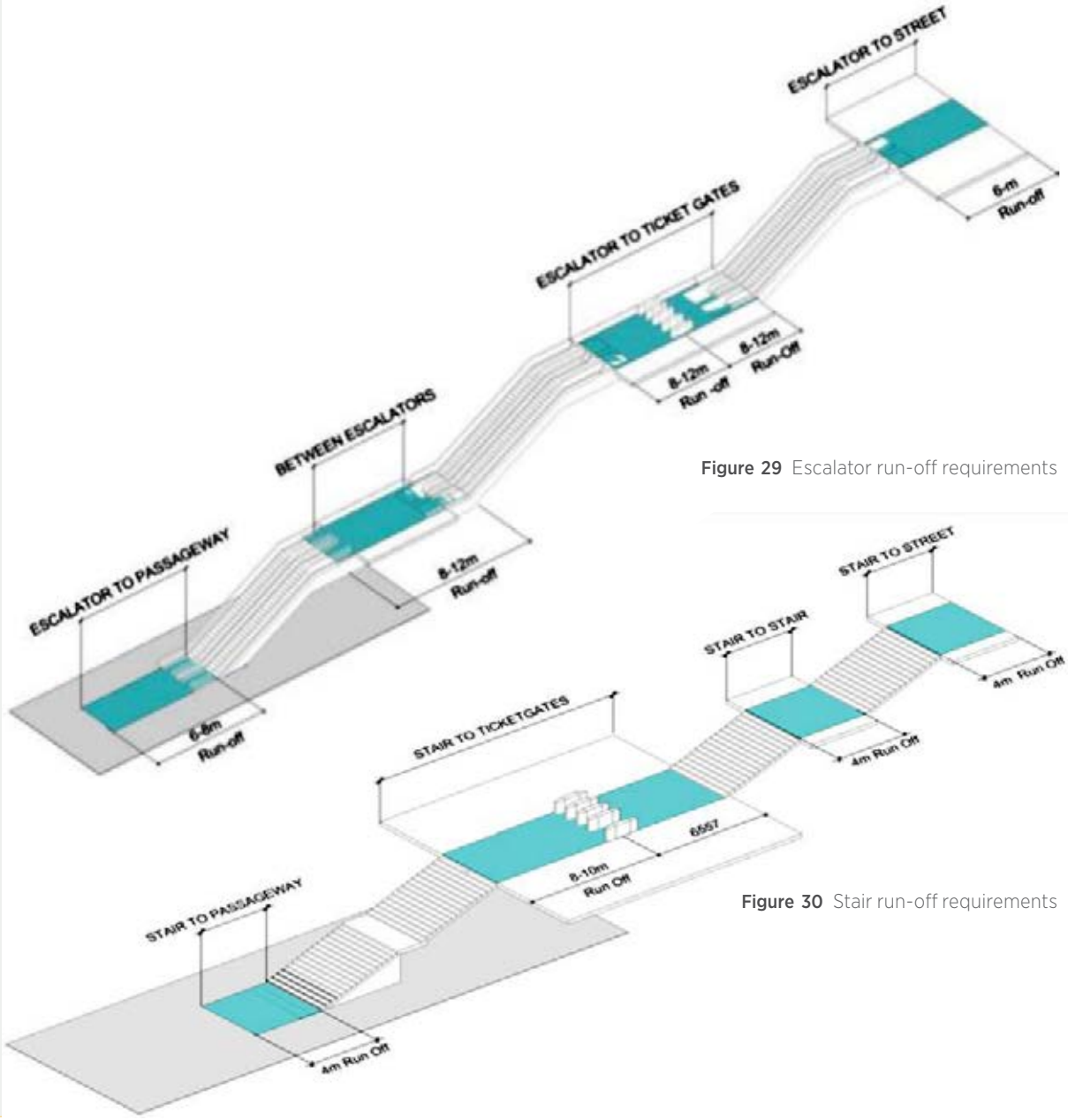



**Figure 29** Escalator run-off requirements




**Figure 30** Stair run-off requirements

## VERTICAL CALCULATIONS

Vertical circulation capacity must be calculated as follows:

