FOREWORD

The way that people access activities and places can significantly impact social, economic and environmental outcomes in the local community. The City of Stirling (the City) has developed an Integrated Transport Strategy (ITS), which aims to provide for a diverse range of travel demands throughout the community, efficiently and effectively. The strategy profiles key transport issues for the City to address and identifies existing strengths to build sustainable transport policies on. It is intended that the strategy will foster joint capacity between various levels of government, the private sector and the wider City of Stirling community in developing a sustainable and efficient transport network which delivers for all. The Strategy will build on the City’s position as a ‘City of Choice’.

The above statement was taken verbatim from the City’s ITS, as it directly relates to the provision all forms of transportation, including pedestrian and cycle facilities. How those two form an integral part of the ITS is expanded on in that document with a section devoted to each. The ITS places all forms of transportation within the contextual background of the City and the wider Perth metropolitan area and, therefore, this ‘Cycling Strategy’ does not seek to reproduce the wider view but to focus on those issues that relate to cycling (and to some extent the interrelated interests of pedestrians).

This strategy explains the rationale behind existing cycle provision, the constraints and opportunities that exist for the development of cycling and, most importantly in the final section the methods (or tools) that can be used to develop an effective cycling network within the City.

This Integrated Cycling Strategy (ICS) is not provided as a document to be placed on the shelf and reviewed every five to ten years, but as a ‘live’ document that will be available to all, through the City of Stirling website, and updated annually.
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EXECUTIVE SUMMARY

This Integrated Cycling Strategy functions as a high level document which defines Council Policy and how the City of Stirling should respond in the delivery of a strategic cycling network that caters for the needs of all ‘design cyclist’ groups. Particular focus is given to the development of cycling, as a mode of transport, for “everyday people wearing everyday clothes and going to everyday places”.

Part One is intended to be used as a reference document. Some readers may wish to read the detail behind the development of this strategy, while others may wish to scan quickly through to the key section of this document which then, in Part Two, sets out ‘The Way Forward’ and provides an analysis of the ‘Tools’ available, and in some cases to be avoided, to develop an effective cycling network within the City. Whichever way this document is read many, if not all, of the answers to questions are available in the reference section.

Section One provides background information and sets the scene within the overall context of metropolitan Perth and in particular the City of Stirling.

Section Two looks at where we are now, why changes are needed and the key drivers for change, and how that feeds the need for a proper method of audit. The most important element of this part is in defining the three ‘Design Cyclist’ groups which is fundamental to determining whether any particular facility type (or tool) is fit for purpose for any or all of the design cyclists.

In Section Three the process of how an audit should be conducted, what is required and how that information can be processed is explained. A key outcome from that process is that there is considerable scope for future development that will enable the City to provide detailed information on the City’s website, not only on where routes are provided but also how suitable for each user group they are.

The issues of duty of care, safety, legal controls and the implications confronting both riders and providers of infrastructure, are then detailed in Section Four. Because cycling (within the road reserve) is regulated by the state government, and requires a common solution across all areas, the discussion is not limited to any single local government but spans all jurisdictions within metropolitan WA. Because much of the existing cycling infrastructure depends on shared paths, which are not a universal panacea and may under many conditions provide an elevated risk, path safety and selection is covered at some length. This part includes an analysis of the public consultation, undertaken as part of this strategy, by providing additional information on cycling behaviour and how this affects or is affected by the key issues.

Section Five discusses options for future action with a more detailed assessment of a number of critical issues and provides advice on how they can be addressed, both locally and in the global context. The most significant outcome from this section is the concept of ‘Think 20’. Based on clear guidance from Austroads, as well as a considerable amount of correlating evidence worldwide, a speed differential exceeding 20 km/h has a profound effect on how safe a facility may feel and may actually be but, most importantly, on whether it will deter some users thereby suggesting an alternative may need to be considered.
In the final section of this part, Section Six, the previous threads are being pulled together to begin to lay the basis for future development. Drawing on a successful approach used elsewhere the target group is defined as the urban cyclist – essentially a pedestrian who has been augmented by a bicycle to enable them to travel faster, and hence further, in the same time and conditions and wearing the same clothing.

The need for primary and secondary routes and how they contribute, in the same way that motorised vehicles have a hierarchy of roads, is then discussed together with the role of the tertiary environment (where people live and work) and how this can be improved on in conjunction with other initiatives. The particular benefits of cycling as part of a multimodal journey are also assessed leading to the conclusion that the most dramatic benefits can be achieved within 3.0 km of major transport interchanges and activity centres, providing adequate end of trip facilities are provided as an integral part of any routes. The main conclusion, arising from sub-section 6.5, is that the development of complete routes, from a specific origin to a specific destination, must be the most appropriate method of achieving an effective strategic network, through efficient application of resources capable of delivering early results.

**Part Two**, ‘The Way Forward and Toolkit’ is the product of the exhaustive study, as outlined in the reference part above, and introduces the separate ‘Bike Route Development Plan’ (BRDP) which is intended to identify the Primary and Secondary routes which will form the basis of the City’s investment in cycling for the next ten years and beyond. This BRDP will both focus on cycle specific investment on ‘qualifying’ routes but will also depend on continuing improvements within the tertiary areas which will see significant improvements through separate programs delivered as part of an integrated transport strategy.

Section Seven is all about how we go from here and outlines the way that this is achieved by applying a set of primary ‘tools’ or facilities which are enhanced by secondary ‘tools’ or supporting measures. This ‘Toolkit’ provides the essential elements to design and ultimately deliver a ‘complete route’ which is capable of serving all design users.

Building on from this strategy, based on international experience but adapted to local circumstances during the detailed design stage, the City will be able to develop a series of ‘Practice Notes’ relating to each infrastructure type which can then collectively become a working ‘Design Guide’.

During the course of producing this strategy a number of ‘recommendations’ have been made and these are included in this summary as follows:

- **Recommendation 1**
  Urge State Government to consider revising the under 12 year old rule to an under 10 km/h rule, on all ‘unmarked’ paths, for all ages of cyclist.

- **Recommendation 2**
  Urge State Government to establish a robust system for collection of cyclist accident data and, in conjunction with cyclist traffic counts determine actual Accident Factors for typical facility types.
• Recommendation 3
  Ensure that all cycle paths and shared paths are signed and marked in the same manner as roads and that the full range of regulatory signs and markings are applied by the City, or MRWA where that authority has not been delegated.

• Recommendation 4
  As the PSP though Stirling is a primary cycling facility AND an essential part of the local footpath network, that the City works with the DoT to secure co-funding to resolve those issues which currently restrict the ability to increase cycling and pedestrian activity. Furthermore, by providing alternative paths, or a segregated path where not practicable, to reclassify the PSP as a PBP.

• Recommendation 5
  To adopt ‘Think 20’ as a tool to be used when determining future cycling provision and to promote its use across the wider metro area which is within the range of more experienced cyclists.

• Recommendation 6
  To develop a robust but simple NMU audit form to be used for all proposed street modifications within the City. This requirement to apply equally to City Business Units, private developers and state government agencies that carry out works that could impact on vulnerable users. City policies for works within the road reserve should also be aligned with the requirements of the NMU audit principles.

• Recommendation 7
  Following publication of the Cycling Strategy to arrange high level meetings with State Government to determine improvements and additions to the primary cycling routes in and through the City based on the suggestions within this plan.

• Recommendation 8
  Actively consider the use of Local Area Traffic Management (LATM schemes) with reduced 30 or 40 kph zones in potentially high ped/cycle areas, and promote through community consultation.

• Recommendation 9
  Retain all PAWs and, where land is available to the City, consider constructing additional PAW links. Where antisocial behaviour is encountered, or requests are received for closure, this should be denied (unless exceptionally the PAW has no contribution to increased permeability) and instead the PAW upgraded to cater for cyclists and additional measures taken to improve surveillance and minimise antisocial behaviour.

• Recommendation 10
  Target a significant proportion of funding on cycling to improving or creating routes to meet the needs of all with 3km of public transport hubs, in conjunction with the PTA and an adequate provision of bike parking. As this is of strategic significance to the State Government seek, at least, matching funding to these routes.
• Recommendation 11
Where new routes are planned or provided then the City is to negotiate with the destination facility to ensure the above Reward principle is implemented as a condition of providing that route. In many cases the end user will be COS facilities, however, school and college campuses, shopping centres and the PTA and any other providers who will benefit from improved cycle access, should be asked to agree to this principle. Future Planning policies should accommodate this principle and, where long distance commuter cycling is envisaged, this should extend to Full EoT.

• Recommendation 12
Urge the State Government to incorporate pedestrian and cycling friendly phases to all new signals and to modify existing signal phasing where this forms part of a designated route.

• Recommendation 13
Urge the State Government to consider posting reduced speed limits to drive reductions in speed, rather than to reflect observed 85th percentile speeds.

• Recommendation 14
Continue to use posted speed limits to shared paths within parks and reserves under the City’s local laws. Advocate for the State government follow suit and to use posted speed limits on shared paths to advise cyclists of the desired (appropriate) maximum speed.

The Integrated Cycling Strategy was formally adopted by City of Stirling Council on 5 May 2015.
PART ONE

Section 1: Introduction
Section 2: Where Are We Now?
Section 3: Audit Process – What Have We Got?
Section 4: Strengths and Weaknesses – What Do We Need to Do?
Section 5: Treatments and Action Plan – How Do We Respond?
Section 6: Future Development – Getting Even Better
1 Introduction

1.1 Mission Statement

The City of Stirling will work to double the numbers of people cycling, at all levels, within the next five years. By definition this means that the majority of cyclists, by 2020, will be those that are currently not cycling and, therefore, consideration needs to be given to promoting access equally to all.

Note: This statement conforms with the overarching vision to double the number of people cycling over a similar period, confirmed and signed up to by Commonwealth and Government Ministers of every State and Territory, in the “Ministerial foreword” to the Australian Bicycle Council’s ‘National Cycling Strategy 2011-2016’ published by Austroads.

By 2020, cycling should be so enmeshed within the transportation fabric that it will be a transportation ‘mode of choice’ for many and not just the few.
1.2 Background

The provision of cycle facilities within the Perth metropolitan area has been undertaken under the coordination of Bikewest, a section now within the Department of Transport* (DoT), in association with Main Roads WA (MRWA), and in conjunction with the primary providers represented by the various Local Government Authorities (LGAs).

*Previously Bikewest had been located in the now defunct Department for Planning and Infrastructure (DPI). For historical continuity any remaining references to DPI should be taken to refer to the ‘Bikewest’ function which now sits within the DoT as the “Cycling and Urban Strategies” team.

One of the primary documents providing direction on the provision of cycling facilities, and one which would in all probability be used by Magistrates in determining liability in the event of a claim against providers or regulators of infrastructure, is the ‘Austroads Guide to Traffic Engineering Practice – Part 14 Bicycles’ which is subsequently referred to as “Austroads Part 14” in this document. This guide was redrafted and republished in 2009 as the ‘Austroads Guide to Road Design’ and, whilst cycling is integrated within the whole document, of major significance is ‘Part 6A: Pedestrian and Cyclist Paths’ which is subsequently referred to as “Austroads Part 6A”. Although very different in presentation, they share common content and much of the guidance has not changed. Both versions of the guide will be referenced, where appropriate, as they relate to existing (past practice) or future guidance.

Investment in primary cycling facilities, essentially Regional and carrying cyclists through LGAs, adjacent to primary transport corridors such as Reid Highway, the Mitchell Freeway and railway corridors, has primarily been through State Government funding, via the DPI and MRWA, and on land predominantly within the care and control of those bodies which represent both the provider and regulator. In particular the Principal Shared Path (PSP) through Stirling is a state government facility, although some sections of the route (where it remained incomplete) have been provided by the City and consist of Shared Paths (SP) and on road cycling.

Investment in secondary cycling facilities (District level within LGAs), is generally located on roads and verges that are in the care and control of local government. In these circumstances Local Government is the provider although MRWA remains the regulatory body (except for areas covered by Local Laws which are not subject to the Road Traffic Code 2000). These have primarily been provided by local government, in some cases with grant assistance from the DPI, and comprise of the Perth Bicycle Network (PBN) and Recreational Shared Paths (RSP) such as the coastal shared path, together with on road bike lanes.

Tertiary cycling facilities (Neighbourhood level within suburbs) comprise other Local Bicycle Routes, safer streets and Shared Paths serving residential properties and focus on access to local facilities and schools. These have been predominantly funded entirely by Local Government as needs are identified and often in conjunction with other road improvements.

A more detailed explanation of primary, secondary and tertiary cycling networks can be found in sections 6.2, 6.3, and 6.4 respectively.
Generally cycling has been underfunded for many years by all levels of government, Federal, State and Local. Some great concepts have been put in place and the provision of Principal Shared Paths has proven successful in mobilising significant numbers of commuting cyclists. The new PSP, associated with the Kwinana Freeway, is more successful in increasing cyclist participation, primarily because it was better funded, does not suffer the shortcomings and breaks in continuity of its northern counterpart and, as a result, carries about twice as many commuters.

It does, however, suffer from increased conflict and accidents predominantly because it is ‘shared’. State funding for improvements to the Mitchell Freeway PSP, previously ‘off the radar’, has now been identified following publication of the WA Bicycle Network Plan (WABNP) and, as of July 2014, the first new section between Erindale Road and Reid Highway (Gribble Road bypass) is already under construction.

The PBN network was created to provide a secondary network, by identifying preferred routes, and includes a mechanism for targeted funding from the DPI to improve them over time. Unfortunately improvements have been slow to materialise and poorly targeted, often on proposals unrelated to any PBN route. The PBN network, however, would appear to be a basis on which to further improve cycling at district level.

![Figure 1: PBN network 2003](image)

Worldwide, funding in many jurisdictions is an order of magnitude higher than in WA. European countries have for decades invested significantly and even late starters are stepping up. For example, in the UK, cycling in some major cities benefits from an investment equal to about £12 (AU$ 20) per capita. In Australia, by 2010 Victoria was achieving significant investment, with half of councils meeting the minimum standard of $5 per capita, set for spending on cycling, with eight councils allocating expenditure
ranging from $10 to $18.96. In Brisbane and Hobart, in 2008, expenditure per capita was $19 and $8.70 respectively.

Contrast this with WA where the DPI offered less than $1 per capita annually for the PBN network in the Perth Metro area and the City of Stirling had previously allocated only $3 per capita for provision of new footpaths and cycle facilities combined. Since 2009 however, under the ITS, the City of Stirling has increased this allocation and has been investing more than $10 per capita on new footpaths which does, indirectly, assist with more vulnerable cyclists.

To meet the minimum standard ($5/head) adopted by Bicycle Victoria, the City would have to allocate in the order of $1m for cycling alone and, if State Government matched this, a further $1m would become available resulting in a $2m annual investment towards cycling in Stirling. Until recently the funding available to LGAs, through the PBN grant scheme, was by application and from a limited ‘pool’ that does not reflect the fact that 95% of the cycling ‘network’ is within the control of local government. To meet the shared objectives, of doubling cycling participation, consideration should be given to increasing that ‘pool’ to reflect those shared objectives. With all metropolitan councils participating, if co-funded by the State, this would equate to more than $18m annually towards cycling in Perth. Looking at a more generous $10/head from both Local and State Governments could see at least $36 million invested per year in cycling. (Figures based on 2013 population figures of 206,000 for Stirling and 1.8 million for Perth Metro area). This level of funding could transform cycling and, more importantly, provide a cost effective solution to congestion of both road space and car parking.

Note: The draft WA Bicycle Network Plan (WABNP), released for consultation early 2012, identified increased funding for PBN grants and outlined a program for upgrading or extending the PSP network. It is worth noting, however, that apart from the PSP network (provided within arterial routes otherwise unsuited to cycling); the vast majority (in the order of 95%) of cycling routes and solutions are on streets, and through parks and foreshore reserves, that are in the care and control of Local Government.

Although the funding to local government under the PBN grants scheme remains relatively low, when the additional investment on the PSP network, under the WABNP, is taken into account current (2014/15) expenditure on cycling equates to about $10 million or about $5 per person annually.
1.3 Objectives of the Integrated Cycling Strategy

A Local Bike Plan is a planning tool to coordinate the promotion, development and integration of bicycle infrastructure within individual municipalities. In too many cases this follows a standard formula that provides a document, with limited circulation, that is often relegated to the shelf, and infrequently read. In the City’s case the first Bike Plan was completed in 1992 and was not reviewed until 2002. The revised Plan was published in 2003, not widely circulated, was little used and does not appear to have contributed to the development of cycling in Stirling.

The City’s new Integrated Cycling Strategy seeks to redefine this tool, by changing the focus. Rather than a document that is fixed for a time, this Strategy is dynamic and intended to be used and constantly updated. In order to ensure that it is referred to, and so that members of the public can be encouraged to read it and respond, it will be published and made available on the City’s website. The adoption date, subject to Council ratification, is envisaged for April 2015, with an intention to review at least every two years and possibly annually. As part of the process, a précis of any revisions will be provided to Council for approval prior to publication of the updated version on the City’s website.

As a tool, the Strategy will contribute to the development of safe, convenient, efficient and attractive cycling infrastructure, available for all, and providing not only a viable alternative transport mode, but also recreational, leisure, tourism and health opportunities for the community.

Cycling has the potential to become an integral part of the transport network, not just for the dedicated ‘cyclist’ commuters, but for everyday ‘urban cyclists’, wearing everyday clothing, on everyday bicycles, who can travel short distances to destinations or, as part of multimodal transportation, to bike parking associated with public transport. This is explained further in Part 6.
2 Where Are We Now?

2.1 Overview

Bicycle riders vary in skill from novice to expert and ride for a variety of reasons ranging from commuting to utility, as well as recreation, leisure, tourism and health. There is a general consensus that almost 80% of all trips made in Perth are less than 3km in length and, therefore, potentially suitable for cycling. The facilities, however, often provide a barrier to safe cycling and do not suit many potential users. As a bicycle is classed as a vehicle, the rider has all the rights and responsibilities of any vehicle driver (unless directed otherwise) and, in an ideal world, all cycling should be on the road (carriageway). In Perth, however, in common with many other cities, cyclists are often fearful of cycling ‘on road’ and implement their own ‘risk management’ strategies. In many cases footpaths, that are far from ideal for cycling at high speed, become an integral part of individual cycle routes with the vast majority (94%) of those surveyed (see section 4.5) indicating that they used foot only paths (believing that this was illegal) to avoid greater risks elsewhere. Enforcement is so lax, and probably is best so, that the risk of enforcement is seen as far less than the risk of the alternative on road route. There is a powerful argument for relaxing (or reinterpreting) regulation in this area to bring it more in line with community practice and the level of police enforcement.

In many cycling cities such as Amsterdam, Copenhagen and Bogotá, where cycling is more established and the road space is better calmed, cycling on road is the norm with Shared Paths viewed as the last resort and Separated or Segregated Paths filling the gaps.

![Rush hour in Copenhagen.](image)

Figure 2: Rush hour in Copenhagen.

Here in WA, roads are generally wider, faster and motorists are often oblivious to the rights of cyclists to (an equal share of) the road space. As a result, unless they are experienced and assertive, cyclists perceive many roads as hazardous and consider the use of paths essential. Shared Paths, therefore, will continue to provide an essential part of the cycling infrastructure to the extent that, even where they are not provided, most cyclists see any path as ‘fair go’ alternative, however, more effective controls are required to manage speed, and increased numbers of conflicting users, without compromising safety.
2.2 Background

In 2007, in identifying proposals for inclusion in the 2008 round of PBN grant applications, the City commenced a sample review of some routes. Initial observations indicated that there were significant deficiencies in those routes and that the existing Bike Plan had little relevance in determining priorities. Accordingly a review of the Bike Plan was included in the projects put forward to, and approved for part funding by, the DPI.

It was decided to conduct the review in house rather than employ a consultant. The primary reason for this was the fact that the City could put together a multi-disciplinary team within Engineering Design, ably supported by the TravelSmart and Road Safety Officers. Furthermore, as cycling impacted upon so many areas for which the City had responsibility, and a considerable breadth of experience, a holistic approach could provide the best outcomes and integration with other strategies.

In preparing for the review, over a period of nine months, every opportunity was made to observe cycling within Stirling and the wider area, research best practice worldwide and debate issues with representative bodies and listen to cyclists. The following are a brief summary of the findings:

- The provision of cycle facilities was dysfunctional and incoherent.
- Physical Connectivity was, at best poor, and in most cases did not provide a satisfactory route.
- Visual connectivity was often lacking with no indication of where, or on which facility, the route continued.
- Conflict resolution was minimal with many intersections proving unsuitable for all but the most experienced cyclist.
- Many registered Shared Paths were unsigned and, therefore, considered unlawful for cycling by adults. *In fact, as the law stands, most paths used by cyclists are de facto shared paths even when not signed as such.*
- Many were also located inappropriately close to property boundaries, with compromised visibility and an attendant risk of collisions.
- Several paths were unimproved and too narrow to meet the standard required and, in one case, did not even exist.
- Exclusive (on-road) Bicycle Lanes were provided unrelated to other facilities and often terminating at the point of most need. These bicycle lanes were also informal and had no legal standing.
- Off-Road paths were generally provided in parks and reserves and, even when separated, conflicted with other users.
- The PBN network had potential and was generally signposted more effectively than other routes; however, changes to roads and street furniture have reduced their legibility.
- The PBN routes were subject to deficiencies that rendered them unsuitable for all users at some place in the route.
- The primary deficiency for experienced users was kerb to kerb narrowing where traffic calming and/or median islands had been installed.
- Shared paths, in many cases, had dangerous intersections with other paths and driveways, with no indication of the hazard (to either path) or the safe speed.
• The Principal Shared Path (PSP) route was incomplete and often reliant on other facilities. Consequently it was a limited success, with unacceptable risks in some locations owing to its ‘shared’ status and significant time penalties (and hence risks) at road intersections.

• The Recreational Shared Path (RSP), along the coast, was a qualified success as it provided a continuous facility that was easily legible. However, that was not without significant risks, primarily at beach accesses and areas of high interaction, and a perception by the many pedestrian users, especially those with young families, of dangers posed by excessive speed by cyclists. As a result of being utilised by fast cyclists (which it was not designed for) it was failing to be ‘fit for purpose’ for those it had been provided for.
2.3 The Need for Change – Driving Forces

Cycling will have an increased role in the future for a number of reasons which are outlined below.

