AUCKLAND DESIGN MANUAL
TE PUKA WHAKATAIRANGA I A TĀMAKI MAKAURAU

Auckland Council
Te Kaunihera o Tāmaki Makaurau



**Movement networks >**

# Introduction

**The design of roads, paths, lanes and links – the movement network – is one of the most important design decisions in creating vibrant, safe and prosperous places.**

The road network not only enables us to get from A to B, it defines the quality of a place by prioritising it as somewhere for people. This is supported by the design of development located along a street's edge. The topics covered in this element provide guidance on how to design a movement network that will facilitate prosperous local centres, safe streets, ease of movement for all and a place that is easily understood as you move through it.

## Site contents

The contents list and design outcomes for the whole of this section are listed below. Each subheading highlights a separate webpage that can be accessed by clicking on the menu located to the left of this introduction.

## Connections and connectivity

### Design Outcome

Subdivisions provide movement choice and connectivity, while balancing costs, safety, and privacy.

## Walkable neighbourhoods

### Design Outcome

Prioritise pedestrian convenience and access to destinations in the design of subdivisions.

## Legible hierarchies

### Design Outcome

A clear and consistent road hierarchy helps to create accessible, legible and safe subdivisions and helps people understand how to get to main routes and know when they are on them.

## Managing speed and modes

### Design Outcome

Subdivision design ensures the safety of pedestrians and cyclists by managing vehicle travel speed, and provides equally for the four major modes (walking, cycling, passenger transport, vehicles) in a way that will appeal to the users of each.

## Vehicle emissions and road layout

### Design Outcome

Movement networks are designed to minimise the costs and environmental impacts of unnecessary travel.

**Movement networks >**

# Connections and connectivity

## Design Outcome

**Subdivisions provide movement choice and connectivity, while balancing costs, safety, and privacy.**

### A connected network is based on convenient and logical connections between destinations, based on the most direct route possible.

Subdivision design should allow movement that maximises opportunities for social and economic exchange, while minimising the costs and general need for travel to make such exchanges. The 'right' amount of connectivity should be delivered, instead of any particular fixed standard that may be either too little or too much for a particular site. However, most subdivisions usually require 15 to 35 per cent of the gross developable area to be allocated as movement network space, depending on the density and degree of connectivity being proposed.

## Better Design Practice

- Street links should be short and direct unless this is not possible because of the land form (topography), important ecological areas or natural features.
- Decisions about the number, type and design of roads should be based on how best to integrate the subdivision successfully into the surrounding area, and facilitate travel with the least effort required.
- Subdivisions should provide a choice of routes and modes of travel, by having a mix of different activities within a walkable distance, and by minimising the number of lots that are served by only one route through the subdivision. Lots that are accessible by vehicles only should be avoided.
- Streets should accommodate a mix of transport types. Safety is enhanced when different transport types use the same space, and travellers can see each other and what is happening across the whole road. In this way, infrastructure can be more efficiently used. For example, a single light pole for vehicles, cyclists and pedestrians rather than multiple poles on multiple separate routes.
- The level of connectivity and choice of routes in subdivisions should correspond to the density and land-use mix. As density increases, so should the degree of connectivity and the number of route choices available. Pedestrians should be able to cross roads comfortably without having to deviate significantly from their route to access a crossing point.
- Try to provide full street connections (routes that accommodate vehicles, pedestrians and cyclists) wherever possible, unless the landform prevents it. If a pedestrian- and cycle-only link is required, make it wide (more than six metres), straight, as short as possible and well lit.

## Rules of Thumb

**1. The best outcome is when pedestrians can walk directly when walking from point A to point B within a subdivision, rather than having to 'double back'**

**2. Street patterns should enable pedestrians to walk to key destinations in less than twice the ‘as the crow flies’ distance**

**3. Connected roads forming urban blocks are better than a pattern of many cul-de-sacs and a few through roads**

**4. Limit the use of cul-de-sacs to when:**

- the topography stops a workable road connection being made
- the land that would get access from the through road is very constrained, and joining it to the road network would lead to a significant loss of potentially developable land
- a connected road would lead to an unavoidable and significantly adverse landform or habitat loss
- a connected road would require unreasonably significant engineering structures and cost

**5. Cul-de-sac lenths should be minimised to allow people to see from the mouth of the road to the end, and to promote slow vehicle speeds. These qualities will improve the safety of pedestrians and children playing in the cul-de-sac**

**6. As the scale and density of a subdivision increases, consider giving more space to streets and other movement links:**

- In very low density areas, where average lot sizes are larger than 1500m$^2$ to 2000m$^2$, limit movement networks to less than 20 per cent of the gross land area in these areas.
- In typical suburban areas, where average lot sizes are between 700m$^2$ and 1000m$^2$, between 20 per cent and 30 per cent of the gross land area may be appropriate for movement networks in such areas.
- In very dense suburban settings, where average lot sizes are less than 400m$^2$, between 30 per cent and 40 per cent of the gross land area is typically allocated to movement networks.