- Vertical transport must be calculated on average per-minute flow rate in the peak 15-minute period.
- Vertical transport must be calculated for two trains arriving simultaneously on station platforms.
- A Fruin level of service C must be achieved on the platform and clear all alighting passengers from the platform area in under 2 minutes.
- Vertical circulation to and from platforms must be designed to accommodate one escalator and/or lift being out of commission for prolonged maintenance during normal peak operating periods at each station. During these times, level of service for degraded operations is acceptable.
- Under degraded conditions, it is acceptable to utilise all available circulation elements between the platform and entrance (including intervention stairs).
- Circulation elements are to provide convenient and intuitive movement paths between platforms and station entrances. Sizing of elements are to serve the predicted passenger flow anticipated for the entrance being served.

## ESCALATOR CALCULATIONS

The number of escalators must be determined as follows:

$$\text{number of escalators} = \left(\frac{\text{peak minute one way flow}}{100}\right)$$

## STAIR CALCULATIONS

Stair width must be determined as follows:

$$\text{2 way staircase width} = \left(\frac{\text{average peak minute flow}}{28}\right)$$

$$\text{1 way staircase width} = \left(\frac{\text{peak minute one way flow}}{35}\right)$$

## LIFT CALCULATIONS

Lift provision must be determined by station requirements as follows:

$$\text{The number of passengers waiting for lifts} = \frac{\text{(Peak minute passengers using lifts x lift cycle time (min))}}{\text{Number of lifts 28}}$$

## PASSAGE CALCULATION

Passageway width must be determined as follows:

$$\text{1 way passage width} = \left(\frac{\text{average peak minute flow}}{40} + (2\text{x}0.3)\right) \text{m}$$

$$\text{2 way passage width} = \left(\frac{\text{average peak minute flow}}{50} + (2\text{x}0.3)\right) \text{m}$$

## TICKET WINDOWS AND VENDING MACHINE CALCULATION

The number of ticket windows and ticket vending machines must be calculated using:

- The peak 15-minute morning entry flow
- The percentage of ticket window and ticket vending machine sales, based on peak 1-hour entry flow.
- The transaction times for ticket windows(60 seconds) and ticket vending machines (45 seconds)
- Maximum queuing time; 95% of people wait no more than 3 minutes.

There must be at least:

- Two ticket windows and one assistance window.
- One ticket vending machine, multi fare.
- One ticket vending machine, fare machine.
- One accessible ticket window and one accessible ticket vending machine per location.

TABLE 17 PERCENTAGE OF TICKET SALES

| Category of station | Total ticket sales* | Window sales | Ticket vending machine sales |
|---|---|---|---|
| City centre | 15% | 2% | 13% |
| Inner city | 15% | 2% | 13% |
| Suburban | 15% | 2% | 13% |

* Sales as a percentage of the total entry flow in morning 15-minute peak.

Use this formula to calculate the required number ticket windows:

$$\frac{\text{peak 15min TW sales x 95\% x average TW transaction time (sec)}}{\text{5 (no. of 3min periods in 15min) x 180 (no. of seconds in 3min)}}$$

Use this formula to calculate the required number ticket vending machines:

$$\frac{\text{peak 15min TW sales x 95\% x average TVM transaction time (sec)}}{\text{5 (no. of 3min periods in 15min) x 180 (no. of seconds in 3min)}}$$

## TICKET GATE CALCULATION

Each ticket hall must have at least three automatic gates. To see if more is required, follow these steps:

1. Calculate the number of gates required for entry flows, based on the forecast peak 5-minute entry flow.
2. Calculate the number of gates required for exit flows, based on the total of the alighting loads from all platforms, with the alighting load from the busiest platform increased by 25% (to allow for a gap in the service), all passing through the ticket gate line in two minutes.
3. if the total so far is 10 or less, add one additional gate. If it is more than 10, add two additional gates.

The same demand period must be used for entry and exit flows. This must be the busiest forecast 5-minute period in the traffic week. If forecast flows are not available, then the result based on current demand levels, before rounding up, of each of the first two parts of the calculation must be multiplied by 120%. Thus the required number of gates is determined by the formula below:

$$\left(\frac{\text{5min entry flow}}{25 \times 5}\right) + \text{Round up} \qquad \left(\frac{\text{total alighting load}}{25 \times 2}\right) + X$$

Where: X = 1 if total (without X) is less than or equal to 10 gates or X= 2 if total (without X) is more than 10 gates.