Public perceptions are changing, as illustrated by the fact that during 2008 the number of bicycles purchased in Australia exceeded the number of cars for the first time. Apart from the increases anticipated from policy objectives, promoted in the Integrated Transport Strategy (ITS), there are other driving forces at work. Whilst not wishing to repeat what has been said in the ITS, the following are worth specific mention here because of their relevance to cycling:

- **Climate Change:** Cycling is the greenest mode of transport at a time when public awareness is increasing and ‘carbon neutral’ has become more desirable and even necessary.
- **Peak Oil (see note):** There is a growing consensus that ‘Peak Oil’ may already be upon us and it is only the Global Financial Crisis (GFC) that has contributed to staving off its effects. Oil rose to US$140/barrel during 2008, from a base of US$50 earlier that year. Whilst the GFC saw oil prices plummet, they have already recovered to more than US$100/barrel and that at a time of low growth! Whilst overall numbers may rise, individual car usage is predicted to fall as petrol prices rise and many families are likely to seek alternatives to the second car. In fact, during 2008 when petrol prices peaked, the PTA saw a 7% increase in patronage – away from the car. **Note:** The 2015 reduction in oil prices needs to be viewed in the context of ‘Peak Carbon’ which is just likely to affect availability of oil in the future.
- **Obesity Crisis:** Major programs are being implemented, both federal and state, to encourage exercise. Walking and cycling are seen to be a significant contributor to increased exercise and improved health.
- **Recreation and Leisure:** As the cost of running a car increases cycling will be seen more as an alternative form of recreation as well as a means of accessing leisure activities. A bicycle trip is an ideal way to ‘warm up’ and ‘warm down’ as part of more vigorous exercise. Many attractive local facilities, within easy cycling distance, are often passed by when using the car to travel to other more distant facilities with studies demonstrating that cycle usage actually benefits businesses along bicycle routes.
- **Tourism:** The potential for tourism, through cycling, has enormous potential as is evidenced by the cycle hire facilities located at Scarborough and other tourist locations.
- **Increased population:** The effects of migration and subdivision places increased pressure on parking provision, as lots transform from single to multiple dwellings with no increase in road frontage. The equivalent area of one car parking place can cater for 8-12 bicycles.
- **Community:** Walking and cycling are social activities that improve interaction and a sense of community. Car usage has limited interaction and, where it does take place, it is generally negative.
- **Congestion:** Cyclists often quote the mantra ‘One less car’ and this is (in sufficient numbers) a very effective way of using limited road space and reducing congestion on major roads. An additional benefit is that at the destination, far less space is needed to park bicycles as opposed to cars, which can have significant impact on land usage. At train stations more passengers can be accommodated within existing car parks and at final destinations less, wasteful and expensive, car parking is required.
2.4 Objective of Audit

As outlined in section 2.2, it was concluded that little hard data was available to determine the status of many of the existing cycling facilities. The only strategic approach had been limited to the PBN routes and, owing to limited and poorly targeted resources, even these did not provide an adequate Level of Service (LOS) and in some cases introduced or encouraged an unacceptable level of risk.

Although the initial concept was for a basic simple audit, using aerial images and drive by site assessments, it was concluded that to properly identify the status, constraints and risks it was necessary to audit in greater depth - by bicycle!

It was decided that audit outcomes needed to identify, in each case, the facility type, status, signage, width, adjacent facilities and any constraints. Also essential was the fact that output from the audit should enable the degree of suitability for each user type to be determined, which could also be linked to a risk rating for the facility to identify problems that required remedying. This process is outlined in more detail in Section 3, although one of the more fundamental outcomes from this process was the identification of two clear types of problem (risk), those that are 'Persistent' and those which are 'Point'.
2.5 Definition of Users

The previous Bike Plan had identified seven categories of cyclists (Austroads Part 14, Section 2.3), although there had been no mechanism for evaluating the performance of cycling facilities against the needs of any group. For improvements to be better targeted, and risks mitigated, it was necessary to devise an audit, and subsequent treatment plans, with ‘Design Cyclists’ in mind.

Each group of cyclists has requirements which are predominantly based on a blend of skills, the need for safety and conflict resolution, and the desire for speed. The three groups below were identified as most appropriate and form a basis for ensuring that designs can cater for all users. A risk matrix could then be prepared, with appropriate values for each ‘Design Cyclist’ group, to ensure that appropriate constraints or solutions could be identified.

The final objective was to enable every facility to be rated, against each group, indicating whether the facility met their requirements and could be used in relative safety or whether alternatives should be sought. It was recognised early on that not all routes could meet the needs of all users and that in some cases alternative facilities would need to be provided or retained.

The following are the three ‘Design Cyclist’ groups:

Group A - ‘Vulnerable’ - The 12 Year Old Cyclist

Highlighting the vulnerability of a group that includes young, inexperienced or wary cyclists, including seniors and beginners.

- Inexperienced cyclists with poor road sense or mobility and limited peripheral vision. Applying to beginners but equally to the aged and less mobile.
- High priority given to safety and conflict resolution, especially at intersections.
- Operating at a lower speed and accounting for other users, often with parental guidance on routes. (Frequently at 10 km/h and not generally over 20 km/h )
- Prefer to cross roads using pedestrian facilities within the competency of a 12 year old (such as to go to school).
- Recently disenfranchised from, but still similar to the under 12 permitted on, any path in WA.
- Needs (and uses even if not provided) shared paths and pedestrian facilities at larger or busier intersections.
Group B – ‘Utility’ - The Intermediate or ‘Urban’ Cyclist

“Everyday people, in everyday clothing, on everyday bikes”.

Figure 5, 6 & 7: Pedestrians on bikes for transport and recreation.

- Understands the road rules, probably as a driver.
- Still relatively cautious as a vulnerable user with vehicular traffic.
- Local use, relatively close to home, longer at weekends and for fitness.
- Includes family groups of all levels including young children.
- Safety is important and speed ‘negotiable’. (will tolerate sections at 10 km/h and averages less than 20 km/h)
- Will use simple intersections on road.
- Will seek (and use even if not provided) shared paths and pedestrian facilities at larger or busier intersections.

Group C – ‘Assertive’ - The Advanced or Commuter Cyclist

Often, but not exclusively, fast, fit and Lycra clad and travelling longer distances both for travel and recreation.

Figure 8 & 9: ‘Fast and fearless’ on-road cycling, Scarborough WA and London UK.

- Understands the road rules, generally as a motor vehicle driver.
- Competent on the road and is able to negotiate for road space.
- Longer distance for commuting or long distance rides.
- Often solo although may be part of an organised group.
- Speed is very important to keep journey time down (does not tolerate speed restrictions and averages 30 km/h)
- Will use almost any type of intersections on road, but dislikes kerb to kerb lane widths less than 4.2m.
• A significant proportion seek (and use even if not provided) shared paths and pedestrian facilities at larger or busier intersections and along major roads.
• For a significant number increased awareness means safety is a lower consideration, in so far as they are strong enough to compete in almost all road locations, however, they may often perceive shared paths to be safer than they are in reality and consequently may place other users at risk.
• The assertive skills necessary to negotiate and survive on roads in some cases leads to them appearing too aggressive particularly to other road users including pedestrians.

The three groups cover all of the potential users, as there are skills and ability overlaps within the seven categories. The descriptions below explain the linkage with the Austroads Part 14 categories and an indication of their suitability for Shared Paths, as well as some design parameters.

**Group A:**
On their 12th birthday children, previously permitted on any path, now become disenfranchised and reliant on the ‘adult’ facilities. However, just as they are acquiring skills from a low start, such as Primary and Secondary school children (up to 14), this grouping also caters for adult novices and the more mature rider who may suffer reduced mobility and peripheral vision. This group is welcome on all Shared Paths and offers minimal risk to other users. The suggested ‘Design Speed’ for this group is 15 km/h with an acceptable range, or expectation, of 10-20 km/h. This represents a group that can be encouraged to utilise cycling as a transport mode – even before they can drive - and, with adequate facilities, retained thereafter. Furthermore, with an ageing population, it is also representative of a growing minority grouping comprising retirees and those whose children have left home.

**Group B:**
With a higher (collective) skill level, this group can and will go faster, where appropriate, but do not see speed as essential and will be tolerant of reduced speed zones. Posing a low to moderate risk to other users, this group can and will use more complex road environments and will generally modify behaviour when using Shared Paths. This group covers most recreational and utility cyclists, as well as some commuters, and may find the use of Shared Paths appropriate and can generally be tolerated there. The suggested ‘Design Speed’ for this group is 20 km/h with an acceptable range, or expectation, of 10-30 km/h. This group, sometimes referred to as the ‘urban cyclist’, represents the majority of potential cyclists.

**Group C:**
Competent and assertive on almost all road environments. With speed as a priority most should use adjacent roads in preference to Shared Paths and find 50 km/h local streets an acceptable option. Poor coordination of facilities, however, means that a significant number are forced, or chose, to use paths at excessive speed thereby posing a high risk to other users and themselves. It is important that adjacent roads are not compromised and remain available for these cyclists, or that suitable alternative routes are signed. This group primarily caters for commuters and those engaged in training or fast touring, as well as large groups, and should be dissuaded from using Shared Paths. The suggested ‘Design Speed’ for this group is 30 km/h with an acceptable range, or expectation, of 20-40 km/h. They represent a significant ‘minority group’ that are, nevertheless, important and may act as an ‘elite’ goal for existing cyclists to progress to.
2.6 Application of Risk Assessment Protocols

The initial review, undertaken prior to designing the audit, had indicated that there were significant risks that needed to be adequately assessed and, therefore, the audit was devised for input into a ‘Microsoft Access’ database in a form that was then capable of being processed through a Risk Assessment matrix (dealt with in more detail in Section 3).

The principles of Risk Management, where appropriate, were applied to identify the level of risk, interpret the hazards and the consequences of uncertainty, in a consistent, logical and systematic manner. Potential treatment plans could then be prepared by establishing the context, identifying, analysing, evaluating data and developing solutions in line with recommendations in the Australian Standard for Risk Management (AS/NZS 4360:2004) and the British Standard for Asset Management of Physical Assets (PAS 55-1:2008). Final output could then be undertaken using ‘MapInfo’ to graphically display the locations of identified risks.
3 Audit Process – What Have We Got?

3.1 Scope of Audit

The principal aim of the audit was to capture sufficient data to enable a model to be constructed which is capable of being risk assessed to enable both suitability (for users) and appropriate treatments (for designers) to be identified and displayed in an intelligible manner.

In devising this audit it became apparent at an early stage that it would be very time consuming and outside the resource time and funding allocated. Furthermore, the extent of risk, and therefore need for treatment, identified would be too much to action immediately. Stirling covers an area of 100 sq.-km with more than 1000 km of roads. Accordingly, the City was divided into three zones with the first stage audit undertaken in Zone 1 (Freeway to Coast).

![Figure 10: Plan showing zone boundaries (Freeway and Karrinyup Road/Morley Drive)](image)

The primary focus of the audit was on the PBN routes as, properly improved with some additions, they could form the basis of a familiar and functional secondary cycle network. In some cases adjacent streets may provide a better alternative, but any realignment is anticipated as local and minor diversions. PBN routes are, in places, just that (a route) however, it was important that these routes were audited in their entirety, as it was necessary to identify both hazards and opportunities for the whole route, irrespective of whether any cycle specific facilities existed.
Although most of the Northern PSP follows the Mitchell Freeway, and lies outside of the City’s jurisdiction, it was important to include it within the Bike Plan as it forms the (Primary) backbone for commuting from the western suburbs, an integral part of the City’s cycle network, and an essential part of the local pedestrian network which the freeway intercepted (which is the most significant constraint to the safe function of the PSP).

Individual elements, such as Shared Paths, Separated Bicycle Paths (exclusive for cyclists), Segregated Paths (dual separated walking and cycling paths) and on-road Cycle Lanes were audited even though they did not form part of any route.

Local ‘Good Road Riding Environments’, as displayed on current maps, were not included as all local streets are potential cycle routes - although none at present meet the requirements of all user groups. The focus on these will be at the tertiary level and where opportunity exists to integrate them into ‘route development’.

### 3.2 Identification of Risk Types

The process of risk identification was primarily based on determining the likelihood and consequence of an attribute, present along a cycling path or route, posing a risk to each of the ‘Design Cyclists’. Key attributes that were considered are speed, visibility, presence/absence of cycling facilities, and road design parameters. Based on the probability that those risks would cause varying degrees of inconvenience, incidental or even malicious bodily harm to the cyclists, pedestrians and other road users, a risk matrix was developed to categorise the level of risk. The trigger for an appropriate treatment plan was referenced to the risk matrix developed, which allowed for the ability to deliver the appropriate treatment solution, consistent with City of Stirling Bicycle Strategy objectives.

Figure 11: Critical risk at blind intersection between path and fast bicycle traffic on PSP.

Figure 12: Hamersley Rd, Subiaco – Poor road markings lead to cyclists using footpath.

Figure 13: West Coast Highway – Fast cyclist chooses 70 km/h road over shared path.
3.3 Consideration of Parameters

It was vital that, when auditing the cycle facilities by bicycle, the team members collected all potentially relevant data. Therefore, a standard cross section was devised to ensure that data was recorded for assessment of the current (and any future) facility.

Cyclists are legally classified as vehicles and entitled to utilise the adjacent carriageway even when a Shared Path is provided. Therefore, the designer needs to consider the requirements of the faster cyclist, who poses a significant risk to other path users, and must not deny the user that choice by compromising the function of adjacent carriageways for cyclists. It was important that areas where that compromise had been created could be identified.

![Figure 14: Cross section showing all elements to be audited.](image)

For example, even though the facility being audited might be a Shared Path, it was vital that the full section was audited to determine the functionality of the alternative carriageway for fast cyclists. Where kerb to kerb widths are compromised this will inhibit faster cyclists resulting in many using the path, either below an acceptable LOS (speed), or with unacceptable risk to themselves and others. By appropriately rating the facility such users can be advised that they will need to accept a time penalty or seek an alternative route.

Another consideration was lateral visibility which affects the ability to avoid conflict (collisions) with others and bears a direct relationship with ‘safe’ speed. For example, the proximity to the boundary, or other features, is crucial where interaction takes place (eg: intersecting driveways, beach and park accesses and intersecting paths), but not as relevant where no interaction occurs.

In this case data is required to identify treatment that may be Point (where the conflict is isolated and can be treated) or Persistent (where the conflicts are recurrent, such as driveways, and the facility requires treatment (by regulation or even prohibition).
An example of a Persistent problem was at Trigg Island Surf Life Saving Club where fast cyclists conflicted with the users of the lifesaving club, restaurant and general beach accesses. The successful treatment plan here was to treat a length of 220m by erecting speed limit signage and placing speed control measures at each end. This resulted in both a reduction of speed and a reduction in volume as some faster cyclists elected to use West Coast Drive.

Lateral visibility was audited to identify the following (the actions in brackets are a likely treatment where the conflict is persistent):

- **<0.6m**: Critical score, no visibility prior to entry into the path of a cyclist (consider banning or alternative route)
- **0.6m to 2.5m**: High score, visibility severely compromised (consider warnings, contrasting surfaces and/or speed limited to 10 km/h)
- **2.5m to 4.5m**: Moderate score, visibility enables drivers entering forward to see (speed limited to 20kph)
- **>4.5m**: Low score, visibility allows visual interaction by both parties (no specific speed limitations).

References to speed were intended primarily to determine the safe speed of a prudent user and, therefore, an indication of LOS. As discussed in part 2.5 the three cyclist ‘groups’ have differing ‘Design speeds’ and ‘acceptable ranges’. The relative merits of, and possible need for, speed signage is discussed in more detail in 4.2.

The facility type and its width and signage are also very relevant, in particular with Shared Paths, and included in the parameters set. At present any traffic volumes are largely unknown and, in any event, not representative of those achievable by a coherent and complete network or route. Cyclist volumes will become relevant, in future revisions of this plan, and in determining the trigger for upgrading substandard facilities. Currently the scores will relate to Adequate, Sub-standard, or Unsuitable. It is important to bear in mind that, as the infrastructure improves and a modal shift away from cars develops, current levels of conflict will increase and measures currently not provided may well become imperative. The danger is that success will deliver unacceptable risk unless good engineering principles are embraced and alternatives developed.
Point features were also identified for inclusion and include, but are not limited to:

- Local obstructions and street furniture.
- Bus stops.
- Localised narrowing.
- Isolated intersections (e.g., PAW link).
- Blind spots.
- Unresolved conflicts at intersections.

Figure 16: Intersection of Cedric Street and Karrinyup Road, Stirling.

Figure 17: PSP at Beach Road.

Two very different ‘Point’ problems are illustrated here. On the left, a signal controlled intersection leaves many less experienced cyclists feeling very exposed and unsafe thus deterring use while, on the right, along the busy PSP, the critical lack of visibility places conflicting pedestrians and cyclists at grave risk.
3.4 Data Capture Rationale and Methodology

Fundamental to the audit is the requirement for every route and facility to be surveyed by bicycle. A two man team was equipped with ‘Trimble’ data loggers with GPS capability. Unfortunately this equipment was unable to support the amount of data captured, which required Microsoft Access functionality, resulting in data being manually entered at the end of each trip. The team has identified a suitable rugged tablet PC, for bicycle mounting and use in the field, which is currently under evaluation with a view to purchase. This will streamline future data capture and also provide a useful asset for other similar asset management projects.

Concurrent with the data input, photographs were taken of points of conflict for future reference by designers and the digital images stored and referenced together with GIS locations.

The data collected is then uploaded into MapInfo, from where it can be processed for display purposes. A model is then built up and processed through the risk assessment matrices, in a procedure that is predominantly automatic, providing the desired outputs. Results are very promising, with minor recalibration undertaken based on sample sites, which has enabled the output to be fine-tuned to match predicted outcomes at control locations.
3.5 Output of Information

The main starting point for the whole process of bicycle route planning was to be able to output the data to the various users in an easily understood manner. It was decided, at concept stage, to utilise a traffic light system (green/amber/red) to indicate both suitability and risk.

For example:
- **Users:** Suitability can be displayed by selecting a map (layer) for each user category with colour coding to denote suitability. For example for Group A (12 year old): **Green = suitable; Amber = parental guidance/caution; Red = Unsuitable.**
- **Designers:** Risk ratings can be displayed to denote level of risk and prioritise treatment. For example: **Red = Critical Risk (urgent action); Amber = High/Medium Risk (treatment required); Green = Low risk (no treatment).**

Processed data has already been successfully displayed for designers to be able to identify problem areas and provide treatment plans and subsequent targeted improvements. Future development potential exists, in the medium term, to provide graphical output, through the City of Stirling website, to enable users to view the facilities and routes available, and colour coded, to suit their (selected) user Group. The full potential of MapInfo has not yet been fully exploited and further development is being undertaken to streamline the process and enhance the final output.

At this stage the route audits tend to indicate where there are problems that need addressing and function primarily as a design aid. As can be seen from the examples below, for Group A and Group C cyclists, there are few routes that do not have unsuitable ratings at some stage along the route (although for group C most routes are acceptable). The preparation of a bike route development plan will enable investment to be targeted to providing complete routes where constraints (risks) have been reduced to the lowest practicable level. At this stage audits have only been undertaken along PBN and related routes in zone 1, however, as routes are upgraded, realigned or new routes established, the information gathered from audits will expand the database which will then enable ‘route rating’ plans to be uploaded to the City’s website.

The two examples below show the information output for both the Group A (12 year old) and Group C (adult experienced) ‘design cyclists’. The coloured lines show the risk rating for the facility (persistent) while the rectangles, circles and crosses show intersections and conflicts (point).
As can be seen, by comparing the two risk maps, much of the on road cycling, indicating amber or red for the vulnerable cyclist, now rates green or amber for the assertive cyclist. On the other hand elements of the coastal shared path (RSP) which showed amber for the vulnerable cyclist now show red for the assertive cyclist. This is particularly true for the point conflicts where limited visibility had flagged this amber (caution) for Group A which flagged as red (unsuitable/critical) for Group C.
Both the RSP and the Mitchell Freeway PSP reflect the fact that they are less safe for faster cyclists than vulnerable cyclists at point conflicts. Taking the audit outputs and assessing the outcomes the following observations and design recommendations could be made:

- **RSP Group A**: The facility is generally acceptable although limited visibility flags medium risk at accesses and some recreation areas may still pose a speed constraint. *Recommend improving visual recognition at access points and appropriate speed measures in slow areas.*
- **RSP Group C**: Use of this facility is unsuitable through recreation areas and where limited visibility, in particular at beach access points, is incompatible with the ‘target’ speeds of many riders. *Recommend ensuring alternative road routes are made more attractive with improved route marking on adjacent facilities and inducements for faster cyclists to use the alternative coupled with inhibiting measures on shared path (speed signage and physical calming where required).*
- **PSP Group A**: This facility is generally good although medium risks remain at some path intersections and more severe risk at two crossing locations (Cedric Street and Karrinyup Road). *Recommend improving visual recognition at access points and improved crossing facilities at major roads if this facility is to become rated suitable for this group.*
- **PSP Group C**: This facility is good although, owing to the higher ‘target’ speed of this group, the risk has increased to critical at some path intersections. The increased experience and competence of this group has lowered the risk rating at the two crossing locations (Cedric Street and Karrinyup Road) to low (they are now inconvenient rather than hazardous). *Recommend removing access points wherever practicable (by providing alternative footpath routes for pedestrians) and improving inter-visibility for those which remain. Where not possible consider separating path function with integral physical measures coupled with localised speed controls.*

The speed of a road is also accounted for and this can be seen from the two (parallel) east-west routes (Sackville Terrace and Moorland Street) where the following observations and design recommendations could be made:

- **Sackville Terrace Group A**: The on road bike lanes are flagged red owing the speed differential encountered on a 60 km/h road. *Recommend providing an alternative shared path (or route) or additional protection to enhanced bike lanes.*
- **Sackville Terrace Group C**: The on road bike lanes have now flagged amber reflecting the fact that the facility is acceptable but less attractive to some users. *Recommend providing an alternative route or additional protection to enhanced bike lanes. The facility is acceptable but would benefit from improved speed differential tolerance through buffering or reduction in speed limit to 50 km/h.*

The above examples are not conclusive design requirements but provided as an indication of how the audit process can provide some of the data to be accommodated in detailed route design.
4 Strengths and Weaknesses – What Do We Need To Do?

4.1 The Bicycle as a Vehicle – Rights and Obligations

Many people, pedestrians, cyclists and motorists, are not aware of the rights and obligations of a cyclist, and of them to cyclists, even though many of them belong to all three groups.

A cyclist has every right to be on the road, as a vehicle, except in limited circumstances and must obey all regulatory signage and road markings as a vehicle. This applies equally to paths, shared or exclusive, as the path is a form of ‘road’ for cyclists and regulatory road markings and signs apply and can be enforced as they would for any carriageway.