**7. Driveways and right-of-ways should serve no more than three lots**

**Movement networks >**

# Walkable neighbourhoods

## Design Outcome

**Prioritise pedestrian convenience and access to destinations in the design of subdivisions.**

**Walking brings direct health and lifestyle benefits to communities, as well as a more efficient use of transport infrastructure and increased consumer spending.**

At some point in life everyone is limited to moving only as a pedestrian: through age, wealth, medical impairment or choice. Therefore subdivisions, and all roads within them, must be designed to prioritise walking.

## Better Design Practice

- Subdivisions should be very walkable, with generous footpaths and landscaped berms. Pedestrian routes should be designed to be well overlooked by vehicle lanes and property frontages, to provide passive surveillance.
- Road placement and orientation should be based on providing route choices that are direct and allow pedestrians to intuitively understand where they are going. Pedestrians should be able to primarily travel in a straight direction and should never have to walk in the opposite direction to where they are headed.
- Footpaths take precedence over vehicle crossings. Continue the gradient and material of the footpath across the top of vehicle crossings, and design transitions to maintain the levels of the footpath.
- When vehicle access to lots from the street is not permitted (for example along high-speed routes), lot design and the location of buildings should ensure that buildings still face and overlook the street.
- Avoid rear lots as they do not encourage walkability.
- Driveways and right-of-ways should serve no more than three lots.

## Rules of Thumb

**1. Subdivision design should maximise the area and the mix of activities that can be accessed from each lot within a ten-minute walk.**

Able-bodied adults can walk at an average speed of 1.5 metres per second, or up to 800m in 10 minutes, accounting for occasional delays. Consider a slower speed of around one metre per second if the target market for the subdivision includes the elderly or families with young children.

**2. Subdivision design and layout should consider how easy it is for pedestrians to access public transport routes (existing and future) and local reserves.**

**3. Where rear lots are unavoidable, limit them to less than 10 per cent of the total number of lots in the subdivision.**

**4. Reduce block sizes as the density and number of residents increases.**

With more people needing to access more destinations, the demand for different route options increases, and smaller block sizes can facilitate this.

**5. Large blocks can discourage walking as pedestrians must make inefficient and time consuming zigzags around them. Therefore:**

On flatter land or subdivisions featuring small sites the preferred distance between road intersections (known as block dimensions) will be less than that on blocks on sloping land and with large sections. This will balance an efficient block structure with walkability.

**Movement networks >**

# Legible hierarchies

## Design Outcome

**A clear and consistent road hierarchy helps to create accessible, legible and safe subdivisions and helps people understand how to get to, and when they are on, main routes.**

**Clear and intuitive road hierarchies promote safety, legibility and way-finding.**

Travel is safer, more efficient, and more comfortable when people have confidence in where they are and where they are going. A consistent approach to road design also helps to emphasise local access and residential amenity, in order to slow vehicles down to speeds that have lower risks of injury to pedestrians or cyclists.

## Better Design Practice

- Focus on the safety of all road users, especially vulnerable pedestrians (including the elderly).
- Roads should be designed with the needs of people who live along them in mind, not solely from the point of view of vehicle users.
- Different types of street trees and vegetation should be used to highlight important streets and destinations.
- Street layouts should be designed to be clear and easy to understand, accommodating a mix of transport types.
- Emphasise corners (including bends) with taller street trees.
- Allow for landmark buildings to contribute to way-finding and legibility.
- Crime Prevention Through Environmental Design (CPTED) principles should be applied to the design of all movement routes and open spaces.

## Rules of Thumb

**1. Use a consistent and easily understandable road design that clearly sets out the purpose of each road type. As a guide:**

The context of different roads, including adjacent land uses and the density of those land uses, should inform the selection of road type and its design, and will have an impact on the appropriate landscape treatment. All roads will have both a movement and a place function.

**2. Aim to have street trees on all roads**

**3. Locate street trees on a berm or on build outs that go out into the on-street parking lane. Street trees can also be located on islands. The exact placement, form or 'shape' and species of street trees should be considered in conjunction with the context and function of the road.**

**4. Clearly demark street parking lanes. This can be done by different techiques, depending on the location or context of the road, for example by using painted lines, a different material, colour, or finish to the main vehicle carriageway.**

This will make the vehicle carriageway seem narrower and slow vehicles down.

**Movement networks >**

# Managing speed and modes

## Design Outcome

**Subdivision design ensures the safety of pedestrians and cyclists by managing vehicle travel speed, and provides equally for the four major modes (walking, cycling, passenger transport, vehicles) in a way that will appeal to the users of each.**

**Despite the economic benefits of having the shortest possible journey times for the movement of goods and services, fast-moving free-flow traffic also brings major safety and amenity problems that can only be addressed by restricting pedestrian and cyclist use of the road.**

This action can be fair on busy arterial and collector roads in peak times, but is not appropriate on local roads or in inter-peak periods.