The total alighting load must be calculated from an individual train alighting load data for each platform or using the peak 15-minute flow data with the following formula applied to each platform.

The formula is:

$$\text{alighting load} = \left(\frac{\text{peak 15min alighting load}}{15}\right) \text{x train service headway}$$

Where:

- Train service headway is the time in minutes between trains in the peak hour in the period being considered.
- The alighting load is the number of passengers alighting from trains serving a given platform.
- For platforms served by a multiple train service (e.g., stations on the circle line), the combined train service headway must be used.
- The maximum number of passengers alighting from a train must be the practical crush capacity for the train stock type on the line.
- The alighting load from the busiest platform must be increased by 25%.
- The total alighting load must be sum of the alighting loads from each platform, including the increase of 25% to the alighting load from the busiest platform.

## PLATFORM WIDTH CALCULATION

The actual width required must be determined by passenger modelling. All platform sizing must be tested and confirmed with dynamic analysis.

- **Island platforms** must be at least 9.6m wide where the width is based upon a pair of escalators within the operational platform length with 3m clearance either side to the platform edge.
- **Side platforms** must be at least 4.5m wide where 3m is obstruction free and the remainder is occupied by seating and other station components.

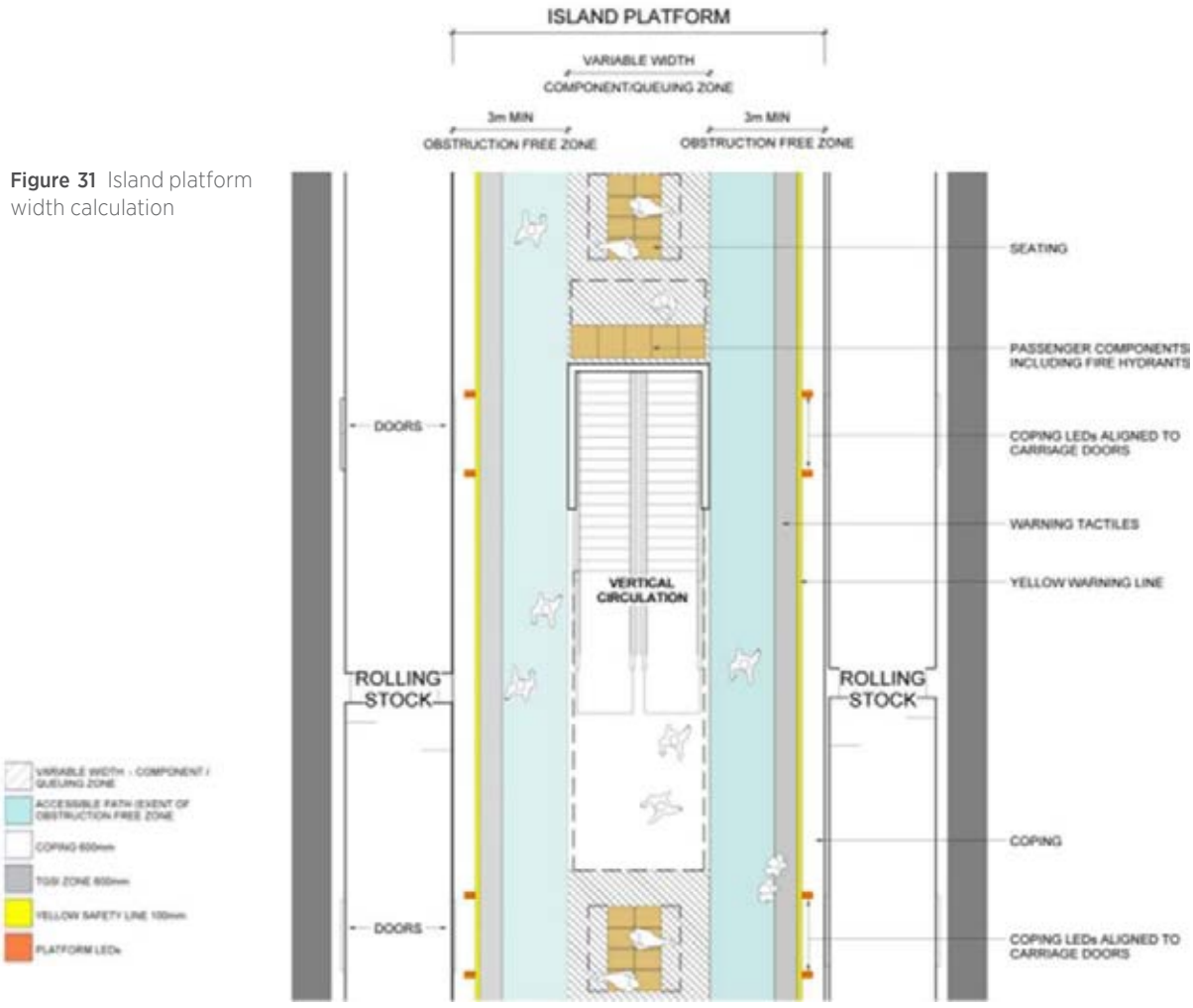



**Figure 31** Island platform width calculation

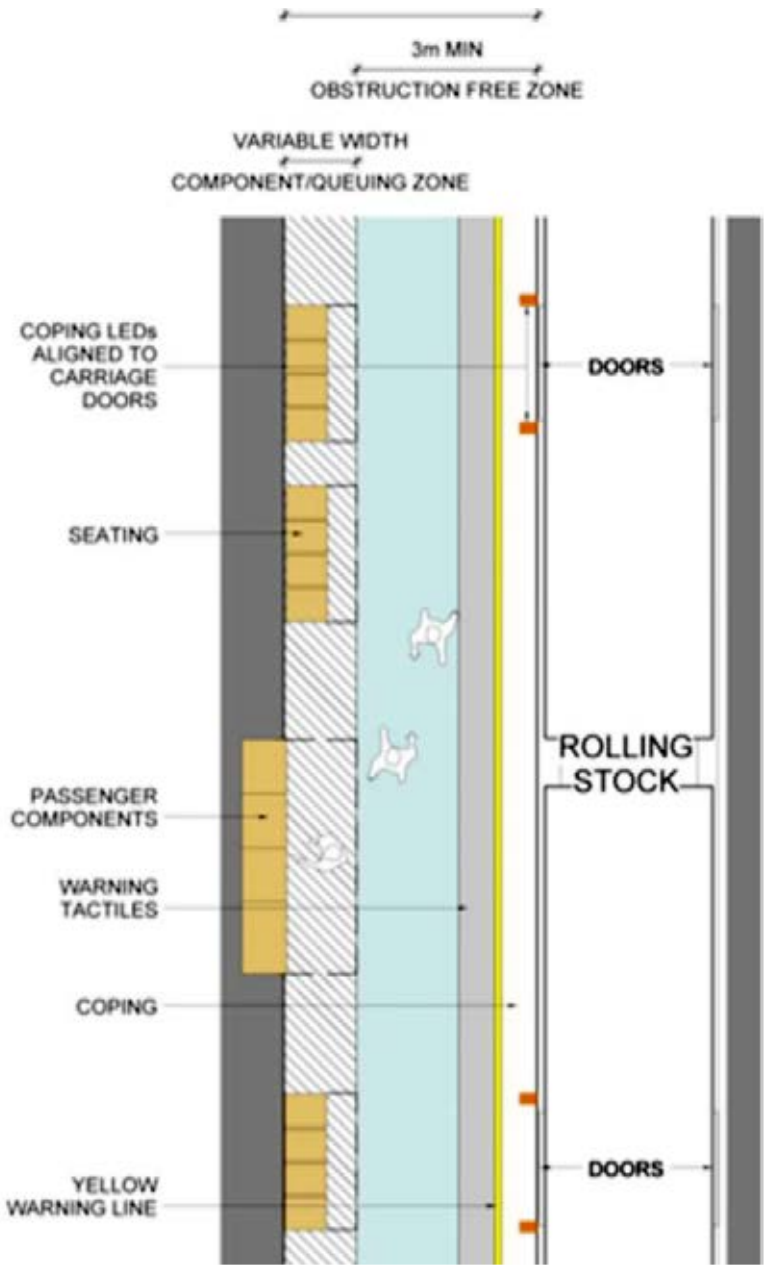



**Figure 32** Side platform width calculation

Platforms must be designed for disproportionate passenger bunching in the busiest portion of the platform. Assume that 35% of the passenger demand occupies 25% of the platform length and the platform is sized to provide each passenger with 0.8m2, with 1m added for edge effects.