In essence, under the Road Traffic Code 2000 (RTC 2000), a bicycle is considered a vehicle and has all the rights and responsibilities of a vehicle (with some limitations and qualifications). Under RTC 2000 a bicycle includes recumbent bikes and tricycles and bicycles with auxiliary power not exceeding 200 watts. However, under Austroads Part 14 (which advises on uniform design and construction standards) a bicycle is defined as a “two wheeled vehicle propelled by muscular force exerted by a rider through pedals”. Recumbents, tandems, tricycles and bicycles with trailers (whether foot or hand cranked) are classed as “Human Powered Vehicles” and may not be catered for by the standards. This is also commented on in Austroads Part 6A which defines the bicycle as the standard vehicle for design of paths and states that allowance for HPVs may be appropriate in some areas.

Within the road reserve, on the carriageway (road), a cyclist is regulated by the RTC 2000 and treated as a vehicle except that:

• It is not permitted on freeways or where specifically prohibited.
• It may travel up to two abreast within one vehicle lane (no more than 1.5m apart). Other vehicles may not.
• It must utilise a Bicycle Lane where one is provided (and fit for use). All other vehicles must not.
• It may pass stationary vehicles, in the same lane, on the left when stationary in queues. All other vehicles must not.
• In common with all other vehicles it is subject to the Speed limit applicable to the road, or that part of the ‘road’ it is on where this differs.

Elsewhere, on Shared Paths within road reserves a cyclist is regulated by the RTC 2000 and treated as a permitted vehicle except that:

• It must give way to pedestrians at all times.
• It must keep to the left (but pedestrians are not required to).
• It must obey the regulatory signage and markings associated with the path (as a ‘vehicle’ on a ‘road’).
• It is subject to the Speed Limit applicable to the adjacent road unless an alternative speed is signed which must then be observed.
• Cyclists may not travel two abreast on Shared Paths.
Away from road reserves, in Parks and Reserves, a cyclist is not regulated by the RTC 2000 and will be treated as a vehicle (unless classed otherwise) under the relevant Local Law:

- Local laws are enacted under the Local Government Act and conform to a standard with some variations.
- In the absence of signage to the contrary, it is not unreasonable for a cyclist to continue along a road or path under the same rules that apply under the RTC 2000, however, this is not a guaranteed right.
- Many Local Laws apply a speed limit.
- Under the City’s ‘Local Government Property Local Law’ a vehicle (including a bicycle) is subject to a 10 km/h speed limit unless signed otherwise.

Cyclists do not have the right to use pedestrian crossing points on roads, where a pedestrian is given right of way at road intersections a cyclist is not (a cyclist only has these rights by dismounting and becoming a pedestrian). A cyclist may only use a signal controlled crossing where there is an additional green light for bicycles.

Pedestrians, and this definition includes wheelchairs, motorised gophers and in-line skaters, have right of way on any shared path, when walking along or crossing the path. They must not, however, cause an obstruction to other users (this includes cyclists) but slow speed is not obstruction.

Cyclists on shared paths need to account for the fact that pedestrians may not be aware of their presence and may make sudden changes in direction. This is particularly applicable where children and animals are involved and where the paths pass through grassed recreational areas. It is worth remembering that a cyclist is still a vehicle ‘permitted’ to be in an otherwise pedestrian environment and, in the event of an accident, under current laws the cyclist would start from a position of liability.
4.2 Speed, Safety and Shared Paths

Austroads Part 14 (AR14) deals with issues relating to speed in limited detail and is geared predominantly to the faster commuting group rather than the less able. This can be seen in section 3.4 with the statement “cyclists typically travel at speeds between 20 and 30 kph although they may reach in excess of 50kph down hills”. Relative speed is a factor mentioned in section 4.2.5 where, in relation to speed differential, the following is quoted “Where the difference between bicycle and motor traffic speeds is less than 20kph full integration may be acceptable” and “segregation is most desirable where the difference between bicycle and motor traffic speeds exceeds 40kph”.

Taking the two arguments together it is reasonable to conclude that for a Group C experienced cyclist (design speed 30, range 20-40 km/h) full integration may be applicable on residential roads at or below 50kph but not for roads at 60kph and above. For Group A, and some slower Group B cyclists, (design speed 15, range 10-20 km/h), it follows that roads speeds should be maintained at 30 to 40 km/h before full integration is considered, giving considerable merit to the application of lower speed zones to promote ‘cycle friendly’ areas.

Consideration is given, primarily, to speed in relation to the needs of cyclists rather than the problems arising from the speed differential between cyclists and pedestrians. A powerful argument could be made that a similar speed differential between cyclists and pedestrians is applicable, in which case full cyclist/pedestrian integration would only be acceptable where cycling speeds are limited to 20km/h. This would immediately preclude Group C commuting cyclists from shared paths unless pedestrian volumes were low and special warnings given.

Of particular relevance AR14 clearly acknowledges this, where confirmation is found in section 6.3.5, with the statement “on recreational and shared use paths where the speeds of most cyclists are generally about 20kph” Furthermore, whilst section 6.3.1 states “it is recommended that paths be designed for a speed of 30kph” the path design criteria in section 6.3 are related to cyclist volumes and, where (under section 6.3.4) reference to pedestrian conflict is made, there is a referral to section 6.6.1 which deals with Shared Paths (which questions the relevance of the path design criteria for application to shared paths as the designer is directed elsewhere).

Similarly, in AR14 section 6.6.1 is the statement that:

“A shared path may be appropriate where:

- demand exists for both a pedestrian path and a bicycle path but where the intensity of use is not expected to be sufficiently great to provide separate facilities;
- an existing or low use footpath can be modified to provide for cyclists by satisfying legal requirements and as necessary upgrading the surface, width and kerb ramps and/or
- there is an existing road available for faster cyclists to use, to limit the extent of user conflict on the shared path”.
Consideration of speed is now introduced by:

“Shared use paths that utilise existing footpaths may be satisfactory where they provide:
- A convenient and safe option for inexperienced and young cyclists. Because footpaths usually have drive crossings or side streets intersecting at frequent intervals they are only suitable for low cycling speeds (less than 15 kph)”.

(Note that this important statement is retained in Austroads Part 6A section 3.4)

This section is now providing a clear linkage between conflict and speed, but perhaps the most telling argument is found in Austroads Part 14 Figure 6-15 and reproduced in Austroads Part 6A as Figure 2.1.

![Path selection table from Austroads Part 6A.](image)

This figure clearly identifies that, unless both bicycle and pedestrian demand are low, a shared path is only suitable where speeds are below 20 km/h. There is, therefore, a clear implication that, where observed speeds on a shared path are significantly higher than 20 km/h, measures should be put in place to either reduce the speed, introduce separation, or warn other users of the significantly increased speed (and hence risk) applicable for that path. Note that in AR Part 6A, Low Demand, for both bicycle and pedestrian use, is defined as ‘Infrequent’ (less than 10 users per hour). Here a case may be made for signing higher speed limits, to empower faster cycling, while warning slower users and pedestrians.
Both versions of the Austroads guide make it clear that Shared Paths may be appropriate where “there is an existing road nearby which caters well for faster cyclists (e.g. has on road bicycle lanes), to limit the extent of user conflict on the shared path” (Austroads Part 6A section 3.4).

A clear conclusion, therefore, is that Shared Paths may well be appropriate where faster cyclists have an alternative (adjacent) on road option. Observations, for example Riverton Drive in Shelley, where riverside paths are in close proximity to a ‘safe’ residential road, demonstrates that, when provided with the alternative, faster cyclists will utilise the road rather than the path. Where an adjacent road network does not exist, or is not conducive to cycling, there would seem to be a prima facie need for speed mitigating measures, regulatory signage, or alternative provision for pedestrians. Such concerns must be taken seriously with respect to some of the PSP paths (and RSP paths) where they provide the only route for both pedestrians and cyclists with no viable alternative for either group. West Coast Drive is a case in point where median islands, coupled with a speed limit of 50 km/h, have compromised cycling use, with fast cyclists then displaced onto the recreational path.

(Note: Parts of the Mitchell Freeway PSP through Stirling form an essential part of the pedestrian network and any increases in either pedestrian or cycle traffic would exacerbate an already critical conflict). In such cases the only viable option would appear to be segregation or separation!

It is worth noting that in Darwin (NT) all shared paths are subject to a 20 km/h limit. In Melbourne (Vic), Sydney (NSW) and Brisbane (Qld), regulatory speed symbols are used in some locations to indicate speed limits between 10 and 20 km/h. Even in WA, the speed limit for the recreational shared path in Busselton (in the promotional brochure albeit not indicated on the ground) is stated as 20 km/h, at the Old Brewery beside Mounts Bay Road regulatory 10 km/h limits are signed and in Kings Park, subject to Local Laws, shared paths are subject to a 10 km/h limit.

Figure 21: Kings Park

Figure 22: Brisbane

Speed, therefore, is very relevant to the use of shared paths with the maximum safe speed, as argued from Austroads, clearly defined as 20 km/h. In devising the audit the relationship between speed and the lateral visibility at intersections and conflicts was a key survey parameter, as outlined in section 3.3 of this document. The obvious minimum, or datum speed, which needs to be applied to any path, is logically, 10 km/h.
This is the lowest speed that should be indicated or expected of a cyclist, as it is the speed that the conflicting users (cars from drives, pedestrians from paths) should expect from other legitimate path users such as:

- Motorised Gophers – classed as a pedestrian up to 10 km/h.
- Joggers – Average jogging speed (not intensive training) of 10 km/h.
- Child cyclist, under 12, generally about 10 km/h.
- Australia Post motorbikes authorised for use on footpaths up to 10 km/h.

As lateral visibility of potential conflicts increases so may the safe speed for that path. At 2.4 to 4.5m an emerging vehicle or person at 4 km/h will enter the shared path in 2 to 4 seconds, which will just about enable most cyclists at 20 km/h (5.56m/sec) to respond and brake in time (over approx. 20m) to avoid a collision. Thus it may be reasonable to accept 20 km/h as a maximum speed where this range is encountered. Above 4.5m it is reasonable to assume that, with more than 4 seconds to react and/or give an audible warning, higher speeds may not pose an unacceptable risk, particularly as other interactions should inhibit the majority of safer cyclists.

How a safer speed regime can be established and why this is necessary under a ‘duty of care’ is covered in more detail in section 5. As already alluded to there are, in assessing problems or risks, two distinctions with differing responses that can be summarised as follows:

- **Point** scenarios – These are where conflicts arise and local treatment can be employed to minimise the conflict and/or the speed at that location. Typically these are path intersections, bus stops, isolated obstructions and bends. This can be achieved by warning, separating, some form of physical intervention, or any combination thereof and could include advisory speed signs and barrier, stop or give way lines.

- **Persistent** scenarios: These are where the facility is subject to continuing conflict along its length. Typically these occur where repeated conflicts occur with restricted visibility such as driveways, beach accesses and ‘kids and dogs not on leads’ in recreational areas. This is far more likely to require a regulatory speed limit to educate, and ultimately enable enforcement (if all other measures fail); of what is the safe speed. Once a speed limit has been applied, but not before, consideration may then be given to physical constraints to ensure (enforce) compliance or deter use.

The following image highlights an example of a “Point” problem, typical of many, can be found along the freeway PSP. In this location cyclists, travelling at 40 km/h, conflict will pedestrians entering with zero visibility – and this is a route to primary school.
Below is the example of the section of path at Trigg Island Surf Life Saving Club, part of the coastal Regional Recreational Shared Path (RRSP), with a persistent problem of high conflicting use and restricted visibility, where a 10 km/h speed zone and control measures were applied. This has been successful to the extent that some faster cyclists are observed taking the alternative road route past the area and pedestrians are reportedly more relaxed within the zone. It also ensures that safety barriers can be erected, in conjunction with surf club activity, without accepting a higher degree of liability as fast cyclists would be liable for the result of their actions if the signs were ignored.
As an example of how critical this issue can be, the RRSP (with a recommended maximum speed of 20kph) is often operating at much faster speeds. The graph below shows the speed and volume of cyclists at a location south of Brighton Road used as a beach access by significant numbers of pedestrians. Taken for a week, from 20 February 2010 (Saturday) to 26 February (Friday), it shows that nearly 70% of all cyclists exceeded 40 km/h at the intersection with a beach access. Many residents south of Brighton Road, and east of West Coast Highway, use this path for their primary beach access, as do the multi occupancy and tourist related properties directly backing onto this path.

![Graph showing speed and volume of cyclists](image)

**Figures 25 & 26:** Data output from traffic counter showing excessive speed.

The conflict between pedestrians and cyclists in this area, with differential speeds in excess of 40 km/h predominating, is of sufficient concern that action is necessary to reduce vehicle (bicycle) speeds to an acceptable level. The probable solution, pending any longer term changes to the infrastructure itself, would appear to be the application of a speed limit with integral ‘traffic’ calming measures.
4.3 Legal Issues

The City sought legal advice on a range of issues relating to cycling in general, footpaths, shared paths and the application of speed limits. This advice was sought to determine the areas in which the City had a ‘duty of care’, the level of risk that the City might be exposed to, whether speed was an issue that necessitated specific action, what other parties had legal obligations and matters relating to path construction and drive crossovers. The six main queries and an outline of the key issues are expanded on below:

1) This relates to shared paths and the regulatory signage needed to legitimise one as well as the ability to provide additional regulatory signage. Under the Road Traffic Code 2000 (RTC), regulatory signage, as set out in Schedule 2 or Schedule 3, gives official status to a shared path, however, only the Commissioner of Main Roads (the Commissioner), or an authorised delegate which the City is not, has that power. Advice provided is that any regulatory signs erected by the City would be unlawful and the conduct regulated by that sign likely to be unenforceable.

But, of considerable relevance here is that a shared path, is defined as ‘an area open to the public….that is designated for, or has one of its main uses, use by both riders of bicycles and pedestrians’. This means that many paths become shared paths by virtue of use, despite the prohibition in regulation 216(1) against cycling on footpaths. The conclusion here is that many, or all, unsigned paths do in practice have ‘unofficial’ status and are legal shared paths. In fact the PBN route signage would in some locations appear to legitimise the use of paths, sometimes in high conflict and dangerous locations.

2) The second query related to the City’s responsibility for an accident on an unmarked shared path. In essence, if the accident related to the failure to erect appropriate regulatory signage then MRWA rather than the City would be liable. However, knowing that unsigned paths may be shared paths, if the accident was caused by other factors, or the City was aware of material risks and failed to inform the Commissioner, then the City may be held liable.

3) It is clear that, once risks have been identified, the City has a legal duty of care to take remedial action in response to foreseeable risks of harm. In so doing it must be proportionate and reasonable and should include the development of an action plan including:
   - Making appropriate representations to the Commissioner in respect of identified risks of harm, on both forms of path being used by both cyclists and pedestrians, including risks attributable to excessive speed.
   - To erect appropriate signs (other than regulatory).
   - Developing a prioritised work programme for more substantial works.

4) The fourth query related to the use of regulatory speed signs on shared paths and whether they would be enforceable given the often held and quoted presumption that this cannot be done. The response provided, on the information available and in light of guidance from the Austroads Guidelines, confirmed that:
   - as a general proposition, regulatory speed signs on a shared path would be appropriate; and
• in at least some circumstances, regulatory speed signs on a shared path would be necessary;
• the Commissioner (and only the Commissioner) has the power (within the road reserve) to erect regulatory speed signs on a shared path and;
• in the absence of an appropriate authorisation, a regulatory speed sign erected by the City (within the road reserve) would be erected unlawfully and likely to be unenforceable.

5) Advice provided also concluded that, in the event that the City identified a need for speed signage, communicated that to MRWA, and that action was denied, then: ‘Because the Commissioner of Main Roads, in the absence of relevant authorisation, has the exclusive power to erect speed signs on a shared path on a road reserve, the Commissioner would be liable for the consequences resulting from any failure to exercise that function lawfully and properly’.

6) Finally, in the matter of whether drive crossovers should replace a continuous path, it was confirmed that the City has potential for liability in all scenarios, as it has responsibility for ensuring that crossovers are properly constructed and maintained. In fact ‘this may require that the crossover is constructed so as to enable the shared path to be continuous (in terms of the materials that are used, the design, dimensions, colour etc)’. Because all paths are potential shared paths and, in any event, used by cyclists under 12 and other users including gophers, it would be prudent for the City to ensure that all new paths are constructed across existing drives and that all new drives maintain the visual continuity of the path while being made trafficable.

The above legal issues relate to paths constructed within the road reserve and covered by the RTC 2000.

Where paths are not within the road reserve they are generally covered by the City’s relevant Local Law. For continuity it would seem desirable that a consistency of signage is applied and that the above conclusions are deemed to apply. The one fundamental difference, however, is that any reference to the Commissioner, and his powers and responsibilities, would now be equally applicable to the City as the ‘regulator’ – or in the case of land not in the care and control of the City the other ‘land owner’. Some shared paths are located in land, ‘owned’ by the State of WA, DPI and other state bodies, that are not road reserve.

In Conclusion, the most significant issue arising in this section would be the fact that most footpaths are shared paths, whether or not they are signed and that there are two categories:

**Official, or signed, Shared Paths**

These are Shared Paths that have been constructed or modified with the intention of being used as formal shared paths. With regulatory signage they carry a higher ‘duty of care’ which includes the necessity to inform of an appropriate speed applicable to the conditions and/or other measures to mitigate risk and these issues are addressed in detail in this document.
Unofficial, or unsigned, shared paths

Any path, irrespective of whether it was intended as such, is potentially a lawful shared path. In fact, as defined by the law, together with the fact that cyclists under 12 are specifically allowed to use them, and that most paths are regularly used by adult cyclists, it would seem that every footpath, unless signed otherwise, must be considered as a shared path. That being the case, a duty of care must exist, however, this is tempered by the fact that the actual and lawful use was probably unintended at the time of construction.

As was argued in section 4.2 the minimum or datum speed should be that of the recognised pedestrian users (taken as the 10 km/h applied to a motorised gopher). The fact that these paths are ‘de facto’ shared paths means that an effective remedy must be applied to address the inconsistency between intended and actual use. Here lies the quandary for local government as the problem faced is not of their making and neither is the most effective remedy.

The cost benefit and works required to bring all paths to official shared path status would be both prohibitive and counterproductive but is also unnecessary and would also be an unfair impost on the local government providers. This problem is clearly a matter for the State Government, which has provided the legislation and management practices that have caused this situation to arise, however, there is an effective remedy that would require no change in the law, or any significant expenditure. The issue here is not to treat or modify the facility but to modify or legitimise the behaviour of the user.

Currently under rule 216 (RTC 2000), covering shared paths and separated footpaths, section (1) states: “The rider of a bicycle who is 12 years of age or older shall not ride on a footpath, that is not a shared path or a separated footpath”. It could and should be argued that age is not a valid determinant of safe and appropriate cycling on a footpath, but more appropriately that which creates the primary risk – speed! Given that cycling on an unmarked footpath is lawful (as it is a shared path and does not contravene this rule) the use of all paths, unless signed otherwise, is already providing an effective remedy for parents with children, inexperienced schoolchildren over 12 and adults, and in any circumstance where the adjacent road is deemed to hazardous. What is not acceptable, or lawful, is to cycle at a speed that a path is not suited for and was not intended for.

Whilst it could be appropriate, as a last resort, for the City (or any other LGA) to unilaterally apply advisory signage to take action, it would be unreasonable particularly as the State Government is best placed to provide a uniform solution across the state.

**Recommendation 1:**
Urge State Government to consider revising the under 12 year old rule to an under 10 km/h rule, on all ‘unmarked’ paths, for all ages of cyclist.
This is a simple but effective solution, requiring no changes to primary legislation, as it is a clarification of existing rights with confirmation of an obligation which places the main 'duty of care' on any cyclist exercising that right. The benefits include:

- Onus placed on cyclist to keep speed at or below 10 km/h.
- No excuse for not having a speedometer (onus on cyclist to keep slow to exercise right).
- Does not disadvantage current safe usage of paths by vulnerable cyclists.
- Does clearly inhibit use by fast cyclists.
- Resolves the conflict between the law (as perceived) and actual enforcement (virtually never).
- Will provide an effective solution to those that previously avoided cycling because of gaps in infrastructure.
- Provides conforming cyclists with the same protection under the law as other ‘pedestrian’ users below 10 km/h.
- Provides an effective defence to innocent parties who may conflict with faster cyclists.
- Minimal cost to State Government to implement.
- No cost to Local Government.
4.4 Duty of Care – The City, Main Roads WA and State Government of WA

General

It is quite clear that there are many government bodies that are responsible, in one way or another, for the provision of cycling infrastructure as ‘providers’ and/or ‘regulators’ and that a ‘duty of care’ exists to cyclists and other users that may be affected.

Local Government has ‘care and control’ of the majority of the road network, as well as paths and roads within parks and reserves not subject to the Road Traffic Code 2000. As such they are the main ‘provider’ of the vast majority of cycling infrastructure and ‘regulators’ in areas outside of the road reserve.

State Government has ‘care and control’ of parts of the cycling infrastructure located within freeway and railway reserves as well as other associated land. In these areas they are the ‘provider’ of those sections of infrastructure. Although representing only a small proportion of the network they constitute the most heavily trafficked parts, generally as a PSP. The bodies with care and control are generally (but not exclusively) part of the Transport Directorate, reporting to the Minister for Transport, which comprises the Department of Transport (DoT), Main Roads WA (MRWA), and the Public Transport Authority (PTA).

Except on property covered by Local Laws, LGAs do not have any powers for the control, regulation and enforcement of traffic, including bicycles. These powers are conferred upon:

- The Commissioner of Police who ‘is responsible for the control and regulation of traffic in the State and for the enforcement of the traffic regulation provision of…’ through the provisions of the Road Traffic Act 1974 (RTA).
- The Commissioner for Main Roads, through the RTC 2000 (made under the RTA) who is empowered to erect the regulatory road and traffic signs and road markings. No local government has been delegated that power in respect of cycling within road reserves.

The City (and by implication all other LGAs)

It is clear, therefore, that the City, in common with other Local Government Authorities within their areas, has a ‘duty of care’ in respect of infrastructure for which they are the ‘provider’.

Although Local Government has care and control of the vast majority of the road network, because the carriageway is largely controlled by the application of regulatory road signs and markings by MRWA, it has, therefore, limited exposure to liability providing that the surface is adequately maintained and design complies with guidance in Austroads. Any cyclist using the carriageway does so, and has generally the same rights, as any other vehicle. With road marking and signage the responsibility of MRWA there is little risk specific to cyclists that the City would be liable for. One exception might be where a route, indicated as suitable for less competent cyclists, provided those cyclists with no choice but to utilise a carriageway that they would otherwise have avoided. Care, therefore, must be exercised when providing, and particularly when way-marking, routes that utilise safe roads or shared paths that lead into or along more hazardous roads.
Unfortunately matters are not, at present, quite as clear-cut particularly when it comes to shared paths. Whilst legal advice provided (see section 4.3.1 above) is that it is unlawful for shires to provide regulatory markings and signage, this has been common practice as MRWA has not done so and, together with the DoT (Bikewest), has actually expected LGA’s to do so, albeit without proper authorisation.