## Better Design Practice

- Street design provides a signal of what speed a vehicle should be travelling, through elements such as road width and landscaping.
- Roads should not be over-designed for vehicle safety with features such as wider than necessary travel lanes or corners.

- Over-design, often based on concern for vehicle occupant safety, can unintentionally result in drivers concentrating less (a phenomenon known as 'driver automation') or increasing their travel speed. Therefore, roads should be designed based on a balance of safety and amenity for all users, not just for vehicle occupants.
- Pedestrian and cyclist safety comes first when deciding on elements such as street trees, islands or berms. Speed reduction devices, safe and logical crossing points and easy routes that directly follow desire lines will also contribute to pedestrian and cyclist safety.
- Streets should be designed to encourage the lowest possible vehicle speed for the use of the road, based on the importance of the road in the road hierarchy. Low speeds can be achieved by:
    - geometric design and curve radii
    - managing sightlines and long straight links
    - reducing the width of the vehicular travel lanes
    - using a variety of textures and surfaces
    - using flush medians only on very busy streets
    - promoting slow speeds at intersections and road entrances

- Design intersections and the beginning section of each street in a way that slows vehicles down to an appropriate speed from the start, rather than further along the street. Landscaping should be integrated into such thresholds.
- Traffic-calming tools include:
    - using different materials, textures or colours to make vehicular carriageways, footpaths, cycle ways, parking bays and manoeuvring areas clearly legible
    - 'tightening' intersection corners to ensure slower vehicle movements
    - incorporating islands or raised berms to help pedestrians cross and slow vehicles down
    - avoiding long stretches of straight local residential roads by using the road reservation width to allow for regular bends or 'shifts' in the carriageway
    - incorporating chicanes at key points to slow movement. The use of mountable kerbs can allow more space for large and emergency service vehicles
    - incorporating landscaping into parking bays to help make the carriageway seem narrower to drivers
    - developing tables (essentially large, flat speed humps) with material differentiation to aid pedestrian crossing without relying on formal crossing points
    - raising intersections and using different materials to make these points more prominent, while helping to slow vehicles down
    - speed bumps or humps are the least desirable form of intervention for traffic calming.

- Design higher-density subdivisions carefully to avoid a high number of vehicle crossings passing over the footpath, and to maintain the level and flatness of the footpath.
- The amenity and sense of character, or 'place', of streets that people live along is essential to successful and liveable subdivisions. The predominance of vehicles in street design (including the number of travel lanes) and high vehicle speed are the biggest risks to establishing and maintaining this amenity.

## Rules of Thumb

**1. Design to achieve lower maximum speeds on all local roads, with the speed reflecting the function of the road. The lowest design speeds should be used on very quiet roads. For example 40km/h maximum speed might be appropriate on local roads, whilst a 30km/h maximum speed might be appropriate on very quiet roads.**

Economic and social impacts result from pedestrians not being able to easily cross a street and from a loss of amenity when vehicle numbers and speeds increase.

**2. Consider having separate cycle lanes on appropriate roads, where there are high vehicle speeds and where there is the opportunity for creating a connected network of cycling infrastructure. Early discussion with Auckland Transport is required.**

These can be either 'on road' next to the vehicle travel lane or 'off road' next to the footpath. Where the vehicle speed is lower than 40km/h, cyclists should be able to safely share the road with vehicles and feel comfortable. Low-speed shared vehicle and cycle lanes also allow cyclists to travel two-abreast instead of single file.

**3. Vehicle crossings (driveways) should be as narrow as possible for every lot, to reduce vehicle entry and exit speeds.**

This will ensure that streets and footpaths are not dominated by vehicle access, and will limit interruptions to pedestrian amenity. It also ensures there is sufficient street space for street trees and on-street parking bays.

**Movement networks >**

# Vehicle emissions and road layout

## Design Outcome

**Movement networks are designed to minimise the costs and environmental impacts of unnecessary travel.**

**The environmental impact of vehicle travel creates the greatest sustainability challenge for cities in terms of environmental damage, energy inefficiency and ongoing costs as a proportion of household income.**

## Better Design Practice

- Subdivision road networks should minimise the kilometres travelled by vehicles in the subdivision. Roads should be configured to facilitate dominant flows of traffic in and out of the subdivision.
- Undertake a transport analysis to show the likely split between types of travel and destinations by residents of a proposed subdivision. As a part of this, calculate at least 30 years (preferably 50 years) worth of likely carbon dioxide equivalent emissions and vehicle operating expenses resulting from vehicles entering or leaving the subdivision (calculated in accordance with NZTA's Economic Evaluation Manual, 2010). The solution proposed

should lead to the least possible emissions and future costs by minimising the vehicle kilometres travelled. If it does not, clear reasons should be provided that justify this inefficiency (which could include landform or other constraints).