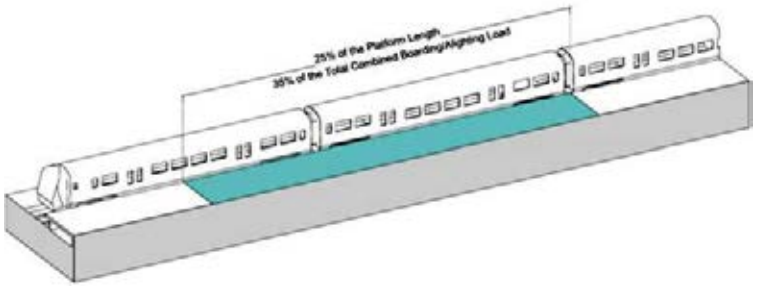


**Figure 33** Platform distribution calculation method

The formula for the width of a platform along its entire length is as follows:

$$\text{platform width} = \left( \frac{\text{platform load per headway x .035 x 0.8m}}{\text{platform lenght x 0.25}} + 1 \right) \text{m}$$

# 15 Cost-effectiveness and durability of design

**REQUIREMENT**

All stations must be cost-effective in terms of their station footprint, space planning, three-dimensional form and the choice of elements incorporated into the station fit-out.

**WHOLE OF LIFE**

Cost-effective design must be considered in the context of whole-of-life cost, comprising initial constructability and inspection, maintenance, operation and replacement costs (where relevant). Life-cycle cost estimates must be provided for all key station components and fittings at Product Definition and Reference Design stages of design development.

**COMMON COMPONENTS**

Common components and modular design of architectural elements must be embraced within the design to enable high-quality affordable station environments to be created in a consistent way, while permitting maximum benefits in procurement of identical products for initial construction and ease of replacement during regular maintenance cycles.

As a minimum, a common component, modular design approach must be developed across new stations for the following finishes and components as appropriate to their location:

- Flooring to all staff and back of house areas
- Flooring to all public areas
- Public area wall finishes/lining systems, including curvilinear finishes to station tunnels.
- Back of house wall finishes (for accommodation rooms)
- Ceilings to public areas
- Ceilings to accommodation rooms
- Balustrading
- Seating, bins, poster/advertising frames
- Internal doors, including common ironmongery suites.
- External doors, including automatic doors, shutters and gates
- External building cladding systems
- Canopies
- Light fittings, loudspeakers, ventilation plant and cooling plant
- Signage, customer information system displays
- Lifts
- Escalators.

## 15.1 Water tightness, drainage and control of water

**STATION ENTRANCES**

Station entrances must be provided with weather protection canopies that prevent wind-driven rain from entering the station entrance. Entrance doorways must be provided with a means of preventing water from being trodden inside by passengers, e.g. provision of drained matt wells and falls to surfaces away from the entrance thresholds. All vertical circulation elements within the station must be provided with protection to remain dry throughout all operating conditions.

Station entrance floor levels must be designed to avoid the risk of localised flooding entering the station from the surrounding precinct. The design of the external envelope of surface buildings must ensure that the detailing of elements, materials specification and workmanship provide a watertight design for the stated design life of the component and finishes. See Appendix A in this document for required design life.

**SURFACE PAVING**

Surface paving and landscaping must be designed with adequate measures to control water run-off.