The principle of negligence is codified in the ‘Civil Liability Act 2002’ (CLA). Whilst this Act provides some protection for public bodies, against claims in negligence, where a duty of care exists and a failure to fulfil that duty by providing an inadequate standard of care has been the cause of harm, then a claim of negligence may succeed. This, however, would be subject to whether the risk was foreseeable, was not insignificant and whether a ‘reasonable person’ would have taken precautions.

The legal opinion advised that: “the risk of an accident between a pedestrian and a cyclist on a shared path is likely to be seen by a court as a foreseeable risk, that is not insignificant and one which a reasonable local government in the City’s position would have taken at least basic precautions to avoid” The problem here is in determining the precautions that should have been taken. Clearly there are some options available to Local Government, in that any physical obstructions can be appropriately coloured and reflective, surfaces can be adequately maintained, and warnings provided. However, with the main risk being speed, and a remedy such as regulatory speed signage beyond their current authority, providing they had identified the risk and brought it to the attention of the Commissioner for Main Roads, Local Governments would in all probability not be liable ‘Because the Commissioner of Main Roads, in the absence of relevant authorisation, has the exclusive power to erect speed signs on a shared path on a road reserve, the Commissioner would be liable for the consequences resulting from any failure to exercise that function lawfully and properly’

An interesting outcome is that “the City’s duty of care obligations in respect of shared paths apply not only to those shared paths that were intended by the City to be shared paths, but also to those paths that, by reason of their use by cyclists, have become shared paths for the purposes of the RTC” In practice this suggests that considerable care must be taken when designing new paths, as well as in assessing and maintaining existing paths, as many are, or could, become legitimate shared paths. In fact all paths are, by law, used by cyclists under the age of 12 unless specifically signed otherwise.

In summary, there are several key issues regarding Shared Paths:

- Local government has an obligation to respond to identified risks in respect of the design, construction and maintenance of the path.
- There is also a duty of care to all users which requires that, as a ‘reasonable person’ the City should take steps to foresee the risks of harm and respond in a reasonable way.
- The audit process has identified speed as a significant risk factor and is in receipt of complaints about excessive speed and reported accidents.
- Enforcement of speed and application of speed limits are not available to the City within the road reserve, but are within parks and other reserves.
- The City should take appropriate action in regard of speed even in the absence of a relevant authorisation and “would have a duty of care to make appropriate representations to the Commissioner of Main Roads warning of, or giving relevant information about, the risk….”
• Responsibility for speed limits rests with the Commissioner of Main Roads who “would have the primary liability in respect of harm caused as a result of excessive speed by a cyclist on a shared path” although where an issue was known to the City, and not communicated to MRWA, the degree of liability may be reduced.

As discussed in section 4.3 every footpath, whether existing or proposed, should also be considered to be a shared path and most if not all of the comments made regarding shared paths will apply. Although traditionally they have only been considered ‘shared’ for children under 12, there is little doubt that every path is used by cyclists and that that behavior is also lawful. Furthermore, whilst the ‘datum’ speed for a footpath is 10km/h, this cannot be presumed and LGAs need to consider how this can be conveyed to cyclists. The most effective remedy sits with the State Government and agencies (Recommendation 1).

Main Roads WA (MRWA)

As has already been stated, the Commissioner for Main Roads, through the RTC 2000 (made under the RTA) is empowered to erect the regulatory road and traffic signs and road markings. No local government has been delegated that power in respect of cycling within road reserves.

Current practice, as espoused by MRWA and DoT (Bikewest), has been for local government to provide regulatory signage and markings to shared paths, which is unlawful. This does not necessarily mean that the signs and marking are inapplicable, as a shared path can become one without a lawful sign, and barrier and give way lines can still indicate a hazard and intended behaviour that is expected of a ‘reasonable person’.

Serious consideration must be given to either:
• Providing formal delegated authority to the City (potentially local government in general) to provide regulatory signage and markings to shared paths. That authority, to be effective, would need to include barrier, give way and stop lines; shared path markings and signs; speed limits and zones; and such other signs as required.
• MRWA providing all regulatory signage and markings, in a similar way to those provided for carriageways within roads under the care and control of local government. MRWA would still retain the primary liability, providing that councils continued to assess and communicate the risk as the ‘provider’ of the facility.

As already explained, the Commissioner for Main Roads is the only body that has the authority and, for the reasons already set out, would have the primary liability for the absence of such signage, in particular that of speed.

MRWA is also the ‘provider’ of cycling infrastructure, adjacent to principal roads (e.g. Reid Highway), the Mitchell Freeway and some other locations. In respect of this infrastructure the majority of the observations regarding duty of care, obligation, risks and liability, as discussed for the City above, would apply to MRWA as the ‘provider as well as the ‘regulator’.
A major concern to the City, for the safety of its residents and the general public, is the Mitchell Freeway PSP. This path provides the only pedestrian alternative to a footpath network that has been severed or inhibited by the freeway reserve and, in several locations, the only path crossing under (or potentially over) main roads intersecting with the freeway. This path places a constraint on future development of the pedestrian and cycling network in adjacent suburbs.

Without question the cyclist and pedestrian traffic on the PSP exceeds (by an order of magnitude) the 'low' threshold of 10 users per (peak) hour applicable to the 'Guide to Choice of Path Treatment' (ref: Austroads Part 14 Figure 6-15 and reproduced in Austroads Part 6A as Figure 2.1) and reproduced in section 4.2. Given that the cycle volumes are in excess of 100 per hour (peak), and the speeds generally range from 30 to more than 40 km/h, a Shared Path is not an appropriate facility. Whilst in itself providing an overriding reason for change, when taken with the fact that there is no "existing road available for faster cyclists to use, to limit the extent of user conflict on the shared path" and that there is no alternative for pedestrians, it becomes critical and urgent action is warranted. In fact it is so critical in many locations that, until an effective remedy is provided, no further development for cyclists or pedestrians can be considered in the vicinity without this being fixed. This means that development of pedestrian and cycling facilities that depend on the PSP for a link, as part of the Strategic Footpath program, are on hold until resolved. (For a discussion of potential solutions refer to section 6.2).

State Government of WA

Whilst the majority of cycling infrastructure is located in areas within the care and control of either local government or MRWA, there are many locations that fall under the ownership or jurisdiction of other state government agencies. In some cases, such as Kings Park, there are local laws and clearly well thought out processes for managing vehicles, cycles and pedestrians which extend to regulatory signs and markings.

There are, however, locations such as train stations (PTA) and other facilities and incidental areas of land (DoT, DoP, DPI etc) that are owned or controlled by government agencies but have no apparent or coherent local law regulating those activities, even where cycling facilities are provided or traverse them. For example the PSP is constructed within land recorded as owned by DPI and PTA (as well as City of Stirling and MRWA). Consideration needs to be given to ensuring a consistency in regulation across these jurisdictional boundaries and, where this is not achieved, clarity in confirming which rules do apply and who enforces them.

Finally the issue of an appropriate speed limit for shared paths, both official (signed) and unofficial (unsigned) is one which the State Government cannot afford to ignore.

For official (intended) Shared Paths, clearly the very explicit guidance provided in Austroads (AR14) has not in many cases been applied, even though the recognised standards are of particular significance and would be taken into account by a magistrate when determining liability. For this reason, and particularly where the speed of cyclists is known to exceed the design thresholds for shared paths, application of a speed limit must be a serious consideration in mitigating the risk, indicating the responsibility and transferring the liability to the cyclist. Where a speed limit is applied then anyone failing to observe it would create a risk that was foreseeable, not insignificant, and one which a reasonable person would have avoided (by not speeding).
For unofficial (de facto) shared paths, it is the State Government which has, through ambiguities and inconsistencies in the legislation, primary responsibility for addressing the risk. Clearly the ‘intended’ speed for footpaths, and one which local governments would have cognisance of when providing footpaths, is the 10 km/h which, in the RTA 2000, is the default speed for a shared road (where pedestrians have priority) as well as the legislated maximum speed for a motorised wheelchair (gopher) to be considered a ‘pedestrian’ or for Australia Post motorbikes to be allowed to ride on a footpath.

Knowing that footpaths are generally de facto legal shared paths, it is therefore incumbent on the State Government to ensure that the use of these paths matches the capability of the infrastructure provided under the presumption of a 10 km/h maximum operating speed. Fortunately, should the state government wish to act on this, as outlined in section 4.3, this requires no change in legislation, merely a clarification of existing rights with confirmation of an obligation which places the main ‘duty of care’ on any cyclist exercising that right. This would have similarities to the legal situation in Queensland, where cyclists are permitted to cycle on any footpath, but with the added safeguard that this privilege should be exercised with a corresponding duty to do so at a pedestrian friendly speed of 10kph.
4.5 Public Consultation – Summary of Results

As an integral part of the ‘Bike Plan’ a survey was undertaken and mailed to 1529 randomly samples households as well as being advertised on a number of websites and with other potential sources. A total of 293 unique responses were received which, while not being statistically robust, are capable of providing some interesting and relevant data from which general observations can be made and further research could be targeted.

For cyclists, 62% cycled regularly, 36% were female and 74% were in the age range 26-54. For non-cyclists, 73% were female, only 40% were in the age range 26-54 and 54% were aged 55 and above.

Some key findings from the consultation are outlined below with some observations and conclusions, as well as recommendations where the information indicates that further more detailed studies are warranted. As many cyclists have the potential to either cycle across the wider metropolitan area, or within districts other than where they reside, the results of the survey cannot account for activity within Stirling alone and for that reason further detailed studies are recommended at State Government level to determine the extent to which further study is required.

Key Findings:

- While 54% considered the provision of facilities for cyclists within the City as OK, more rated it as poor than good (32/12).
- While 55% compared the provision of facilities for cyclists by the City as about the same as other councils, more rated it as worse than better (28/6).
- 74% of non-cyclists and 83% of cyclists thought that it was important that it should be as easy, safe and convenient to get around the City by bike as by car.
- 74% of cyclists and 89% of non-cyclists did not know what the speed limit for a shared path might be and, of those that thought they did, only 2 individuals provided the correct answer.
- 72% of non-cyclists considered that a fifth of cyclists rode unsafely on shared paths while, surprisingly this increased to 80% of cyclists. This appears to indicate that most cyclists may have learnt through experience.
- When asked “do you think it is a good idea for shared paths.....to have information about safe cycling speeds painted onto them” 86% of non-cyclists and 72% of cyclists thought that it was a good idea. This supports the view that most cyclists, and in particular ‘new’ cyclists would observe speed limits if posted and would like to see a safe limit applied.
- The most common reason for not cycling was ‘lack of access to a bike’ (48%) followed by ‘not feeling safe riding in traffic’ (39%) with 45% of women citing this as a reason.
- When non-cyclists were asked ‘what would help you start riding?’ the following (in order of importance) were indicated: Safe local bike routes (37%); More Bike Paths (34%); Bicycle friendly streets (26%); More Bike Lanes (20%); More Shared Paths (20%); End of Trip facilities (17%). Unsurprisingly ‘More Bike Paths’ was the most popular, however, ‘Bicycle friendly streets’ rated above ‘More bike lanes’ and ‘More shared paths’ the latter two being the least desired and most commonly provided by the City. (see graphic below).
There were further subject areas that were probed more deeply and the answers are more complex that can be summarised in bullet point form with a more detailed assessment provided in the interpretation report produced by the City’s TravelSmart officer. Four areas which have influence on developing a strategy are: Perceptions of safety; Accidents while riding; New Ideas and; Illegal Riding Behaviour, are discussed in more detail below.

4.5.1 Perceptions of Safety

For this section, respondents were asked to say whether they thought the facility was safe, unsafe, or whether they had no opinion either way. The percentage of respondents who rated the facility as unsafe was deducted from those who thought it was safe, to provide a “Net Safety Rating” (NSR). Positive ratings indicated that a majority of those who expressed an opinion thought that the facility was safe, while a negative rating means that the majority viewed the facility as unsafe.

The following two graphics illustrate the NSR for a variety of facilities where speed limits of 50 km/h and 60 km/h respectively apply.
The above represents the comments by both cyclists and non-cyclists for a range of facility types for a 50 km/h road. In all cases, except shared paths (along the property line), the cyclist has a higher NSR than the non-cyclist. This indicates that perception rather than reality limits participation and that there is considerable scope to educate and encourage bicycle use. Shared paths, however, appear to be seen as less safe by existing cyclists once they have matched reality with expectation. Note that all facilities, including on road (with no special facilities) have positive NSRs.

**Figure 29:** Survey – Net Safety Rating for 60 km/h roads.

In contrast, the second graphic above, showing the same responses but for a 60 km/h road, indicates a massive drop off of support in all facility types, with non-cyclists indicating a high negative NSR for any on road riding, unless in a coloured bike lane, and even current cyclists rating on road cycling with a negative NSR of -5. These results are in line with the observations supporting, and predictions from, the concept of “Think 20” expanded in more detail in Part 5.

Even segregated paths, when provided adjacent to 60 km/h roads, were given a much lower NSR by both groups. Based on the clear differences there would appear to be a case for reducing speed limits on any urban road, in residential areas or where cycling would prove beneficial, where there is not enough space to provide facilities for cyclists separate from the main vehicle carriageway.

By 70 km/h (not illustrated) only shared paths, red bike lanes and segregated bike paths showed positive NSRs and then only for a few active cyclists. The fact that every facility, on or adjacent to the road, had a high negative NSR for non-cyclists suggests that any road at this speed would not prove attractive to new cyclists, or even many existing ones, unless a substantial separation existed between the road and the facility.

So far none of the speed related results accounted directly for traffic volume. From the responses it would appear that a busy road, irrespective of the speed limit, shows a similar, but marginally worse, set of ratings to the 70 km/h road, as shown below.
The logical conclusion, based on these results, would be that no road with a speed limit of 70kph or above should be used for a (planned) cycling route, unless a good separation is achieved from the road. (*Note: This does not mean that fast experienced cyclists cannot use such roads where they chose to exercise their right – as a vehicle. Just that this should not be a route that encourages less experienced users to use such a road*).

Similarly busy roads, unless subject to some additional traffic calming, should also be avoided. An example of a fast, busy road, where cyclists may not choose to ride, but should feel safe enough to do so as part of a route, would be the shared path alongside Marmion Avenue (80kph) where a substantial grassed verge separates cyclists from the road traffic and, most importantly, there are no property accesses.

It is worth noting that many more questions were asked and responses received which may further influence selection at detailed design stage, that do not warrant inclusion in this strategy. It is, however, worth reproducing the table for Traffic Calming measures as this does warrant some comment.

**Figure 30:** Survey – Net Safety Rating for high traffic volume roads.

**Figure 31:** Survey – Perceptions of safety for traffic calming measures.
From the above it can be seen that some of the traffic calming measures currently employed are not seen favorably by cyclists. Although a solid median with a coloured bike lane rates highly, there are very few in existence in Perth which implies that these may be more aspirational than an observation based on experience.

In particular chicanes (and solid medians where kerb-kerb widths are below 4.2m) are not liked and should be avoided or engineered more appropriately. Surprisingly a solid median, where a red bike lane is provided, has a very high NSR of 74 and warrants further and serious consideration, however, caution is required as what is seen as safer may not actually be so. Speed cushions and bumps (tables) meet with approval – as long as the (effective) road width does not reduce at the same location.

It is suspected that the thought of a narrow road with embayed parking (door zone issues) may have been misunderstood leading to the very high negative NSR of -69 recorded. In fact with embayed parking ensuring that cyclists do not have to continually negotiate road space, the narrow roads constraining vehicle speeds, and with cyclists owning or controlling the lane (vehicles having to overtake rather than pass cyclists) this facility should be capable of providing a much higher positive NSR. Potentially, this is a valuable element of a bicycle boulevard which had a very high approval rating (NAR) of 75%.

This disparity may be because there are few roads in Perth, where the trafficked carriageway is narrower and parking is embayed to create a safer and slower cycling experience, consequently there is a lack of positive experience. Accordingly, perception, promotion and clear affirmative markings and measures may well allow the NSR to match the NAR for a bicycle boulevard if carefully and properly engineered. This mismatch means that engagement with cyclists is vital if the benefits are to be realised.

### 4.5.2 Accidents While Cycling

In this section cyclists were asked whether they had been involved in a crash while cycling, who else was involved, and on what type of facility they were riding at the time.

Whilst the results are not statistically accurate, as they are too small and assume that the accidents reported occurred within the City, this interpretation is not wholly unreasonable as facilities within the City do not depart significantly from the metropolitan average. Less than 1 indicates that accidents/km is below average, and conversely above 1, is above average.

The following table shows the length and percentage of each cycling facility within the City against the percentage of accidents indicated from the survey for each of the facility types. The final column, ‘Accident factor’ is the proportion of accidents to length which, if all factors were equal, should be 1.
<table>
<thead>
<tr>
<th>Type of Facility</th>
<th>Length (Km)</th>
<th>% of Facility</th>
<th>% of Accidents</th>
<th>Accident Factor (1=Normal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Road - NO Bike Lane</td>
<td>978.0</td>
<td>56.8</td>
<td>47</td>
<td>0.83</td>
</tr>
<tr>
<td>On Road - Bike Lane</td>
<td>28.0</td>
<td>1.6</td>
<td>13</td>
<td>8.13</td>
</tr>
<tr>
<td>PSP</td>
<td>8.0</td>
<td>0.46</td>
<td>9</td>
<td>19.6</td>
</tr>
<tr>
<td>RSP</td>
<td>7.0</td>
<td>0.41</td>
<td>9</td>
<td>22.0</td>
</tr>
<tr>
<td>Shared Path</td>
<td>28.0</td>
<td>1.6</td>
<td>4</td>
<td>2.5</td>
</tr>
<tr>
<td>Footpaths</td>
<td>674.0</td>
<td>39.1</td>
<td>18</td>
<td>0.46</td>
</tr>
</tbody>
</table>

The results are represented graphically below:

![Accident Factor against Facility Type](image)

**Figure 32:** Survey – Reported accidents, factored by location.

Interestingly the results would appear to be the reverse of public perception and expectations. Whilst the higher values are certainly indicators of higher usage (and hence accident exposure) it is clear that on road cycling occurs at a significant level yet still only scores 0.83. At the very least it implies that public perception and conventional wisdom are flawed and that ‘safer’ facilities are not so, and ‘more dangerous’ facilities are probably safer that thought.

Furthermore, it is clear that many on road bike lanes (score 8.13) are discontinuous and feed, from and into, normal unimproved roads (score 0.83), ‘shared paths’ (score 2.5) and/or footpaths (score 0.45). For whatever reason bike lanes would appear to be inherently more dangerous. In all probability this is because bike lanes are generally only provided on roads with higher traffic speeds or volumes, where the differential speeds are greater, hence more dangerous.

Two facilities stand out, those are the coastal Recreational Shared Path (RSP) and the Principal Shared Path (PSP) with accident rates (per kilometre) approximating 20 times normal. This may be due to either the high level of cycle traffic (this may well justify compliance/enforcement measures), or the inherent conflicts and hazards (this may justify traffic management measures/separation), or a combination of both. Whatever the reasons, the figures indicate that these facilities are inherently more dangerous per kilometre (of path) and that further research is warranted, to provide a more robust measure of accident frequency/1000 cyclist km, based on accurate accident data and cyclist volumes.
Currently there is no accurate reporting of accident statistics for cycling on different facility types, or even a comprehensive database of basic sound accident reporting, including severity, with many accidents going unreported. In fact mandatory reporting of accidents involving cyclists is only applicable where the accident occurs on the road carriageway leaving many serious accidents unrecorded.

### Recommendation 2:

Urge State Government to establish a robust system for collection of cyclist accident data and, in conjunction with cyclist traffic counts determine actual Accident Factors for typical facility types

#### 4.5.3 New Ideas

In this section cyclists were asked about their support for the trialing a range of cycling infrastructure, rarely used within Western Australia, but which are common in the USA and parts of Europe. A simple question was asked “Would you support the trialing of these ideas within the City of Stirling?” In assessing the Yes/No responses a similar approach to that for facility rating (NSR) can be calculated to provide a Net Approval Rating (NAR).

**Shared lane markings (Sharrows)**

Overall 58% of cyclists said ‘yes’ against 34% ‘no’, giving a good **NAR of +24**. Experienced and younger cyclists (25 to 34) were most likely to support this idea (NAR 40) while intermediate and “sometimes” cyclists were least likely (NAR 4). It would appear that experience and youth support empowerment.

*Figure 33: Sharrows – placed on busier roads to help make cars more aware of cyclists*

**Turn pockets**

These can be marked within the road or even utilise paved verge/path with median refuge. Overall 74% of cyclists said ‘yes’ and 20% ‘no’, giving a high **NAR of +54**. Cyclists ages 35 to 44 were least supportive of this idea (NAR 18), but across all other categories there was little variation in support. This suggests that experienced cyclists have little need for such facilities whereas less experienced would benefit considerably.

*Figure 34: Bicycle turn pockets at intersections*
**Bicycle Boulevards**

There was little variation in the strong support for this idea with 81% to 93% saying 'yes', equating to overwhelming support with an **NAR of between +62 and +86**. Traffic calmed streets, which are cycling priority routes, identified by large bicycle symbols, would appear to satisfy all ability levels of existing cyclists and, by implication, should facilitate new cyclists.

![Figure 35: Bicycle Boulevards—traffic-calmed local roads which have been designed especially for cyclists to use](image)

**Coloured cross-intersection lanes**

These do not give cyclists priority but simply make cyclists, and cycling routes, more visible to turning vehicles. Again, there was little variation in support for this idea, across the different categories of cyclists, with 69% to 80% saying 'yes' equating to an **NAR of between +38 and +60**.

![Figure 36: Bike route marking across intersection.](image)

**Shared path by-pass**

73.8% of all cyclists supported a bypass facility, as illustrated for a roundabout. Averaging 74%, preference varied from 34% (experienced males) to 91% (inexperienced females) equating to an estimated **NAR of -32 to +80**. Experienced cyclists appear to have a lower approval as they chose to ‘cycle through’, and would benefit from affirmative markings, while inexperienced riders prefer the slower ‘safe’ crossing options provided by a bypass path.

![Figure 37: Bike lane bypass leading into shared path, Grand Ocean Entrance, Burns Beach.](image)
4.5.4 Illegal Riding Behavior

In this section respondents were asked this specific question: “Knowing that it is illegal, in what circumstances would you chose to ride on a footpath? The results are summarised in the table overleaf.

Only 6% of cyclists said that they would never ride on a footpath. This implies that 94% of cyclists consider riding illegally on a footpath as an acceptable risk management strategy, where the consequences of enforcement are a lower rated risk than other considerations. As enforcement is virtually non-existent that would seem a reasonable premise and accords with the conclusion in section 4.3 and repeated here:

**Recommendation 1:**
Urge State Government to consider revising the under 12 year old rule to an under 10 km/h rule, on all ‘unmarked’ paths, for all ages of cyclist.

The groups most likely to choose ‘any time that I am cycling’ were female cyclists, cyclists over 55 years old, cyclists who only ride sometimes, and those who rated themselves as ‘intermediate’. These would pose little risk riding at 10 km/h on unmarked footpaths.

![Figure 38: Survey responses to illegal riding behavior.](chart)
The provision of dedicated cycling facilities can help to reduce ‘illegal’, or undesirable, cycling behavior. This is highlighted by the 25% of cyclists who will choose to ride on the footpath of 60 km/h roads, but who will no longer do this if a bike lane is available and the 46% who do so to negotiate intersections safely.

Responses were fairly consistent across all groups of cyclists, except for “if there are no bike lanes available”. Again, ‘intermediate’, ‘sometimes’, female and older cyclists were more likely to choose this as a time when they would ride illegally than those cyclists who rode more often, were more experienced, were younger or male. This suggests that given a lack of cycling facilities, ‘vulnerable’ cyclists will choose to ride ‘illegally’, while ‘less vulnerable’ cyclists will choose to ride lawfully on the road.

Finally, the 59% that would ride unlawfully if riding with children are exhibiting sensible behavior that would benefit from a change to current understanding of the rules. As has been explained in section 4.3.1, it may well be that the interpretation of the law only, rather than the law itself, could effect this and that changes could be implemented by clarification and redefining the responsibilities of cyclists when cycling on unmarked footpaths.

The main conclusion, based on the responses to the questions relating to illegal behavior, is that liberalising the rules relating to footpath cycling are unlikely to, on balance, have adverse consequences. This is because the very group that would avail themselves is that group who already are or the more law-abiding members who currently refrain from, riding on footpaths and are, consequently, deterred from cycling. Because many ‘future’ footpath riders are those for whom safety is an overriding motivation and who are most likely to observe any restrictions (such as a 10 km/h permissive speed limit), implementation of Recommendation 1 is unlikely to pose additional risks to path users and, by stimulating an increased participation, will contribute through ‘safety in numbers’.

Note: This ‘solution’ has been tried and tested in Darwin where, by mandating that every footpath is a shared path but only for cycling at less than 20 km/h, bike riding for casual transport has ‘gone through the roof’, with a mode share more than double anywhere else in Australia with a concurrent reduction in accident rates well below the Australian average.
5 Treatments and Action Plan – How Do We Respond?

5.1 General

If we are to be successful in meeting the goal of doubling the participation in cycling within five years, and so enmeshing it within the transportation fabric as a multimodal transport option that it will become a mode of choice, then we will need to do several things. These can be summarised as follows:

- Rectify existing problems, and particularly those relating to safety and conflict, that adversely impact on existing cyclists, other users that may impede or be impeded by the promotion of cycling, or those that may be deterred themselves.
- Identify those parts of the infrastructure that may ‘fail through success’. Many facilities and conflict points are just ‘getting by’ and any increase in one of the traffic modes (pedestrian/cycle/car) may tip the balance.
- Improve the existing PBN network to closer align it with the key objectives of the Bike Plan.
- Concentrate on providing complete routes, from a defined start and end, particularly, but not exclusively, where these align with PBN routes. This should be the target of future funding.
- Substantially increase the role of data capture and monitoring as a tool to validate or disprove actions taken and assist in identifying areas for future rectification or development.
- Promote cycling, in conjunction with state government agencies, through education and marketing with a particular emphasis on “everyday people, in everyday clothing, riding everyday bicycles”.
- Campaign for, and ensure future policies support, the use of the bicycle as a transport option, both locally and as part of multimodal trips, as distinct from the ‘Lycrist’ (lycra clad club cyclist) sub-culture with its negative connotations to many pedestrians and drivers who might otherwise support increased cycling. This, however, must not be to the detriment of that group who do, or should, use most roads and should not be disadvantaged by what is done.

The latter action may be seen as contentious, however, there is a growing realisation, which is explained in some detail by Mikael Colville-Andersen of ‘Copenhagenize’ fame in his lecture “Changing the Behaviour of Behaviour Campaigns” in NY¹, that this is a necessary action. Some parts of that lecture are referenced and discussed in more detail in part 6.1.

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¹ The text of which was published on the web in an article dated 11 November 2009
Some, or all, of the elements outlined above may form part of, or be addressed by, the following sections.

5.2 Safety and Signage

Cycling is potentially an activity that knows few boundaries. The introduction of a vast range of bicycles, for many environments, means that cyclists experience a freedom from constraints that other transport modes may not possess. Racing bikes, hybrids, mountain bikes and urban bicycles ensure that there are bikes for all uses and, with the addition of cargo bikes, tandems, trailers and recumbent bikes, the options extend even further.

With the ability to hop up and down kerbs, cross verges and lawns, traverse rough ground and even be carried over obstructions and steps, bikes are able to circumvent obstacles that constrain other transport modes, however, with these abilities come responsibilities.

As has been previously discussed bicycles are classed as vehicles, wherever they are used and, except where the rider dismounts and is walking the bike, have to use all road facilities including paths as a vehicle. A bike rider will utilise two main types of facility and these are paths (where they are permitted vehicles on the ‘road’) and the carriageway (where by right they utilise the road as one of many classes of vehicle). While cycling on the road, as a ‘normal’ vehicle they are bound by the regulatory signs and road markings applying to all vehicles, unless there are specific cycling affirmative or prohibitive signs and markings. Because a cyclist will utilise both on and off ‘road’ facilities, and young children and beginners will be almost exclusively off road on Bike and Shared Paths and would benefit from early ‘road training’, it defies logic that paths would not be signed and marked in exactly the same manner, or as close as practicable, to roads.

Currently the behaviour of a significant number of cyclists is to treat regulatory signs and markings as if they do not apply to cyclists. Whilst the proportion on roads is smaller, on paths this becomes the majority. It would appear that this is due to lack of knowledge of the law, ignorance of the fact that it applies equally to paths, and in no small way because the signage used is ‘cyclist’ and not consistent with ‘vehicular’ signs.

It would not be unreasonable to say, that for any conflict that results in an accident, there needs to be a difference in speed (between the conflicting objects or an object and the ground) for the accident to have any severity. Management of speed, particularly differential speed, therefore, becomes an essential part of accident prevention and in mitigating accident severity. Accordingly, it is vital that speed limits are a part the solution for paths – just as they are on roads.

Section 4.3 introduced the legal advice that “as a general proposition, regulatory speed signs on a shared path would be appropriate; and in at least some circumstances, regulatory speed signs on a shared path would be necessary”. Furthermore, Section 4.4 concluded that under a duty of care where “the risk was foreseeable, was not insignificant and whether a ‘reasonable person’ would have taken precautions” would be an important test in determining negligence and/or liability.
Recommendation 3:
Ensure that all cycle paths and shared paths are signed and marked in the same manner as roads and that the full range of regulatory signs and markings are applied by the City, or MRWA where that authority has not been delegated.

There are other Regulatory, Warning and even Guide signs and markings that can, and probably should, be utilised on paths and an initial list of those that are probably appropriate are briefly summarised below (note that this list is not exclusive):

- **Regulatory speed signs to Shared Paths** (whilst 10 km/h may be necessary in high conflict areas it is recommended that 20 km/h should be the norm, unless signed otherwise).
- **Regulatory speed signs to Principal Shared Paths** (these should be considered as affirmative signs, recommended as 40 km/h or above, to *empower* cyclists to render the facility ‘fit for purpose’ whilst *warning* other users of the high speeds likely to be encountered (“dogs and kids on leads”). This should also ensure that the designer or ‘provider’ of the facility properly considers the implications of speed.
- **Regulatory Give Way and Stop signs and markings** that are identical to those used for roads (it may be necessary to scale these down to retain a consistent look on narrower paths) and even “No Overtaking or Passing” signs in some locations.
- **Utilise Regulatory double barrier lines**, dotted on one side if appropriate, to indicate where overtaking is dangerous and, therefore, not permitted. It is essential that these are targeted at critical locations that link the danger to the marking (for example on shared paths this may be on approaches to accesses where overtaking would blind side entering bikes or pedestrians).
- **Warning ‘Entry Left/Right’, ‘T-Junction’ and “Road Narrows” signage** at path/road entries and path narrowing such as underpasses and bridges.
- **Guide signs and directional signs** where they will assist in reinforcing the similarity with roads.

Some examples of how applying regulatory signage and markings, which are employed on roads, can be used to provide the same information on shared paths are illustrated overleaf. Not only does this apply a consistency for experienced road users but it can also act as a teaching facility for younger cyclists who will inevitably have to venture onto roads before they are old enough to hold a drivers license.
The example on the left illustrates how a beach access can be signed and the barrier lines provided so as to allow northbound cyclists to overtake (away from the hazard) while prohibiting overtaking by southbound cyclists (into ‘blind side’ conflict with unseen pedestrians stepping out. Note the use of tactile paving as a warning to pedestrians.

On the right is a situation commonly misunderstood by cyclists who consider a road access, to a car park or similar situation along a SP, as nothing more than a driveway and either see too late or ignore the ‘Give Way’ markings. In this case advance warning signs advise of the **road** entry and the need to Give Way which applies where a path crosses a road.

The key to this is making paths look as close to roads as possible. This will assist in mitigating confusion, where different signage may be misinterpreted, as well as facilitating training, on safer paths, for young or inexperienced bike riders, prior to utilising roads (which then have familiar signage and marking).

**Figure 40:** Warning signs at pedestrian entry.

**Figure 41:** Warning and Regulatory signs at intersection with path
Local roads do not have centreline markings as drivers are expected to know the law and drive left. Why not the same standard for cyclists? Centreline markings apply at areas where there is a risk to be mitigated, so why are formal Shared Paths required to be provided with continuous centrelines? By applying centrelines only at hazards, or between opposing Bike/Arrow/Keep Left markings, they better relate to the road environment and associate markings with risk. This approach will not bring immediate recognition or compliance but, over time and if applied over the metropolitan area, will deliver behavioural change by linking the signage and marking with actual risk locations. Established riders will continue to learn by experience while new riders can be taught from the start. Early familiarity with road signs can only assist with teaching future car drivers, from an early age as cyclists, and may even help to mitigate car accidents by those same cyclists when they become P-platers at a later date. The images below give some indication of current practice, problems and how a holistic solution could assist in providing road/path marking compatibility.

**Figure 42:** Kensington Street in East Perth

In this image a road does not need centreline markings which are reserved for specific areas such as the approach centreline and give way or stop markings for intersecting streets.

**Figure 43:** Bike markings in primary position.

While no centreline markings are normally applied to local roads, the illustration above shows how the philosophy of providing short lengths of centreline (in this case three broken) can be used to reinforce a Bike Route or ‘Bicycle Boulevard’ directional signage on a road. Again this would link in with, and reinforces the benefits of, limited centreline markings for Shared Paths.
In the next image a totally inappropriate solid barrier line prohibits overtaking in any direction, even when departing the distant bend towards camera. All this does is train cyclists to ignore such lines, something that would not be tolerated on roads. Which cyclist would remain behind a slow cyclist or pedestrian, for more than 100 metres after the hazard was passed, with a clear path ahead. This line marking would not be permitted if applied to a road.

**Figure 44:** PSP alongside the Mitchell Freeway at Currambine train station

Sceptics may question the effectiveness of these proposals; however, many would agree that current provision is dysfunctional with very poor compliance. Unless we are willing to embrace a radical change we will not be able to deliver the desired increase in cycling safely.

*If we continue with ‘business as usual’ we will get similar results, but with bigger problems as demand grows.*
5.3 Conflict Resolution

Perth is often promoted as a city well-endowed with both an ideal climate and good cycling infrastructure, with Bikewest literature claiming “The Perth Bicycle Network has long been considered a world class infrastructure initiative for cyclists”. In fact the PBN (network) extends to more than 700km of ‘routes’ within the metropolitan area, comprising a mixture of facilities that often do not connect in a practical or legible way. There is no question that it is a brilliant ‘initiative’ but it does not yet achieve the aspirations envisaged when it was established in 1993.

Furthermore, many articles, press releases and information by bicycle advocacy groups, and even references by the Minister, refer to the extensive network of ‘Bike Paths’ in Perth. An example of this is an article by Lee Rondganger in the *West Australian* (21 January 2010) containing the following paragraph:

“Driven by a desire for a healthier lifestyle and Perth’s 1130km network of bicycle paths, people are sparing no expense when it comes to buying bikes similar to those used by professional athletes”

Sadly this is very misleading and perpetuates the false belief that they are bike paths, whereas the vast majority are in fact shared paths. This article reinforces the growing confusion about what the purpose of the various cycling facilities are and who should be using them. This highlights a dramatic need for better education providing clear information on what the various path types are (FP, SP, PSP and RSP) as well as the rights and obligations of cyclists. Clearly, driving Formula 1 style on public roads is not acceptable, as Lewis Hamilton found when charged with ‘hooning’ in Melbourne, but so is cycling Cadel Evans style on Perth’s shared paths just as unacceptable.

The difference is far from subtle, as a bike path is provided exclusively for cyclists, who have the right of way, and are (with some exceptions) the only permitted users. In contrast a shared path is primarily a footpath for pedestrians, who have the right of way, with secondary ‘one of its main uses’ for cycling, where the cyclist is just a ‘permitted vehicle’ with no right of way over pedestrians and an obligation to give way in all circumstances.

Simple physics is one of the biggest contributors to conflict in that cyclists, unlike cars, require substantial physical effort by the rider to start, accelerate after slowing, or climb hills. Understandably riders are, therefore, reluctant to lose momentum in the first place as this is energy lost. Unless cycling infrastructure can minimise this, and enable a consistent speed to be maintained, it will always provide an incentive to cyclists to ‘go round’ obstructions, run red lights Stop and Give Way lines, and use more direct paths with less obstacles, thereby increasing conflict. On paths pedestrians are then treated as obstacles to a smooth run and, rather than slowing to pass them, some cyclists will retain momentum and seek to ‘blind’ pass from behind or even audibly ‘move’ pedestrians out of the way.

All streets, unless specifically prohibited, are available for cycling although some motorists appear in ignorance of this. Also, as cyclists are vehicles, they are covered by the same road rules as cars and must obey the road signs and markings. Unfortunately poor design often causes cyclists to have to stop or give way too often and, therefore, increases the extent of rule breaking. This has the unfortunate effect of further inflaming
those motorists that resent cyclists, thereby further increasing social conflict and marginalising cycling as a sub-culture.

Experienced cyclists are capable of cycling on 50 km/h local streets, while most beginners may find them daunting, which is then a major deterrent to increased cycling. Affirmative measures to empower cyclists to use the road would assist in confirming to motorists that cyclists are intended users of the road while encouraging less experienced riders to do so. The roads adjacent to shared paths are also vital as an alternative to path cycling and should, with few exceptions, always be available for those cyclists that wish to go faster. Road designers must not produce designs that remove that option for faster and more experienced cyclists, sadly, that has often been the case.

As introduced in section 3, as relevant to the audit process, and discussed in more detail in section 4.2 (Speed, Safety and Shared Paths), consideration is given to two types of conflict ‘Point’ and ‘Persistent’ and whilst the majority of concerns relate to the path network, there are some conflict issues related to the road for which the City has a lesser, but still some, responsibility. Some of these are outlined below with suggestions as to how they can be addressed.

Persistent problems with roads:

- Wide roads which enable cars to pass cyclists thereby relegating all but the most assertive to the edges where the majority of hazards are. A solution may be to narrow the road to ensure that cyclists can more easily control the lane, as cars can no longer pass but are obliged to overtake. Combine this with affirmative road markings and changes in priority to favour the cycle route and we have a Bicycle Boulevard.

- Conflict arises with parked cars, particularly where they are intermittent. Here, by making parking permanent (even when the cars are not there) the cyclist no longer has to negotiate for the road when passing and can control the lane and avoid the 'door zone'.

- Median islands are often employed to traffic calm and improve streetscapes. The unintended result is to ensure that cars have to pass slower cyclists as they cannot overtake. Many cyclists find this daunting and dislike kerb to kerb widths of <4.2m. While narrower widths, such as 3.9m minimum on West Coast Drive, have significantly reduced average (or 85th percentile) vehicle speeds and persuaded many cyclists that it is safer, there are many that find this daunting and conflicting. The solution may be to avoid this type of calming unless additional engineering can be provided. One such option may be to include, or even retrofit, 1.2m Bike Lanes (which is also likely to further reduce average speeds). This will require concessions from MRWA to line mark reduced lane widths.

- Too many opposing Stop and Give Way intersections along a road route. A solution would be to change intersection priorities to favour this route, with car diversions and bike bypasses if necessary to avoid rat running. Again a potential Bicycle Boulevard.
On Hamersley Road, even though it has PBN road markings, parked cars force cyclists to continually negotiate for road space. Consequently many were observed using the adjacent narrow property line path, which conflicted with the concealed driveways.

In East Perth, however, embayed parking has made the parking permanent and reduced the functional road width to just 6.5m. Consequently all the cyclists that used this route to access the riverside RSP were observed using the road.

Point problems with roads:
- Signal controlled intersections, in particular where the approaching roads have bike lanes, are often daunting for inexperienced cyclists. A solution for less experienced cyclists is to provide shared path bypass facilities using crossing points that all children should be capable of using by the age of 12. More experienced cyclists, where this is part of a route, should be provided with lane continuation through the intersection and head start facilities where cycle usage is high. Where such intersections form part of a principle route, such as along a PSP, consideration should be given to cyclist only phases across the intersection.
• Roundabouts are another point problem. Single lane roundabouts on low volume roads may be acceptable for all levels of cyclists but, where volumes are higher (LDR and above), shared path bypass facilities are again recommended for inexperienced users and should be provided where bike lanes are on the approaching roads. When bypass paths are provided it is essential that cyclists are empowered to retain the road, by affirmative markings (such as Sharrows) to advise motorists of the need to accommodate cyclists.

In the example below, on Sackville Terrace in Doubleview, the approaches on NW8 are provided with bike lanes. As illustrated, these used to terminate abruptly with cyclists facing a high kerb or solid barrier line (which had the unintended effect of advising motorists the cyclist should not use the road by rejoining the entry lane).

![Figure 47: Sackville Terrace in Doubleview.](image)

Provision of limited additional paths, and ramps at the lane terminations, enables less experienced cyclists to bypass the conflict. Breaking the solid barrier line AND placing a PBN cycle symbol (or Sharrow) on the road at the approach would then empower the cyclist and warn the motorist of the interaction (resolved conflict).

At the bypass ramps and path, with contrasting road crossings around the roundabout, have been provided and cyclists have the child friendly option of avoiding the roundabout itself.

![Figure 48: Grand Ocean Entrance, Burns Beach (City of Joondalup)](image)
From the bike lane above, more experienced cyclists can utilise the roundabout, however, to enable this the solid barrier line to the bike lane should be dotted, to allow the cyclist to merge lanes and advise the motorist that this can occur.

But, because of the clearly visible off-road route which is a direct continuation of the bike lane, it is also recommended that a bicycle symbol and arrow is provided on the road lane at roundabout entry to further empower cyclists.

![Figure 49: Grand Ocean Entrance, Burns Beach (City of Joondalup)](image)

As the image above shows, less experienced cyclists can be provided a safer, albeit slower, alternative well within the competency of a schoolchild walking (or riding) to school.

**Persistent problems with paths:**

- A common persistent problem is one that repeats at regular intervals, such as drive crossovers. In this case the safe speed is a function of the lateral visibility, discussed in section 3.3, and there is little scope for any remedy other that a speed limit to indicate the safe speed. Vehicles crossing a path are required to give way to path users; however, the contrasting crossover surface is often carried across the path providing a conflicting visual message. New or replacement paths should be continuous across the driveway to visually reinforce the legal status of the path user to the conflicting vehicle.

- The regional RSP along Stirling’s coastline is intersected by frequent beach accesses (75 along 6.2km) which pose a significant safety risk. Whilst it would not be practicable to place warnings at every one, or a speed limit to suit the worst, a holistic solution is needed. The recommendation is to apply measures to reduce speeds to that appropriate to a shared path of 20 km/h. This can be effected by providing an adequate road alternative, in conjunction with some deterrents for fast cyclists, and probably formal application of a speed limit. Those ‘bad’ path entries, that would remain potentially unsafe, would then need treating as point problems.

- Environmental issues also create a persistent problem. For example where a shared path traverses a recreational area, such as a picnic or play area where ‘kids and dogs are not on a lead’ cyclists need to slow to about 10 km/h. Fortunately in most of these areas, under the City’s local laws, the speed limit is already 10 km/h (unless signed otherwise). Consideration must, therefore, be given to signing this speed limit, but also to providing an alternative route for those cyclists that will not tolerate such a time penalty. Where an alternative cannot be provided consideration must be given to providing a segregated path with a higher speed limit. This must act like a cycling ‘road’ and path to provide physical and visual cues that young children are taught to recognise.
Figure 50: Use of kerbs and ramps to segregate cycling ‘road’ within a park.

The illustration above shows how a segregated path can be provided through a park or similar environment. The essential characteristics are:

- The cycle ‘road’ and pedestrian path are side by side to minimise creep where, for example, the pedestrian eventually turning right might walk on the right.
- Any intermediate verge should be avoided as this will encourage ‘desire line’ creep.
- The cycle ‘road’ is bounded by kerbs to ensure the faster cyclists cannot swerve into the pedestrian safe areas.
- The kerbs reinforce the well understood relationship between the road and path that young children are taught to recognise from an early age.
- Pram ramps are used at path intersections to further reinforce the ‘road’ crossing and encourage young children to wait for parents and hold hands.
- Faster speed limits require posting to both empower cyclists and warn other users. *Note: By informing cyclists where they may go faster this will assist in differentiating faster paths from those where lower speeds are essential for safety (for example PSP v RSP).*

Point problems with paths:

- A common point problem is one that occurs in isolation or infrequently. Typically these are sharp bends or underpasses with poor visibility, intersecting PAWs and paths into parks and reserves, and accesses to major buildings and train stations. Providing visibility between conflicting users is compatible with cyclist speeds no action may be required. Where it is not, then treatment with warning signs, double barrier lines, tactile paving and protective bollards or barriers may be appropriate.
- In more extreme locations, particularly on down slopes and restricted sections, path deflection, chicanes, rumble strips, ramps, median landscaping areas and even high visibility bollards may be an appropriate response to enforce compliance.
- Extreme care is required if using bollards to form barriers or ‘gates’ to avoid forcing conflicting users into a restricted gap. Bollards and similar obstructions on a fast path are hazards in themselves; however, when used in conjunction with a speed zone or limit, the burden of liability for accidents will shift towards the speeding cyclist and away from the provider if those signs are ignored. It is not possible to eliminate all risk so, providing the residual risk is less than the foreseeable risk if nothing was done, then such barriers become an option that must be considered.
• Other point problems are infrastructure, such as power poles, located within paths. Where new paths are constructed around such obstructions then appropriate barrier lines and high visibility treatments should be provided. Where existing infrastructure exists, or is proposed, then the owner/provider of that infrastructure should be advised of the need to adequately mark and treat that risk.