**ROOFING**

Particular attention is drawn to the choice of roofing materials, the falls required to shed surface water and detailing of roofing junctions with other building elements for all station buildings and structures to provide the 50 year life expectancy of the finished roof. Membrane roofing materials must not be used on any railway station structures. Drainage gutters and downpipes must be designed to take water outside of the building envelope in the event of blockage to prevent water damage to interior fittings, fixtures, systems and finishes. All lifts and escalators must be fully protected from exposure to water ingress, including wind driven rain and surface water run offs from adjacent paved areas.

**UNDERGROUND**

Underground railway structures must generally be considered to be subject to aggressive exposure conditions. Particular attention to finishes chosen for fixing to the external envelope of station boxes and tunnels must take into account of the risk of corrosion and be designed to resist premature degradation of finishes and failure.

**SUMP PUMP ROOMS**

Critical sump pump rooms must be provided at each sub-surface station for the purpose of removing water seepage from station and tunnel structures to holding tanks before being discharged into the local drainage system. Where station structures are lined, internal cavities to channel water ingress to collection points must be designed into the wall lining system. Access to all drained cavities must be provided for regular inspection and cleaning.

**LIFT PIT SUMPS**

Lift pit sumps must be provided with duplex submersible pumps for the removal of water seepage and provide redundancy in the event of failure.

**JUNCTIONS**

Particular attention must be paid to the junctions between different forms of underground structure and the likely ingress of water through these construction joints over time. The design must specifically address drainage collection gutters and drains at these locations.

## 15.2 Constructability

REQUIREMENT

Stations must be designed to enable safe construction and maintenance. Maximum use must be made of offsite pre-fabrication of components, fittings and finishes and the most efficient assembly methods for their installation. Note sufficient space must be allowed for construction methods within the designated site boundaries to install prefabricated materials and components in close proximity to the operational railway. Safe access and maintenance provision must be made for the whole of life operation of the station that minimises the impact on rail operations.

MODULAR

Station designs must adopt a modular approach to common components and where possible utilise components, fittings and finishes that are common across other stations on the Auckland rail network to reduce construction time, ongoing maintenance costs and simplify the replacement during the life of the facility.

PREFABRICATED

Structural steel components must be designed to be prefabricated off site as much as possible so that factory applied coatings can be use.

LIVE ENVIRONMENT

Station designs must be developed in the context of delivery in a live operational railway environment. Construction methods must be chosen that minimise the disruption periods to the operating railway and that maintain safe operating conditions at all times.

## 15.3 Design life for station components

REQUIREMENT

Each component in the station design must be considered in terms of its durability. Recognized standards must be used when considering the durability of each component. New, unproven products and finishes must be avoided unless the design life and performance in use in the location intended is validated by submitted analysis against appearance, performance and cost in use.

ENVIRONMENT

Consider the specific environment in which the component and finishes will exist, as well as the monitoring and maintenance works required to maximize the life of the systems and components.

WHOLE OF LIFE

In assessing station components, finishes and fittings for stations a whole-of-life costing approach must be adopted where the optimum balance between initial cost, cost in use and life expectancy is compared against other options before the option choice is made.

CLEANING

Cleaning regimes for finishes must be determined and recorded during design development to maintain performance and remain within supplier and material specific warrantee conditions.

LIFE EXPECTANCY

The design life for station elements must be in accordance with the typical life expectancies stated in the table below.

TABLE 18 DESIGN LIFE FOR STATION ELEMENTS

| Category | Major maintenance frequency (years) | Design life (years) |
|---|---|---|
| Air conditioning plant | 10 | 20 |
| Applied coatings | 10 | 20 |
| Balustrading | 25 | 50 |
| Canopies | 25 | 50 |
| Electrical wiring | 10 | 20 |
| Escalators | 10 | 25 |
| External building cladding panels | 20 | 35 |
| Internal partitions | 20 | 50 |
| Lifts | 10 | 25 |
| Local ventilation systems | 10 | 20 |
| Major tunnel and sub-surface ventilation fan systems | 10 | 20 |
| Paving | 25 | 50 |
| Primary structures | 20 | 100 |
| Public area ceilings | 20 | 30 |
| Public area flooring | 15 | 25 |
| Public toilet fittings | 10 | 20 |
| Roofing and gutters | 25 | 50 |
| Sculpture | N/A | 50 |
| Seating | 10 | 20 |
| Secondary structures | 20 | 100 |
| Signage | 10 | 20 |
| Staff area ceilings | 10 | 20 |
| Staff area flooring | 10 | 10 |
| Staff counters and fittings | 10 | 20 |
| Station internal secondary wall lining panels | 20 | 30 |
| Station internal wall lining system | 25 | 50 |
| Station structural linings system | 25 | 50 |

## FORM

Simplicity of form and layout must be adopted wherever possible for all components and finishes. Overly complex shapes and forms must be avoided along with overly complex junctions and fixings between materials and components.

**SURFACE FINISHES**

Surface finishes in public areas must be designed to be relatively non slip and durable. This must be achieved by good design and the specification of appropriate surface materials, support systems and high standards of workmanship.

Finishes in public and staff areas must be designed to be robust, be capable of withstanding impact from passengers and maintenance activities, be non-porous to enable ease of cleaning and prevent penetration/staining/scratching from liquids and graffiti.

**CLADDING**

Internal cladding panels within common modular cladding systems to walls, floors and ceilings must take account of the problems associated with airborne dirt collection and its subsequent removal to maintain visual appearance. In particular at lower levels discolouring can be caused by train braking emissions.

**WALL LINING**

Wall lining panel designs must take into account resistance to deformation and surface damage due to impact, particularly in the zones below 1.8m from floor level.

**FLOORING**

Flooring to all public areas must be designed to be easily cleaned and to achieve a high level of non-slip performance in dry and wet conditions.

**CEILINGS**

Ceilings to all staff and public areas must be designed to be generally open and be readily demountable to access services above within the designated non-operational periods each night.

**EDGES**

Horizontal ledges, inclined and curved surfaces within public spaces and staff facilities must be avoided to minimise the potential for these surfaces to accumulate rubbish and airborne dirt.

**FIXINGS**

Station components and fittings must be provided with suitable fixings such as bolts, nuts, brackets, etc. and these must be provided with the same level of protection as the primary elements being fixed.

**COLOUR**

All internal finishes must be chosen from a palette of materials, colours and tones that provide good light reflectance values and contrast, minimising the need for an excessive number of light sources, producing a bright clean station interior and avoiding high energy requirements to provide acceptable lighting conditions.

**COLOUR FAST**

Materials must be used which provide a high retention of initial tone and colour for the life of the product. Matt finished and heavily textured surfaces should be avoided as these are highly susceptible to accumulating airborne dirt in railway environments and are difficult to clean, leading to premature degradation of surface finish and quality of the station environment.

**STEELWORK**

All structural and non-structural steelwork must be protected by hot dip galvanising and by an application of a proprietary coating system, where appropriate. Protection coating systems must be maintenance free for at least the first 15 years of operation.

GLASS

Toughened laminated safety glass must be considered for use in all locations in public areas susceptible to vandalism and impact loadings. Laminated anti-bandit glass must be used in all glazing to secure areas to prevent access even after breakage occurs. Glazing within public spaces must be considered for the application of anti-scratch film in areas vulnerable to this type of graffiti.

If glass is proposed to be used on horizontal surfaces, adequate access and maintenance provision must be fully integrated within the design.

Glazed cladding and glazing to stand- alone structures must be designed to be regularly cleaned without reliance upon unavailable local specialist equipment. Glazing must also include vision strips to public doorways and facades of unrelieved glass construction to ensure that the surface remains visible to passengers.

EXTERNAL

External concrete and masonry surfaces which face public areas must be designed to permit application of anti-graffiti coatings.

PROTECTION COATING

Protection coating systems must be maintenance-free for at least the first 15 years of operation.

DETAILING

Detailing of station elements must take into account the robust nature required in railway environments and in particular elements that are exposed to vandalism in the public domain and sub-surface environments exposed to water borne pollutants. Detailing of elements such as escalator surrounds, balustrading to landings and corner skirting details must be designed to facilitate cleaning and avoid dirt traps that cannot be cleaned without disassembly of the component.