• Bus stops are a point conflict and need careful consideration where they impact on a shared path with anything other than minimal use. Not only the post or sign, but also the waiting and boarding areas, pose a potential conflict. These facilities are provided and operated by the PTA who will need to account for the shared path function when installing, modifying, or bringing to DDA compliance any bus stop. Ideally, in particular where a bus shelter may impede inter-visibility, the path should be routed around the bus stop. Where shared paths are proposed they must account for any bus stop and should clearly define the safe waiting area as distinct from the through pathway.

![Figure 51: Footpath joining PSP at Gwelup](image)

At this point, cyclists on the Mitchell Freeway PSP (MRWA) are travelling at 40 km/h past an intersecting path with NO visibility and NO warning that has resulted in a serious accident. Although a hoop barrier attempts to inhibit entry even peering around the wall is not without risk. This is on a pedestrian route from a residential area to the primary school!

The solution could be to remove, or relocate the access to provide better visibility and/or place warning signs at the entry point as well as on the cyclist’s approach. If the existing location is retained then barrier lines to deflect cyclists from the immediate conflict point and a barrier hoop to enforce a ‘safe refuge’ may be an option.

The next image, overleaf, demonstrates the conflict between the recently upgraded RSP and a PTA bus stop. Apart from the bus stop post being a hazard there is no space for passengers to wait for a bus thus causing an obstruction inducing greater conflict.
A solution, in many ways the preferred option, could be to forego the bus embayment thus creating space and a waiting area away from the path route. In other situations the relocation of the bus stop, or in extreme cases even the bus route, may have to be considered. This demonstrates the need for the PTA and Local Government to work together to avoid or resolve such conflicts.

In resolving any conflict it is essential that no current or future cycling participant or group is disadvantaged by the measures undertaken. Only in extreme cases, where current use of any facility is sufficiently conflicting, with obvious risk and no alternative route, will action detrimental to cyclists, that cause a significant reduction in LOS, be undertaken (for their own and the safety of others).

An example of a critical conflict (above) existed between pedestrians accessing the station from Delhi Street and cyclists on the PSP at City West.

The two cyclists are: (1) Travelling too fast on a conflicted shared path (reckless riding); (2) Failing to observe Keep Left markings; (3) Crossing a solid barrier line (no overtaking); (4) Failing to give way to pedestrians; and (5) Failure to stop at a marked pedestrian crossing when pedestrians are actively crossing. All of these are offences with penalties and yet these cyclists do not appear to consider this so.
Fast cycling on a PSP is seen as appropriate and pedestrians are viewed as obstructions not people with right of way. *Note: These very same cyclists would probably be enraged if similar behaviour was inflicted on them by motorists in an equivalent situation where they had right of way!*

In this situation the provider of the facility, Department of Transport, has since implemented further compliance measures as the current regulatory signage was not working. This marginally reduced the LOS for cyclists (but increased their safety and reduced risks of litigation) in order to reinstate the rights of, and LOS for, pedestrians.

Normally, however, an appropriate principle would be to use a ‘Carrot before Stick’ approach, where the ‘Carrot’ (alternative provision) is provided before the ‘Stick’ (restriction or control) is used and only if necessary, to encourage a change in behaviour or use of the alternative.

Two examples illustrate scenarios where this approach can be utilized:

The coastal (regional) RSP suffers from excessive speeding to the detriment of the pedestrians and slower cyclists for which it was intended. Before placing any restrictions (sticks) to slow cyclists utilising this path, the road environment for cyclists needs improving (carrot) to provide an equivalent or greater LOS for faster cyclists – even if this places some constraints on motorised traffic.

The freeway PSP suffers from critical conflicts between the high speed cyclists and pedestrians. In this case the intended use is for high speed cycling and this has been compromised by the need for this path to act as a pedestrian link to mitigate the severance effect of the freeway corridor. Using the ‘carrot’ principle alternative path provision needs to be provided, with some segregation in limited locations where this may not be viable. Once this is achieved then the ‘stick’ can be applied, pedestrians prohibited, and the PSP can become an exclusive Principal Bike Path or PBP. As an interim measure empowering commuters, fast (say 40 km/h) speed signs can be utilised, in conjunction with warning signs, to advise pedestrians that they are on a shared path where fast cyclists (this is the current reality) will be encountered with the attendant risks.

As an example, at a location where the City has full care and control (including for regulation under the City’s local laws) within the Excalibur Reserve in Carine, this approach has already proven effective by providing a new PSP path parallel with a new internal shared path. Because the PSP is located within a reserve (10 km/h unless otherwise signed), it will be necessary to install speed limit signage that reflects the functional speeds of the PSP.

**Recommendation 4:**
As the PSP through Stirling is a primary cycling facility AND an essential part of the local footpath network, that the City works with the DoT to secure co-funding to resolve those issues which currently restrict the ability to increase cycling and pedestrian activity. Furthermore, by providing alternative paths, or a segregated path where not practicable, to reclassify the PSP as a PBP (see above).
5.4 Continuity, Functionality, Legibility and Signage

For any cycling route to become sustainable, attractive and encourage new and less experienced cyclists there are at least four elements that are required, often interdependent, where if one is addressed it provides, or requires, the solution to, or of, another. Failure to provide any one will leave a route defective. These elements are listed below:

- **Continuity (or connectivity):** This is fundamental to the creation of a route. Too often routes are aspirational or a construct of facilities that don’t quite connect. A policy on route development is promulgated and discussed in more detail in section 6.

- **Functionality:** A route will not be fully and/or safely utilised unless it caters for the intended users. Gaps in an otherwise safe route will preclude young and inexperienced cyclists, while facilities with unacceptable speed or time restrictions will induce dangerous behaviour or preclude fast cyclists. To place and enforce a 10 or 20 km/h speed limit on a PSP, whilst satisfying safety requirements would not meet the functionality required for commuter cyclists. For that reason it must not be done (with the possible exception of very short sections where conflict is unavoidable). To do nothing to reduce conflict, however, is a disservice to those commuter cyclists.

- **Legibility:** This means that the route must be visible along its whole length and display information of what it is and where it is going. Not just be signed but to exist visually and continuously on the ground. Some ideas on how this is being, or can be achieved, are suggested in this section.

- **Conflict resolution:** Discussed in the previous section, this is primarily about safety, although resolution of conflicts, particularly when employing the ‘Carrot before Stick’ rather than the conventional ‘Carrot and Stick’ approach, is essential to resolve issues and enhance safety. Often the resolution of conflicts will either provide visible continuity or require it in order to be successful. In the examples below resolving conflict of the first will reinstate connectivity whereas, in the second, restoring connectivity (of the intended safe route) will resolve the conflict.

![Figure 54: North Beach Drive at Main Street, Osborne Park](image)

An example of poor continuity and, therefore a ‘fail’ on legibility, functionality and conflict resolution is where PBN route NE11 (along North Beach Drive) crosses Main Street. At what stage was the solid median placed on Main Street, presumably for traffic management of motorised vehicles, effectively severing the PBN route?
In what can only be a massive contradiction and ‘fail’ PBN route NW8 (along Manning Street) crosses West Coast Highway. The new traffic signals include a pedestrian/cycle crossing phase, however, cyclists are given a road link to the T-intersection. When it was pointed out to MRWA that the only time full road crossing is available (green bicycle), it is only for the crossing and any cyclist utilising the road will conflict with turning traffic. The response by MRWA was to erect a ‘No Cycling’ sign along the route of the only signalised ‘Cyclist Crossing’ route.

It is unclear what the message for any cyclist arriving at this point is, however, there are likely to be many interpretations that place cyclists at grave risk, as the actual risk issue is not communicated, rather a simple and conflicting command (No Cycling). The simple solution would be to close the road link replacing it with a ramp to the path - signs it would appear cost less! Good engineering practice should have been able to resolve such contradictions at the design stage, avoiding them altogether.

Simple questions should be asked at the design stage:

- **Does it connect?** If it terminates without connection why is it there and what impact will it have beyond where it terminates? Even at the end of a route a connecting facility is required. This may be connection into a tertiary ‘safe’ local street system or a destination, in which case bike parking is probably required.
- **Is it functional?** If it does not work for all the intended users, or requires a deviation from the natural desire route, then it is not functional. Functionality may be met for some users and not others, in that case provide an alternative that does or do not show it as a route for that group. If this is not done then users who find it dysfunctional will chose their own solution, often at the expense of conflict and safety.
- **Is it legible?** Unless where you’ve been, where you are, and where you are going are clearly visible, by directional signage, contrasting pavement materials or markings (for each user group and route where they diverge), then it will cease to be attractive and users may select an inappropriate route.
- **Has conflict been resolved?** Have point or persistent conflicts along the route, or at the connection point, been addressed?

If these really basic points are not addressed and gaps remain, then it is no surprise that cyclists may avoid that route and opportunities will be lost. Alternatively some will seek their safest solution, which may reinforce the perception by motorists that cyclists are doing the wrong thing, where in reality it is the infrastructure and not the cyclist that is wrong.
A simple Non Motorised User (NMU) audit process can be an effective tool in this and is discussed further in section 5.6. It is important that any works do not adversely impact on more vulnerable users or create circumstances where this might be induced. For example, poor traffic signal phasing for cyclists where PBN routes cross major roads, which favour the motorist, causes cyclists to cross on red (cyclists at increased risk) or utilise footpaths unsafely (pedestrians at increased risk). A simple ‘green bike’ for the full extent of the crossing, each signal phase, might well rectify this.

The Perth Bicycle Network, extending to more than 700 km of routes in the metropolitan area, is unquestionably a prime example of a “world class infrastructure initiative for cyclists”. As previously commented, it has suffered from a lack of targeted investment and most routes fail, on some or all of the above, somewhere along the route. PBN signage has also become degraded over the years as damaged signs have not been replaced, been removed when underground power was installed, or relocated (or remained in the previous location) when road schemes have been implemented.

The above sign, where the Mitchell PSP departs from other routes is a good example of clear signage that supports a route. Although the PSP terminates at this location the clear directions given enable cyclists continuing to Perth City to follow the correct route which will eventually lead to the next section of PSP.

Contrast this with the PBN sign on the next page.
This can only be seen (*it’s about 2.4m up the pole*) when riding along a 1.2m wide (unsigned pedestrian only) path. Any cyclist utilising the road will be unable to follow this route.

![Image of Camberwell Road, Balga](image)

**Figure 57:** Camberwell Road, Balga

What about the cyclists who chose to cycle on the road where it is more appropriate and safer? **Choice is important and the designer should not assume, or presume, the route on behalf of all cyclists!**

Clearly this is an area that must be addressed. Improved signage, fixed in an appropriate location, clear facilities with continuity lines or coloured corridors between facilities, use of route and directional arrows and contrasting surfaces are vital. Above all, retain choice as the various user groups will need to follow that element of the route that supports their needs. Some examples of appropriate treatments for consideration are illustrated below:

![Figures 58, 59 & 60](image)

**Figures 58, 59 & 60:** Use of contrasting material, continuous lines, or contrasting asphalt provides visual continuity across intersections as well as alerting drivers to the presence of cyclists.
Figures 61, 62 and 63: These images from the Netherlands illustrate how consistent treatments can provide easily legible routes.

Figures 64, 65 & 66: These images from Brighton (UK) show how appropriate infrastructure and markings can instruct cyclists on the appropriate action when interacting with other traffic.

Figures 67, 68 & 69: These images from the London (UK) illustrate how appropriate signage and markings may be used to retain a cycling function that otherwise might be denied or lost.
5.5 The Concept of “Think 20”

It is quite clear from a review of many documents worldwide, reinforced in the Austroads guidelines, that speed differential is very applicable to both comfort and safety for cyclists.

In section 2.5, Definition of Users, the concept of a ‘design speed’ was discussed and identified for each of the three design users. This design speed is the basis on which comfort and suitability (relative safety) for each user group is assessed.

In section 4.2 reference was made to Austroads Part 14 (AR14) section 4.2.5, where, in relation to speed differential, the following is quoted “at less than 20kph full integration may be acceptable” and “segregation is most desirable…exceeds 40kph”. This is representative of similar observations or conclusions made from other documents reviewed worldwide and defines the trigger thresholds for consideration of relative speed.

There are many matrices and graphs which have been produced to attempt to define safety for cyclists. All too often they relate how busy a road is and the applicable speed limit to determine how suitable a facility may be at any given location. They usually fail the KISS (Keep It Simple Stupid) test in that they are overly complicated. Put simply, it is the speed differential that is crucial to cyclists being seen in time, how safely they are passed (or pass in the case of pedestrians) and, very importantly, how comfortable (safe) they feel.

In attempting to apply risk management principles, to determine how suitable a proposed facility may be for cyclists, we should consider two factors. Whilst traffic volume on a road may have some relevance to suitability and safety, as the amount of risk increases as more interactions take place (Likelihood), it is the speed differential that is most directly related to the result (Consequences) and perceived to be so by cyclists (or pedestrians) which not only determines whether this should be part of a route, but also whether the intended user would feel safe enough to choose that route.

Obviously busier routes become less suitable, and for that reason less busy routes would generally be more desirable, however, busy routes may also be more direct, with other roads deferring to them, and hence more suitable with appropriate treatment, particularly for the faster cyclist. Also, as routes become busier, the relative safety may actually increase as speeds drop. This is in line with more cyclists on the roads = reduction in accidents.

This then is the basis of “Think 20” which is then the core on which suitability should be determined when planning new facilities or routes.

<table>
<thead>
<tr>
<th>Speed differential is 20 kph or less</th>
<th>Full Integration</th>
<th>No specific facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed differential is between 20 kph and 40 kph</td>
<td>Affirmative Measures</td>
<td>Bicycle Boulevard</td>
</tr>
<tr>
<td></td>
<td>Segregation</td>
<td>On Road Bicycle Lane</td>
</tr>
<tr>
<td>Speed differential is greater than 40 kph</td>
<td>Complete Separation</td>
<td>Off Road Bicycle Facilities</td>
</tr>
</tbody>
</table>

Figure 70: Differential speed thresholds.
Having defined the speed differential thresholds we can now derive a matrix for road speed against bicycle speed and relate this to the average or design speed for each of the user groups.

At this stage the road speed is taken to be the speed limit, which is generally in accord with the 85th percentile speed. Where these are substantially different then either the 85th percentile should be used, or measures undertaken to bring this in line with the speed limit. *Note that affirmative measures or segregation by lanes may well reduce the 85th percentile speed anyway.*

**The “Think 20” Matrix**

![Figure 71: Relationship between road speed and ‘design speed’ for user groups.](image)

The concept of “Think 20” is intended to provide a simple risk assessment tool to enable a designer to determine whether a particular road is suitable for the intended user, when taking speed into account, and if additional measures should be undertaken.

The opposite side of the risk assessment coin is that it also provides a measure of acceptability to the user and can be used to assess whether the intended user will chose that element of a route. This can form the basis on which a suitability rating can be provided for a particular category of cyclist.

Whilst no matrix can apply to all situations, the test is whether it can be used to predict existing behaviour, in which case it is then appropriate for use by designers. Most if not all cyclists should be accommodated within the green zone, without affirmative measures, all will have progressively migrated away within the yellow band, and none, other than the hardy or very assertive, would be found in the red zone. Observations on current behaviour, and results from the public consultation survey, would seem to validate this concept, as the following predictions/observations for each design group indicate:

**Group A - The 12 Year Old Cyclist (Includes Seniors and Beginners) – (15 km/h line)**

- **Prediction**: Full integration should be acceptable on a 30 km/h road with most finding 40km/h roads acceptable. By 50 km/h most will not choose the road and by 60 km/h very few if any will find the road suitable, even with a bike lane.
• **Observation**: Cul de Sacs are the only current 30 - 40 km/h environment widely available and are generally cycled by this group. On local streets at 50 km/h most have migrated to the adjacent footpaths and very few cyclists in this group will even entertain a bike lane on a 60 km/h road. *Note: That by reducing speed limits on lesser roads with a bike lane to 50 km/h this should prove an acceptable facility. Also Bicycle Boulevards, as an affirmative measure, should enable many to utilise the road, particularly if that increased participation and contributed to a further reduction in vehicular road speed.*

**Group B - The Intermediate or 'Urban' Cyclist – (20 km/h line)**

• **Prediction**: Full integration should be acceptable on a 40 km/h road with half finding 50 km/h roads acceptable. By 60 km/h most will not choose the road and by 70 km/h very few if any will find the road suitable, even with a bike lane.

• **Observation**: Roads in 40 km/h zones, such as in Albany, are generally cycled by this group. On 50 km/h residential streets you are likely to see as many on the footpath as on the road and very few cyclists in this group will even entertain a bike lane on a 60 km/h road. *Note: Providing 40km/h speed zones should be particularly effective for this group and affirmative measures, such as Bicycle Boulevards, should also encourage most to use the road in 50 km/h zones.*

**Group C - The Advanced or Commuter Cyclist – (30 km/h line)**

• **Prediction**: Full integration should be acceptable on all 50 km/h roads, with half finding 60km/h roads acceptable, which should increase to the majority when bike lanes are provided. By 70 km/h the majority will not choose a road, even where a bike lane is provided, and by 80 km/h none, other than the hardiest, would use the road.

• **Observation**: Only rarely will a cyclist in this group ride on the footpath in 50 km/h zones and then usually only to bypass traffic controls or where it offers a more direct route. The majority will cycle on 60 km/h roads, unless they have been compromised (such median treatments), increasing to virtually all where a bike lane is provided. Most will use the wider footpaths associated with 70 km/h roads even when a bike lane is provided. Any cyclist, even in a bike lane, is the exception on 80 km/h roads and above. *Note: This group should be cycling on all 50 km/h roads, unless compromised, but would still benefit substantially from affirmative measures that increased cyclist’s priority. Where measures are taken to provide alternatives for less experienced cyclists then additional road markings should be provided to empower this group to continue on the road which reinforces the message to vehicles that they are a legitimate road user and speed limits considered for the alternate path.*

‘Think 20’ is a simple and easy to remember concept yet would appear to reflect the reality of cyclist behaviour and should provide a valuable tool in identifying suitability of future provision of facilities and where measures are required to support differing ‘design’ groups. *It is not a call for speed signage but a tool to be used to assess whether any particular facility is suitable for all cyclists and, where not, to determine what other facility (or changes to the road) may be required to provide a ‘route for all’.*
Most cyclists appear to identify, consciously or not, that a 20 km/h speed differential is the comfort limit and that a 40 km/h differential is not acceptable even with affirmative measures. Unsurprisingly, pedestrians walking at 2-3 km/h feel the same and are uncomfortable with cyclists who are faster on a shared path – and they are the ones without helmets! This concept, therefore, applies just as well to the relationship between pedestrians and cyclists and further confirms the presumption that 20 km/h should be the maximum cycling speed for a shared path without affirmative measures (such as segregation) favouring, this time, the pedestrian.

Finally, there would appear to be no justification for bicycles on urban roads faster that 80 km/h as is illustrated below.

What is normally the hard shoulder emergency lane on multilane roads should never be promoted for cycling. It is not the vehicle numbers that kill, more the single vehicle drifting into a bike lane that, at 100 km/h, cannot respond in time to a cyclist 70 km/h slower.

The Reid Highway, under MRWA jurisdiction with a 90 km/h limit through parts of the City, utilises the breakdown lane marked as a Bike Lane, providing part of the City’s bike network.

Similarly the Tonkin Highway, with a 100 km/h speed limit, does the same. In NSW cyclists are permitted to use these breakdown lanes on the motorways (freeways) and, because of poor related infrastructure, cyclists do so. (They do not have the PSP alongside which is the ‘rule’ in WA)

Sadly, the ‘cycle’ lane on the Sydney M4 motorway was recently the subject of a fatal accident (left) between a truck and a group of cyclists that killed one and left 3 others injured. Most car drivers would feel uncomfortable in a car, in that situation, with other vehicles passing at a differential speed of 70 km/h, let alone on a bike.

**Figure 72: M4 Motorway, Sydney**

**Recommendation 5:**
To adopt ‘Think 20’ as a tool to be used when determining future cycling provision and to promote its use across the wider metro area which is within the range of more experienced cyclists.
5.6 The Role of Non Motorised User (NMU) Audits

Non Motorised User (NMU) audits have been developed in the USA, UK and NZ, amongst other countries, and can be an effective tool in ensuring that any works undertaken, to favour one group of users, does not adversely impact on other, more vulnerable, users. As can be seen from the inverted pyramid, pedestrians (and in particular disabled and children) are more important and warrant a higher degree of consideration than cyclists, who in turn are above cars. Note: In more rural areas, in particular NZ, horses are an NMU between below cyclists and above cars. This could also be significant in the Perth hills, but is not realistic within the wider metro area.

PURPOSE OF THE NMU AUDIT

- Identify existing provision (service level)
- Identify where a priority exists (FP strategy, PBN route, COS Bike Plan)
- Minimum: Ensure that current level of service is maintained
- Desirable: Provide a significant improvement of facilities or LOS in accordance with goals.
- Ranking (importance) is from TOP down.

FOR EXAMPLE

- Installation of shared path MUST ensure that the pedestrian facility is enhanced or at least retained.
- Road improvements MUST ensure that facilities for both pedestrians and cyclists are enhanced or at least retained.

Figure 73: Essential characteristics of an NMU audit.

There are many situations in the metropolitan area where cyclists and pedestrians have been disadvantaged by works undertaken for the benefit of, or to traffic calm, the motor vehicle. If the design had been subject to an NMU audit, it is very likely that the solution would have differed in some way to ensure that the pedestrian and cycling environment was improved, or at the very least retained at the existing LOS.

Whilst the City does not yet have its own, it is intended to develop one, with ideally no more than 2 pages of bullet points to be addressed and a response recorded, so that this can be used to assess future projects affecting the road reserve. To be effective this needs to apply to any Business Unit that may commission any works that affect the road reserve and, where appropriate, needs to be considered by any developer submitting for Development Approval.

Recommendation 6:
To develop a robust but simple NMU audit form to be used for all proposed street modifications within the City. This requirement to apply equally to City Business Units, private developers and state government agencies that carry out works that could impact on vulnerable users. City policies for works within the road reserve should also be aligned with the requirements of the NMU audit principles.
6 Future Development – Getting Even Better

6.1 Defining the ‘New’ Cyclist: Who is our ‘Target’?

Pedestrians on Bike Shaped Objects or the ‘Augmented Pedestrian’.
Whilst Perth benefits from some very good infrastructure initiatives, the direction we are taking in WA is in danger of diverging from the way that cycling is, and has for a long time been, approached and implemented in more ‘bike’ active cities and countries in the world. In particular any focus on cycling as an activity in itself (sub culture), rather than an integral part of transport policy (mainstream), will continue to see cycling perceived as a marginal activity without mainstream funding.