## 15.4 Maintainability of station elements

REQUIREMENT

All station structures, fittings, components and finishes must be designed to enable maintenance operations to be carried out safely and efficiently. This must include anti-graffiti coatings to facilitate graffiti removal. Maintenance in this context must be considered to include regular inspections, cleaning, maintenance and replacement. Maintenance must be capable of being undertaken without interference with normal station operations or else capable of being undertaken wholly within limited non-traffic hours.

SPECIALIST TOOLS

Where specialist tools and equipment are required for maintenance, this equipment must be identified within the design and local sources for the supply of said equipment identified for use by the station maintainer. Where required, station storage of specialist equipment must be provided within the station footprint e.g. extending access platforms, gantries and ride on cleaning machines.

MAINTENANCE ACCESS

The station design must include a detailed access and maintenance strategy that includes a list of station components, the method of access for cleaning, inspection, repair and replacement, the frequency of carrying out the tasks, the

equipment required to carry out the task and the location within the station where the equipment must be stored.

Installations such as safety anchorages, man-safe systems, walkways, gantries, inclined access ladders, safety chains, lifting beams, access hatches and lifting points must be designed into the station structure and fabric to give cost-effective access to the highest levels and the deepest pits within the station design.

**ESCALATORS AND LIFTS**

The maintenance of escalators and lifts and of components above escalators has a key impact on station operations and the capacity of passenger vertical circulation at peak times. Spacing between escalators that permits the installation of maintenance supports allowing safe segregation between a working and non-working escalator as well as the means of supporting maintenance structures above escalators without reliance upon load being carried on the escalator treads or the ceiling above must be included within the design.

**INTERVENTION LIFT**

Agreement from the NZ Fire Service must be sought for the provision of a multi-purpose intervention lift at each station for use by maintainers and emergency services and where appropriate for supplementary evacuation of mobility impaired persons during incidents. This lift must be of a size dictated by the largest and heaviest component of plant and equipment that is needed to be transported to any level within the station. Ride-on floor-cleaning machines, hydraulic access platforms, ventilation fan components, heating and ventilation switchgear modular cabinets and platform-edge screen-door panels are likely to be the components that determine the size of this lift and the spaces that lead from the lift to the areas served by the lift.

Where no specific intervention/maintenance lift must be provided for movement between levels the public lift must be capable of providing sufficient capacity for maintenance equipment, ride on mobility scooters, cycles and passengers.

**REPLACEABLE**

Where components and finishes are not permanent and will require replacement during the life of the project, they must be designed to be replaceable in accordance with a corresponding planned safe intervention method developed as part of the design. An evaluation of the time required for replacement of components and finishes is expected as part of the design process to ensure that the task can be completed within the limited non-traffic hours.

**MAINTENANCE ACTIVITIES**

Station maintenance activities must be developed in line with the station asset management plan to be developed within the detailed design stage of the project.

TABLE 19 TYPICAL MAINTENANCE EQUIPMENT USED IN STATIONS

| Equipment | Usage |
|---|---|
| **Floor cleaning** | |
| Walk-behind scrubber | • Access to all areas (fit in passenger and fire intervention / maintenance lifts)<br>• Stored in cleaners store room with power for charging, water and drainage |
| Scissor mop | • Day to day cleaning for loose dirt and debris<br>• Stored in cleaners store room |
| **High level access** | |
| Scissor lift | • Minor maintenance / inspection<br>• Access to all areas (fits in passenger and fire intervention / maintenance lifts)<br>• Access to all walls and soffits except over escalators / voids<br>• Max platform height: 6m, max work heigh: 8m<br>• Stored in dedicated store room |
| Stackable platform | • Major maintenance / finishes replacement<br>• Access to all areas (fits in passenger and fire intervention / maintenance lifts)<br>• Access to all walls and soffits over escalators / voids<br>• Max platform height: 16m, max work height: 18m<br>• Weekday hours work height limit: 10-12m, weekend hours work height limit: 18m<br>• Stored in dedicated store room |
| **High level wall cleaning** | |
| On-site water-fed pole system | • On site water fed pole system<br>• Applications: international glass, precast concrete, cladding, glazing<br>• Maximum reach: 19.5m<br>• Self-contained water tank or connection to water supply<br>• Stored in cleaner's store room |


2
3
Paper ticket holders or passengers with bicycles, prams or wheelchairs, please use this entrance.