In March 2010, with funding provided by the State Government through the Department of Sport and Recreation (DSR), a ‘Final Report’ was published by the Colin Brown Consultancy entitled “Developing a Community of Cycling in Western Australia”. This was the end result of a consultative process contributed to by a large number of the disparate cycling clubs and organisations, several state government agencies and interested individuals. The initial statement was “Cycling appeals to a wide range of people. It is often referred to as the ‘new golf’ and has figured in newspaper articles that focus on health, transport, tourism and lifestyle; and seldom on the sport”. In fairness, while it is attempting to set up a community to represent and promote cycling and does recognise the alternative uses of a bicycle other than sport, it does seek to establish, at the very least, an overarching coordinating group to take the lead role in coordinating the future of cycling in WA. However, this runs the risk of diverting the focus of State Government agencies away from the real task of improving the infrastructure, and the way it is used, rather than to appeal to the majority and become a ‘transportation mode of choice for many and not just a few’.

For many years, Denmark, and in particular Copenhagen, has been very successful in mobilising ‘urban cyclists’ who chose the bike as a transport mode of choice. Compare this with WA where, to the general public, a cyclist is primarily identified by Lycra clad athletes on expensive sports bikes. In European countries cycling is so mainstream as to appear every day and some may say even boring. Mikael Colville-Andersen of ‘Copenhagenize Consulting’ has been quoted as saying that, when he returns home from lecture trips around the world, Danish friends are surprised that this is a subject worth lecturing about. They compare the bicycle to a vacuum cleaner, just another household tool, and find it hard to comprehend that there is a demand for travelling the world lecturing about and promoting the use of ‘vacuum cleaners’ (bikes). Even more amusing is the thought of ‘vacuum cleaner’ clubs and special Lycra clothing to use (ride) them.

If cycling is to become mainstream, we would be well advised to take note of much of the work undertaken in the rest of the world, where riding a bike is becoming mainstream with much of the credit for this going to a few passionate individuals promoting the ‘new’ thinking which is coming from the ‘old’ world.

In this lecture a number of challenging but powerful arguments were made. It is not proposed to discuss this in detail, as the Blog is accessible to anyone with internet access, but some images and comments are included below:

**Figure 74:** Cycling as a mainstream culture.

In Copenhagen urban cycling is a mainstream activity and stands on an equal footing with public transport and the car as a transport option. Note the very different style of riding.

**Figure 75:** Cycling as a marginal culture.

In Australia (et al) cycling is identified as a sub–culture and represented by the clubs and BUGs. The new urban cyclist is not yet represented and the role of the bike as a transport option not yet realised.

**Figure 76:** Elevation of mainstream cycling to transport mode.

Whilst the sub–culture must be respected, retained and will continue to flourish, it should be separated from the everyday activity of urban cycling which is elevated to a culture equal in status to other transport modes.

**Figure 77:** Equality for mainstream cycling.
We need to be positive about cycling and rebalance the equation, which currently gives too much space and resources to the car by diverting more space and resources to the bike. To quote: “Pointing behavioural fingers at cyclists serves no good purpose if you don’t point the fingers at the other traffic users at the same time. Behavioural campaigns aimed at everyone remove this focus on cyclists and also serve to place the bicycle on an equal footing in the public psyche”.

The clear message here is that, whilst many pedestrians and motorists identify cycling with a few rogue cyclists, who unfortunately may be wearing the ‘Lycrist’ uniform, focusing on corrective behaviour against that few only serves to convince the wider public that cycling is ‘bad’. Looking at traffic behaviour and management as a whole, applying remedies equally to all, by applying the same standards and enforcement for pedestrians, bikes and cars, and positively promoting the benefit of bike riding will have a much better outcome. **Above all, engineers and providers of infrastructure should remember the following quote:**

“What generally, bad behaviour is a sign that cyclists don’t have adequate infrastructure. Increasing cycling’s infrastructure and profile is a good way to calm the traffic in more ways than one”.

Existing cycling groups, clubs and individuals may well howl in protest at the concepts outlined above, however, they need not do so. The elite cycling Sub-culture is bigger in the developed cycling countries than in Australia, just a smaller and less visible part of a larger cycling Culture.

No longer will the sub-culture have to be the free radicals and pioneers and carry the heavy lifting for all, which they have done well so far.

![Figure 78: Mainstream cycling feeds the sub-culture.](image)

Instead they can benefit from being a part of the main bike Culture and focus on their activities, rather than on fighting a cause.

A very telling quote from Mikael Colville-Andersen sums his observation on what is prevalent in Australia and needs to change if cycling is to become mainstream: “There is a strong tribal aspect to the Australian cycling culture. My theory is that, because the Government has shown little or no interest in cycling as transport, this culture, which is all about sport and speed, has grown up by default.”

So, who is the bike rider of the future? As has previously been mentioned, it is ‘everyday people, wearing everyday clothing, on everyday bikes’ using a bicycle just as they do a vacuum cleaner, bus, train, car, or a combination of each (except the vacuum cleaner) for basic transportation. Essentially they are “Augmented Pedestrians” and are currently
referred to by elite cyclists as a ‘POBSO’ (Pedestrian On a Bike Shaped Object) and represent the future expansion of cycling into an accepted culture and an integral part of the transport fabric that we all may use.

The challenge for the engineers and providers of the future is to retain (and improve) the LOS for the elite or faster cyclist, who currently view POBSOs as ‘pedestrians with wheels’, while catering for, and raising the participation of, augmented pedestrians, the urban cyclist. In fact coexistence should not be a problem, more of an opportunity, although currently some of the infrastructure provided and the attitudes of some other road users is - but this can be fixed. Making bike riding a mainstream transport mode should release much more funding than catering for a sporting group ever could and, properly targeted, should deliver substantial benefits for the main ‘Culture’ and consequently the subsidiary ‘sub-culture’.

“Cycling should be ‘dull’, not an extreme sport”. Or, put another way, cycling should be as attractive as driving the car, catching the bus or train and it can be healthy as well. It can also be quicker, cheaper and less prone to traffic jams and delays. Whilst the weather may occasionally be an issue, appropriate infrastructure and attractive routes can and should make it more enjoyable and rewarding than the alternative. If wet, cold and icy countries in Europe can sustain double digit rates of cycling participation then Perth, with a Mediterranean climate and relatively flat terrain, should be even more amenable.

How this may be achieved is explored in the next sections and a ‘Toolkit’, which includes how the ‘Urban Cyclist’ can be promoted, will be discussed in Section 7.
6.2 Primary Network: Improving the Principal Cycle Facilities (Metropolitan Level)

Whilst the need for a hierarchy of cycling facilities or routes has been discussed, those relating to the primary cycling facilities have predominantly been within the domain of the State Government along freeway, primary road, and railway corridors. However, the ‘severance effect’ of these wide reserves has meant that they have also had to provide an otherwise missing pedestrian link. The severance effect where other primary roads intersect at grade also creates an obstacle to fast uninterrupted cycle flow, which is vital to achieving the objectives of the longer distance commuter without compromising compliance and safety. Where this has been resolved, by an under or over pass, another problem is created with the shared path space suffering reduced visibility and width at the most conflicting point. These areas are prone to cycle/cycle and pedestrian/cycle accidents.

Whilst the discontinuous sections of PSP within Stirling are located on land within the care and control of the State Government, and not the City of Stirling, the City does have some ‘ownership’ of it as it forms the spine of the cycling network and an essential part of the pedestrian network. Yet it is operating at speeds averaging 40 km/h, incompatible with shared path status, giving rise to unacceptable risks in conflicted locations, with the only reason there are not more accidents being the low patronage by pedestrians, which is in itself a function of the conflict, and the poor footpath network in feeder suburbs. This means that development of pedestrian and cycling facilities, that depend on the PSP for a link, as part of the Strategic Footpath program, are likely to make a bad situation worse and, where they will be dependent on these links, may need to remain on hold until this can be resolved.

A possible solution has been discussed in section 5.2 and a recommendation made, this is sufficiently important to repeat it.

**Recommendation 4:**
As the PSP though Stirling is a primary cycling facility AND an essential part of the local footpath network, that the City works with the DoT to secure co-funding to resolve those issues which currently restrict the ability to increase cycling and pedestrian activity. Furthermore, by providing alternative paths, or a segregated path where not practicable, to reclassify the PSP as a PBP (see above).

The Mitchell Freeway PSP is not continuous and at times uses shared paths, local roads and even a short ‘Copenhagen style’ section to complete the route. It is hoped that major redevelopment will create opportunities, both in land and funding, to complete the worst of the missing links thereby removing those sections most compromised and conflicting, In particular the section from north of Karrinyup Road to south of Hutton Street is both in a redevelopment area and would resolve most of the issues within Stirling.

The Reid Highway is already provided with some PSP standard sections of path and, potentially, could be progressively improved to provide an east-west primary cycle facility. This should include replacing the bike lanes, where the 90 km/h speed limit has an unacceptable speed differential of 60 km/h. Until, or unless this is done this route could only be indicated for the fast (group 3) cyclists and then only with a red risk rating.
A good commuting route is needed for the east of the City and would ideally be created along the Alexander Drive high frequency public transport corridor should that proceed and it is vital that the inclusion of a primary cycling facility be included in any proposals. Until such time that the State Government commits to such a transport corridor, the only option would be for the City to attempt to integrate secondary and PBN routes along or close to Alexander Drive as existing facilities, or lack of, are too conflicted to support substantial increases in patronage.

The (regional) Recreational Shared Path (RSP) along the coast is not a PSP or designated primary route nor fit for that purpose. It would, however, be inappropriate not to recognise that to some extent this route acts as a primary one. It is essential that fast cyclists are discouraged from using the shared path by the provision of better alternatives on the adjacent road. To that effect any cycling development, and redevelopments such as planned at Trigg and SEAS, will need to accommodate both a slow (10 or 20 km/h) recreational or tourist facility in parallel with a faster road or (limited pedestrian) shared or exclusive cycle path.

Note that existing 30 km/h zones (such as at SEAS) and possible 30 or 40 km/h zones (Trigg, southern area Masterplan) would be ideal for an integrated on road cycling solution. Further north, from Trigg to the City's boundary at Beach Road, proposals are under consideration to improve the on-road cycling environment on West Coast Drive, so that together with the RSP, a functional primary route can be delivered along the coast as part of this strategy.

**Recommendation 7:**
Following publication of the Cycling Strategy to arrange high level meetings with State Government to determine improvements and additions to the primary cycling routes in and through the City based on the suggestions within this plan.

The key aspects of a primary route are that it should be fast, capable of sustaining large volumes of cyclists, with very few crossing conflicts. Where a path crossing at grade is unavoidable then this should be provided with adequate storage areas for waiting cyclists and a dedicated bicycle crossing phase through signalised intersections. Where a principal route uses existing roads it is highly desirable to minimise the give way/stop locations by reprioritising the intersections in favour of the cycle route. Locations where speeds are reduced, either by signage or (cyclist specific) traffic calming, are undesirable and should be kept to an absolute minimum.
6.3 Secondary Network: Making PBN routes Attractive to All (District Level)

Just as primary roads link to each other and connect local streets to the Freeway, so the secondary cycle network should connect the local street network to destinations and primary network routes. Thus they provide the route within suburbs to local destinations (home to school, shops parks etc) and routes from suburbs to the principal cycling and other multimodal routes (home to PSP, train station etc). After careful consideration it was determined that, where possible, the PBN network should form the basis, with some modifications, subtractions and additions, of future development at district level (after all why throw the baby out with the bathwater). There are several reasons which include:

- The fact that they are already used and identified on existing cycling maps.
- They are already, to some extent, legible on the ground with existing signage.
- With some omissions they form the basis of a grid with acceptable spacings.
- They provide an existing interface with other jurisdictions where they cross municipal boundaries.

Although PBN routes are in many places just that – nothing more than an aspirational route, properly improved with some changes they could provide a familiar and functional secondary cycle network. In some cases adjacent streets may provide a better alternative, but any realignment is anticipated to be through local and minor diversions. Currently the PBN routes leave something to be desired for each category of (design) cyclist somewhere along the way and are not sufficiently conflict resolved for less experienced cyclists. Regrettably, some PSP routes will not be supported, as funding constraints preclude the network being too fine grained, as this will dilute even substantial levels of investment by delaying the completion of a comprehensive secondary network. Once that is achieved, however, then there should be a substantial reassessment of the network which could eventually lead to their inclusion in subsequent plans.

For example, whilst shared paths suit the less experienced they are not an appropriate solution for those that consider speed important. In fact they not only place pedestrians at risk, but also the cyclist who does not have the priority across intersecting streets that a pedestrian does and consequently may be involved in collisions. Similarly while an on road bike lane suits the faster cyclist, less experienced and younger cyclists will choose an alternative, such as a property line footpath, where collisions with emerging vehicles pose a significant risk. Remember: “Generally, bad behaviour is a sign that cyclists don’t have adequate infrastructure”.

Future development must address these issues and ensure that these routes cater for all users, along their full length and, where necessary, by employing parallel facilities. An example of this, although there are some conflict issues yet to be engineered out, would be the (PSP route) link along Gribble Road where slow inexperienced cyclists can use the shared path while faster commuters utilise the adjacent local road with relative safety and on a less constrained facility. As an unimproved local road, subject to a 50 km/h limit it should pose no substantive issues for a 30 km/h cyclist.
However, because any part of a route not providing a safe option for inexperienced cyclists will be a barrier to increased participation, and the transitions between path and road are poorly coordinated resulting in cyclists conflicting with motor vehicles, improvements need to be targeted and resources employed to maximise gain and this is covered under section 6.5 “Focus for Future Provision: Route Development”.

Fortunately, as this example is on a primary route, the issues at this location were recognised by the State Government and, as part of the additional funding identified in the WA Bicycle Network Plan, a new section of PSP, bypassing Gribble Road, is almost complete and scheduled to open in September 2014.

The key aspects of a secondary route are that it should be attractive, capable of sustaining moderate volumes of cyclists, and with safe self-explaining solutions for resolving crossing conflicts, but may in certain areas require imposed speed constraints. Areas, such as shared paths, where speeds should not exceed 20kph, are acceptable at this level with a presumption that faster (more proficient) cyclists should be able to use the adjacent carriageway. Path crossings at grade will be unavoidable; however, they should be made as safe as possible using several measures, such as highly visible bike hoops, contrasting carriageway treatments, warning signage and road markings to raise motorists’ awareness of the crossing while reminding the cyclists that they must give way. They should still be provided with dedicated bicycle crossing phases through signalised intersections.

As with principal routes, where a secondary route uses existing roads, it is highly desirable to minimise the give way/stop locations, by reprioritising the intersections in favour of the cycle route, through the creation of Bicycle Boulevards. This should prove much safer and convenient than crossing side streets from shared paths with the additional benefit of providing relatively safe ‘on-road’ learning experience for less confident cyclists.

Where a road becomes part of a comprehensive cycling route, unless the road speeds are within 20 km/h of cyclist speeds, then there is a risk that vehicles entering the road from side streets will fail to observe approaching cyclists. The simple explanation for this is that motorists slow down sufficiently to observe the ‘threat zone’ of an oncoming vehicle at the road speed. A slower cyclist has already passed that point, and although closer and slower, has become invisible to the single glance. Requiring all intersecting streets to be controlled by STOP signs rather than by giving way can mitigate this risk. Although this is normally only warranted where visibility is impaired, when cyclists become a significant part of that traffic, and the speed differential is more than 20 km/h, that restricted visibility warrant is then applicable to cyclists.

An additional measure, on such (shared) bicycle streets, can be to reduce the intersection radii. This is proven to reduce the speed of vehicles turning into the side streets, which then provides further opportunities for cyclists to be noticed and a greater time for them to take evasive action.
6.4 Tertiary Network: The Local Network (Neighbourhood Level)

It would be an impossible task to provide specific cycle facilities along every road and fortunately that is not necessary. State Government efforts and funding, with some assistance from local government, can and should be focused on the primary cycling network (not least because they are metropolitan facilities through districts with many users not residing in the areas traversed. Local government can and should, with some funding contributions from state government, focus on the secondary cycling network which at district level serves residents on local trips and also feeds into the primary and alternate mode metropolitan routes. **Demand for primary and secondary facilities will absorb any available funding for the foreseeable future.**

Even in the Netherlands not every street has separate cycling facilities. This is explained by a simple defining statement "separate where needed and mix where possible" where even Dutch cyclists have to ride with motorised traffic some of the time, but where? In simple terms many streets are designated as an “area where people want or need to be”, which is similar to the UK term “roads that ARE places”, providing road speeds are reduced to around 30 km/h.

**Accordingly there should be no funding provided specifically for cycling at tertiary level.** Resources are already being allocated at the local level to improving and extending the local footpath network (which is also capable of supporting the least experienced and most vulnerable cyclists whether they are under 12 or even older) and making local streets safer through traffic calming and speed mitigation measures. Some local streets may be provided with enhanced facilities, because they will carry higher cyclist volumes where they are supporting a secondary route, but otherwise not from any cycling related budget.

What is vital is to ensure that every local street is considered a cycling street and that no actions are undertaken to prejudice or negate that. Application of NMU audits to any road proposals should ensure the suitability and LOS of every local street is maintained and preferably improved as a matter of course. Applying the ‘Think 20’ concept to all local residential streets covered by the 50 km/h speed limit should suit the needs of experienced cyclists. In the longer term, the application of 30 km/h zones, particularly through Local Area Traffic Management (LATM) schemes and more beneficially ‘Self Explaining Roads’, initially in suburbs where there is high cycling and pedestrian potential, should see all but the most vulnerable (who could be safely accommodated on footpaths) adequately catered for.

**Recommendation 8:**
Actively consider the use of Local Area Traffic Management (LATM schemes) with reduced 30 or 40 kph zones in potentially high ped/cycle areas, and promote through community consultation.
In this example in Inglewood, east of Robinson Street, at almost 10m wide the road does little to deter speeding and cyclists are marginalised to the edges where intermittent parked cars create conflict points. This is not attractive to less experienced cyclists.

The same road, west of Robinson Street, has had a ‘permanent’ parking lane installed, protected by build outs, narrowing the effective road to 6.7m. Particularly when staggered as shown, this is effective in reducing vehicle speeds and allows a cyclist to own the lane, requiring cars to overtake rather than pass cyclists.

The cyclist is no longer relegated to the kerbside and the road is more attractive to cyclists – because it is narrower.

One defect in the image on the right is the unnecessary double lines where visibility is not impaired. These can potentially place cyclists at risk when passing cars avoid crossing the lines.
6.5 Exploiting the Potential of Public Access Ways (Neighbourhood Level)

As Perth has expanded, so has the suburban environment with the motor vehicle having a significant role, and some blame, for the way in which the layout of newer development and suburbs has evolved. Before the car was king, older suburbs such as Mount Lawley and Inglewood were served by a tram along Beaufort Street and the grid network of side streets was narrower and generally benefited from a footpath on each side of the road. This is common in many older suburbs prior to the middle of the last century while trams still ran.

When the car became king, later suburbs became less a grid layout and more a series of branch roads with cul de sacs. This is epitomised in suburbs such as Carine which developed in the middle of the second half of last century. At that time the car was not yet queen too as families had one car and one parent relied on walking to transport, work, local shops and/or school. As a result these suburbs were provided with, and became heavily dependent on, the Public Access Way (PAW) path links between cul de sacs and other roads. Although roads became wider, they often did not have footpaths as traffic volumes and speeds were low. Provision of a comprehensive footpath network, utilising PAW links, is still a viable proposition to provide safe cycling routes to school and to cater for less experienced cyclists.

Towards the end of last century, increases in wealth meant that families had second cars and this extended to third or more as children became drivers. This was the coming of the car as king and queen and then extending to a full ‘royal family’. Roads became even more dominated by the car, becoming even wider in some cases and footpaths were still not provided (even though planning guidance sought to have them included). Suburban road layouts still used cul de sacs but PAWs were often no longer provided. Whilst provision of a comprehensive footpath network will improve options for movement, the curvilinear form of development, with no PAWs, will always make travel more difficult and pedestrians and cyclists will be subject to the same convoluted routes available to the car.

PAWs, therefore, have a vital role to play in maintaining or improving the permeability of suburbs for pedestrians and cyclists. Often a journey, that may take 1.5km by car, can be much shorter, and in some cases little more than a couple of hundred metres, using the short cuts offered by PAWs. Whilst nothing needs doing for the (pre-king) early suburbs, the (king) suburbs must retain the increased permeability offered by PAWs. The later suburbs (royal family) have more limited options; however, there are still small pocket reserves and larger parks and reserves, in lieu of a PAW, which may provide opportunities for the provision of a shared path to improve permeability.

There can be no doubt that PAWs and interconnecting cul de sacs offer immense potential to enhance cycling and walking as an alternative to the car, often shorter and quicker to local destinations and for children between friend’s houses. For this reason PAWs should be retained, and upgraded as soon as practicable, to enhance cycle permeability with additional links provided through reserves and other land within the care and control of the City.
Recommendation 9:
Retain all PAWs and, where land is available to the City, consider constructing additional PAW links. Where antisocial behaviour is encountered, or requests are received for closure, this should be denied (unless exceptionally the PAW has no contribution to increased permeability) and instead the PAW upgraded to cater for cyclists and additional measures taken to improve surveillance and minimise antisocial behaviour.
6.6 Focus for Future Provision: Route Development
(How Can We Maximise ROI to Achieve Goals?)

It is said that Perth has one of the lowest population densities of any major city in the world and that the urban sprawl will make it difficult to transition to a less car dependent environment that can sustain a much higher contribution to metropolitan travel by public transport.

However, the emerging challenges of this century make it not only inevitable, but vital, that action is taken in response. It is probable that the car will become proportionally more expensive to run and that families, as that cost escalates, will seek alternatives. However, in order to be able to enjoy WA and the attractions that make living here so great, at least one car capable of travelling longer distances in comfort will be retained by every family that can afford to do so, where in other cities such as London, owning and running a car is even now a much lower priority and many families live happily without any car. The key to the future may lie in the past, where the car was King only but with a degree of suburban permeability and a public transport system that can cater for the whole family.

The challenge here is how to shrink Perth so that the density is equivalent to that in other metropolitan cities where public transport does the heavy lifting as an alternative to the car. Obviously Perth cannot be physically shrunk but there are some conversions that can be fitted to allow Perth to better access and, therefore, support an expanded public transport network. One of these is the use of cycling as part of a multimodal transport system. Currently new developments within 800m of a train station are given concessions on parking provision because this is seen as the distance that people are willing to walk to access high frequency public transport. In fact as car parking at train stations becomes full this overspills onto local streets within 400-600m as this seems an acceptable walk on top of a local car trip (800m equivalent).

A pedestrian averaging 4 km/h will take approximately 12 minutes to walk 800m, longer if traffic controls are encountered. Wearing the same clothing, in the same time, with no added exposure to weather and with the same degree of comfort, a pedestrian on a bike riding at an average of 16 km/h can travel 3.2km. This has the potential to provide a ‘conversion kit’ that may offer a solution to ‘rescaling’ Perth to become a sustainable multimodal transport city. The difference between the walking and cycling catchment is illustrated overleaf.

It is an unfortunate fact that train stations, when located in the middle of a wide freeway corridor and surrounded by car parking, severs the transport hub from its natural catchment. This severance factor further reduces the walking catchment but has little effect on the similar cycling catchment.

Taking Stirling Station as an example, an 800m walk was found to equate to a 680m radius within which a total of 607 properties were located. Using the ‘conversion kit’ that cycling, as part of an integrated multimodal transport strategy could offer, a 3.2km bike journey equated to a 3km radius within which 18,407 properties were located.

This conversion factor, substituting walking for an equivalent bike ride improved the accessibility, through a larger catchment, by a factor of up to 30. This truly is making Perth smaller and public transport more viable.
This catchment area plan was produced having looked at cycling, as an element of a multimodal trip, for a randomly selected property 3.2km from Stirling Station (in Doubleview) and another 3.2km from Warwick Station (in Carine).

A typical journey to Perth (to the entrance to David Jones Department Store on the pedestrian mall) was then compared for various multimodal and single mode options. The results, actual timings taken by an experienced cyclist observing traffic controls, for the complete trip, and cycling as a POBSO for the short trip, and compared with actual observed bus, train and car times, including any time taken parking, waiting and walking are represented on the two graphics overleaf.

The element and total journey times are indicated as is the cost of fares, fuel only (no car running costs) and car parking based on the commercial rate in Perth for 4 hours (2010). This represents a substantial discount for an all-day commuter and a realistic cost for a short term visitor to Perth for a shopping trip with lunch. Each trip was to arrive in Perth CBD for 9.00am, but the quickest car journey to compare non-peak travel started at 11.00am (shown with green destination times).

The results indicate that the bike/train and bus/train are by far the cheapest solutions for both stations, apart from distance cyclists who also had clothing/shower needs (time and cost unquantified). The bike/train option is also, at peak times, to within a minute, the equal quickest with car/train and quicker than bus/train. It also is ‘guaranteed’ as a cyclist can avoid delays that buses and cars cannot.

Commuter biking takes the longest and requires changing facilities at the end, but is the cheapest and has benefits for the athletic commuter. Car journeys to Perth are slower...
that bike/train and at least $10/day more expensive. Only off-peak car travel, particularly with more than one occupant, is quicker than bike/train albeit at a substantial cost premium for single occupant vehicles and becoming equal to bike/train and bus/train with four occupants.

**Figure 82:** Doubleview to Perth CBD, total time/cost door to door:

**Figure 83:** Carine to Perth CBD, total time/cost door to door:
The logical conclusion to be made, based on the evidence so far provided, is that cycling (as an integral part of a multimodal transport system) is the quickest, or equal quickest, option at peak hours and also the cheapest, or equal cheapest. Furthermore, for the same cost and time it is an option open to 30 times more people than walking.

It is proposed, therefore, to target a substantial proportion of the expenditure on cycling on upgrading the PBN routes, and other potential feeder routes, within 3.0km of high frequency transport hubs. This should have the most effect on increasing cycling to those destinations and will also benefit communities in that area, and maximise return on investment to the City and indirectly the state government in implementing the goals of the ITS and cycling strategies.

The existing focus will be around the three train stations on the Joondalup Line, comprising Stirling (100% COS catchment), Warwick (50% COS catchment), and Glendalough (60% COS catchment). It is also worth considering expanding this process to include those catchments on the Midland Line, in particular Mount Lawley (25% COS catchment).

Alexander Drive is already a significant public transport corridor through the City of Stirling and, even at current provision it was worth considering whether a Bike/Bus interchange, with integral bike parking linked with a bus ‘station’ (similar to the bus station at Karrinyup Shopping Centre), could be provided in conjunction with a small area within the road reserve or Yokine and/or Dianella Reserves. With the MAX Light Rail Transport (LRT) project, now scheduled for completion by 2022, this has the potential to support a bike/LRT hub. With the proposed LRT there is an even greater incentive to provide multimodal interchanges, and a PBP style cycling path in association with the LRT priority measures, as a component of any road upgrade. This must be considered as an integral part of that process. In the interim cycle route development, including End of Trip facilities, can be provided close to the existing bus stops where they are also related to future LRT interchanges and would remain viable should the LRT not eventuate and a Bus Priority scheme replace it.

**Recommendation 10:**
Target a significant proportion of funding on cycling to improving or creating routes to meet the needs of all with 3km of public transport hubs, in conjunction with the PTA and an adequate provision of bike parking. As this is of strategic significance to the State Government seek, at least, matching funding to these routes.
6.7 Destinations: (End of Trip) Facilities
(How do we enable the cyclist to revert to being a pedestrian?)

In section 5.4 the four essential elements of a route: continuity; functionality; legibility and signage were discussed and the fact that the omission of any one is likely to make a route less acceptable, or even unusable, to some or all users. Continuity through connectivity is fundamental to a good route and any element that does not connect to another will fail to achieve its potential. This is just as true for the end of a route – it must connect!

What it connects to is the destination, or ‘End of Trip’ (EoT) facilities and those facilities must meet the needs of the route user. Whilst many fast long distance commuters will need changing and shower facilities, these are not generally provided at the route termination rather the workplace, and those cyclists depart from the route at some stage, along or at the end of the route, onto tertiary facilities such as paths and roads. There are exceptions, however, that may occur for example at outer metropolitan train stations where the distance to Perth may preclude a full cycle commute, but integrate a longer distance cycle with connection to a train. In this case changing and shower facilities may warrant provision at the termination, rather than the final destination. These destination facilities can be described as ‘Full EoT’

There are, however, key destinations that are at end of a route and these require adequate EoT facilities to cater for the intended users, generally facilities that cater for everyday cyclists, or ‘pedestrians on wheels’ will suffice. Route terminations fall into two categories: Those that are destinations (Basic EoT) and those that are interchanges (Secure EoT). Whilst the needs are basically the same, there are subtle differences as outlined below:

**Basic EoT**: These are bike parking facilities that are provided at locations that are destinations, where the cyclist remains in the vicinity and can return at any time. Typical destinations are the beach, libraries, shopping centres, recreational parks, leisure centres or any other significant route termination or node along a route. A basic facility requires sufficient bike parking to accommodate normal everyday needs. Whilst consideration should be given to providing some cover and shade if possible, which also assists in raising the importance and profile of cycling, it is not essential. Basic EoT must, however, be in a convenient location, close to the ultimate destination (a similar convenience and proximity as would be given to disabled car parking spaces) and, above all highly visible for security.

![Figure 84: Poor bike parking provision in an inappropriate location.](image)

This image shows a ‘toaster’ bike rack which is NOT preferred as it is difficult to secure to and causes wheel damage. The location is questionable as it is relegated to a paved walkway and well away from the entrance.
Figure 85: Good bike parking provision.

This image is of U bars which provide secure bike parking which, together with the shade sails and dedicated space outside a busy entrance, avoids obstruction and promotes cycling. The location ensures that drivers are aware that cycling is mainstream.

**Secure EoT:** These are bike parking facilities that are provided generally at **locations that are transit interchanges** rather than destinations, where the cyclist will leave the vicinity and is unlikely to return for a defined period. Typically this would be locations such as train stations, bus interchanges and college campuses, where the bike parking is frequent and repetitive allowing the application of additional security facilities. In some cases that security (and the convenience that goes with it) may be achieved by basic bike rails provided directly outside the station entrance, where adequate passive surveillance is provided, however, in most cases a secure bike facility, in a location equal in convenience to that for a disabled parking bay, kiss and ride or bus stop, is preferable.

Figure 86: Currambine train station entrance.

At this station Basic EoT bike hoops located at the entrance suffice. Here the risk of theft or tampering is reduced by the proximity to the entrance where the racks are well surveyed. Parking gain may be at the expense of pedestrian or amenity space.

Figure 87: Currambine train station car park.

Further away from the entrance secure bike lockers are provided on otherwise vacant paved areas or by replacing car bays at about 16 bikes/3 cars. Parking gain in this instance is about +13 (equivalent single occupant vehicles).
High profile locations within paved (pedestrian) areas are most convenient; alternatively as space runs out, close proximity should be achieved by visibly locating bike parking in car parks, close to the entrance, which further legitimises cycling as mainstream transport mode.

**Figure 88:** Greenwood Train Station.

Here a secure bike cage is provided located in a high profile location close to the station entrance providing bike riders with premium access. Additional cages can be provided by replacing the closest car bays at about 26 bikes/3 cars. Parking gain in this instance is about +23 (equivalent single occupant vehicles).

**Figure 89:** Greenwood Train Station: Conditions of Use signage.

Security measures can be basic (locked for a predetermined period) as at Greenwood where it is locked between 9.00am and 3.00pm. However, as the PTA now uses the SmartRider system for public transport this is being extended to provide secure access to ‘tag in’ and ‘tag out’ of bike cages with little or no additional costs. It could even allow a discount against the fare for bike parking, to incentivise modal shift from the car, making cycling even more attractive.

**Figures 90 & 91:** Bike parking at Manly, NSW.
Another option, as used in Sydney, is to provide a secure parking facility with access controlled by a dedicated card.

This may be ideally suited to locations remote from fixed SmartRider facilities or on campus. In this case a $20 application fee is all it costs for the user, with an additional refundable deposit of $30 for the access card with no ongoing charges.

End of trip facilities can be very effective in raising the profile of cycling and can also enhance the streetscape by doubling as street art. They need not be boring and can be fun. For example, the car frame in a parking bay, the paper clip bike outside a library and the music score bike rail outside a theatre:

*Figures 92 & 93:* These show how bike parking can safely replace car parking thus increasing available on street parking (number of people or patrons).

*Figures 94 & 95:* Bike parking ‘art’ can also be accommodated on ‘spare’ paved areas.

End of Trip facilities are essential to providing an attractive route as, without somewhere to park the bike at the end, the route is compromised and will deter use. Also indiscriminate bike parking is detrimental to the image of cycling and, rather than attracting, may alienate non cyclists.

Where a route is provided then its success can be measured by the amount of bike parking at the end. When the bike parking provided becomes close to capacity, during normal periods for which it intended, then that **success** is **rewarded** by additional bike parking as soon as is possible – no delays, no questions.

Increased bike access is a measure of mode shift from the car and the conversion of car bays to bike parking is entirely justified. For example, 26 car drivers using a bike instead
can be accommodated at the expense of 3 car bays. As most cars at train stations are single occupant vehicles, just like the bike, this is a parking gain of 23, effectively extending the car park with no additional land and at minimal cost!

In summary, ‘End of Trip’ facilities are not an addition to a route, more an integral part of that route. While it is almost more appropriate to refer to them as the final ‘Part of Trip’, as it emphasises their importance in ‘decoupling’ the pedestrian, that would not reflect their essential role at the termination of the bike riding phase of any trip.

**Until the cyclist is walking away, without the bicycle, the cycling part of the route has not been completed.**

Routes, however, as they develop and are extended, will inevitably give rise to an increase in cycling participation as there is both safety in numbers and an increased awareness of the alternatives available (both in time, convenience and cost) for bike riders. It is, therefore, not only necessary to provide routes that are capable of sustaining significant numbers of cyclists into the future, but also important that the EoT facilities are adequate and do not limit the availability of the route (by rationing the bike parking).

But, premature provision of surplus parking will be perceived as inequitable and, particularly where this is commendably at the expense of car bays, may reduce (rather than increase) overall parking provision. It is, therefore, recommended that EoT facilities within the public domain are matched to reasonable short term expectations but that plans and funding are in place to expand them as soon as the existing provision nears capacity.

**Reward principle: Full bike parking = Route success = Reward = More facilities.**

**Recommendation 11:**
Where new routes are planned or provided then the City is to negotiate with the destination facility to ensure the above Reward principle is implemented as a condition of providing that route. In many cases the end user will be COS facilities, however, school and college campuses, shopping centres and the PTA and any other providers who will benefit from improved cycle access, should be asked to agree to this principle. Future Planning policies should accommodate this principle and, where long distance commuter cycling is envisaged, this should extend to Full EoT.
PART TWO

Section 7: The Way Forward and Toolkit
7 The Way Forward and Toolkit

7.1 The Way Forward – A ‘Bike Route Development Plan’ Based Program

This Integrated Cycling Strategy functions as a high level document which defines how the City of Stirling will apply Council Policy in the delivery of a strategic cycling network that caters for the needs of all ‘design cyclist’ groups. This strategy explains the rationale behind existing cycle provision, the constraints and opportunities that exist for the development of cycling and, most importantly in this section the methods (or tools) that can be used to develop an effective cycling network within the City.

A separate ‘Bike Route Development Plan’ (BRDP) will identify the Primary and Secondary routes which will form the basis of the City’s investment in cycling for the 10-year plan. This in turn will feed into the 5-year planning horizon which will determine the design program required to underwrite each annual budget submission to Council.

The BRDP is not intended to detail how any particular route or location is catered for, or even the exact street that will form part of that route. It will indicate the coarse grained network by which cyclists, originating from within tertiary areas, will be able to access a route that will then connect to the strategic cycling network. Even with a significant expenditure, specifically related to cycling, it will take time to provide a functional strategic network. Whilst the focus will be on the primary and secondary routes there will be many occasions where a secondary route will traverse the tertiary environment requiring the appropriate standard of provision for a route to be applied. In other cases a secondary spur may be required, most likely in commercial or industrial areas where the environment is less conducive to cycling, or to major educational or transport hubs where significant cycling volumes may need to be catered for.

The intention is that bike facilities within the City of Stirling will no longer be provided on a piecemeal basis but will consist of developing a ‘complete route’ that will have a defined function from a start to an end. The design will take account of the needs of all prospective cyclists and, except in exceptional circumstances, will provide a suitable facility for all three design cyclist groups. In some locations a single infrastructure facility (tool) may suffice for all users, in other locations there may be more than one type of facility (tool) required. For example a 50 km/h distributer road may be the preferred option for Group C and most Group B cyclists, while an additional parallel shared path may be required for Group A and some less confident Group B cyclists. Section 5.5, explaining the concept of ‘Think 20’ outlines the process that should be used to assess the suitability of a facility type and whether additional facilities should be considered to adequately cater for all cyclist groups.

A ‘Complete Route’, in order to be sustainable, attractive and encourage new and less experienced cyclists, must encompass all four elements as discussed in section 5.4. These are: Continuity (connectivity); Functionality (level of service); Legibility (a clearly visible route including signage and way-marking where necessary) and Conflict Resolution (removal of point or persistent conflicts along the route wherever possible).
As outlined in section 6.3, tertiary areas will not be specifically addressed, in terms of cycling related funding, as the need to provide an effective primary and secondary network will absorb any available cycling specific funding for the foreseeable future. Any improvements will, therefore, be the result of other programs within the integrated transport sphere. The City is currently spending $2 million per year on the Strategic Footpath Program which, together with quieter back streets, cul de sacs and PAWs, will directly cater for cycling to primary schools. Footpaths also provide ‘de facto’ shared paths for other more vulnerable or inexperienced cyclists as an alternative to less attractive parts of the local street network. Development of LATM schemes, and in particular the progressive introduction of lower speeds (which is the inevitable outcome from proper application of the state governments ‘Towards Zero’ policy) through regulation and/or traffic calming measures such as Self Explaining Roads, must continue to be promoted as the preferred solution in residential suburbs. This accords with the Dutch strategy of “separate where needed and mix where possible” through the provision of streets that are designated as an “area where people want or need to be”, which is similar to the UK term “roads that ARE places”, where road speeds are reduced to around 30 km/h and are distinct from “roads that are going places”.

Bicycles are legitimate vehicles which, with few exceptions, have the same right to be used on the public roads as do motorised vehicles. Riders are, however, extremely vulnerable and have little protection where heavier and faster vehicles fail to take proper care. Although, in an ideal world, all cyclists should be competent, and feel comfortable riding on most roads the reality is that many riders (or their parents) do not and many roads are not appealing to inexperienced and more vulnerable cyclists.

The conundrum facing providers is that, while cyclists need to develop the necessary skills to ride on roads, by riding on roads, the condition of the roads and attitudes of drivers is inhibiting. As a consequence some transitional solutions, which are not without their own inherent problems (such as shared paths), will continue to be necessary in the medium term. The risk is that by providing cycle specific facilities this can reinforce an apartheid attitude, between motorists and cyclists, to ‘keep in your place’. Thus, if ‘divisive’ infrastructure is used it may be necessary to provide ‘inclusive’ additional tools to the adjacent road - to empower faster cyclists to use the road while advising motorists that cyclists still have a legitimate right to, and may still be encountered on, the carriageway.

For these reasons, the first choice in all tertiary environments and most secondary routes should be for inclusive on-road cycling and supporting that as much as possible. Whether the inclusive road is suitable for all users can then be assessed on the basis of the road geometry, traffic volume and speeds and, where not, additional measures should then be considered.

Where highly visible alternatives to an inclusive road are needed for some or all user groups (such as an adjacent shared path or an intermittent bike lane) the continued use of the road by fast experienced cyclists must still be facilitated by secondary tools (such as road markings and signage). It is only where a specific cycling facility (such as an exclusive bike path) can cater for all users, and is superior to the nearby road, that secondary tools to support cyclists in the road become unnecessary.

In conclusion, “separate where needed and mix where possible” is the defining strategy, even though in some locations both separation and mixing may be necessary and appropriate (to suit differing user needs).
7.2 Selection – The Process of Determining the Route (Hierarchy of Measures)

Bicycles are classified as vehicles and, as such, have the same general rights and responsibilities on the road (and road related areas) as any other vehicle. For many fast or experienced cyclists much of the existing road network already provides their most direct cycling route and may already be adequate (even if far from ideal). Not every road can be made a cycle route and cyclists will continue to make their own selection, however, in many cases the direct nature of already well-used roads will make them ideally suited for upgrading to a route. Section 6.1 outlined the importance of cycling being considered a mainstream transport mode.

Urban cycling needs to be seen as a mainstream activity, standing on an equal footing with public transport and the car, as a transport option. The preferred option should always be full integration wherever safe road conditions can be provided.

Even with less experienced or novice cyclists there are roads, such as cul de sacs and quiet back streets, where cycling takes place and is seen as safe. The primary aim, therefore, should always be to consider how safe on-road cycling could be provided rather than providing separate cycling infrastructure. Safety in numbers ‘on the road’ will only be achieved if cyclists can gain the experience while cycling ‘on the road’, providing that can be done in a manner that equals or exceeds the safety of off-road facilities.

Historically, in the metropolitan area, the provision of shared paths has been the main infrastructure provided for cycling. This is far from ideal as it can transfer the risk to the very areas used by the most vulnerable users (pedestrians, children and those with disabilities), is unsuitable for fast cyclists (and consequently avoided by most but unfortunately not all), and provides by far the lowest ‘Level of Service’ and greatest risk at intersections (where cyclists lose any priority or right of way). Shared paths for transport will still have an important role, in catering for vulnerable cyclists alongside an adequate road environment for others, but should be seen as a ‘last resort’ rather than as a ‘first choice’.

Applying the following ‘Hierarchy of Measures’ when planning and designing a route provides an effective method for facilitating cycling as a mainstream activity. When selecting a road or street, to form part of a route, the following order (from 1 first to 6 last) should be considered:
1) Traffic Volume Reduction: The amount of traffic using a street will both increase the risk exposure for cyclists and reduce its attractiveness - this is particularly applicable with heavy vehicles and trucks. The solution to this is commonly referred to as ‘Volume Management’.

In some cases a road may be selected because the existing traffic volume is already low – in this case care (and appropriate measures) will be required to ensure that motor traffic does not increase, or create a ‘rat run’, as a result of improved route connectivity. In other cases, where higher volumes are already present, the use of that road may be predicated on effective measures to reduce traffic with affirmative measures to encourage and enable bicycle use. The application of Volume Management, however, can only be applied to roads that form part of an interconnected local network and are not applicable to distributer or arterial roads, where displacement of traffic would be undesirable.

2) Speed Reduction: It is generally accepted, worldwide, that where vehicle speeds are below 30 km/h then full integration of all cyclists groups can be achieved. Under ‘Towards Zero’ this maximum speed is also recognised as very effective in reducing serious injury rates for all vulnerable road users. In the longer term there is a strong case, in conjunction with the concept of ‘Self Explaining Roads’, for many local streets to eventually become 30 km/h areas. However, until that occurs, more local measures can be employed to reduce speeds along bicycle routes to within 20 km/h of cyclist speeds. The ‘Think 20’ concept can then be applied to determine which cyclists would benefit from that route and whether alternative facilities would be required where differential speeds exceeded tolerances.

For example 50 km/h roads can and do meet the needs of 30 km/h cyclists and, with some additional measures such as the creation of a Bicycle Boulevard, may extend that tolerance to a 30km/h differential thus catering for most design cyclists.

A Boulevard treatment, in conjunction with 40 km/h speed limits, should prove acceptable for virtually all design cyclist groups and would only be required in 30 km/h zones where way finding and volume reduction was required for a defined route and high bicycle volumes needed to be accommodated.

3) Junction Treatment and Traffic Management: A major impediment for all cyclists, and in particular the less experienced, is complex intersections with priority roads, roundabouts and traffic signals. These place cyclists into conflict with stopping, turning, merging and weaving traffic that may not be acceptable for the faint hearted or inexperienced cyclist. However, it may be possible, when route planning, to avoid these areas and utilise existing traffic management features to provide relatively safe crossing facilities to major roads.

For instance, where a complex intersection or banned turn cannot be avoided then solutions are required to ensure that all cyclists are accommodated and, where not, less experienced cyclists have an alternative. There is no simple answer, as each location should be assessed individually on its merits, however, the following represent some of the potential solutions: Advanced Stop Lines (ASL); cycle slip lanes; bicycle only signal phases; contrasting bike ‘corridors’ are but a few; and, where vehicle movements are otherwise restricted, bicycle exemptions.
Additionally, existing traffic management can offer opportunities for a route to be provided, through simple modifications giving preference for cyclists, such as contraflow cycling (on one way streets) and bike lanes/tracks through road closures or restricted intersections. In other cases, where volume management is necessary, either to reduce traffic or ensure it does not preference towards a bike route, those same traffic management measures can be introduced. However, the single most effective measure along a cycling route is to mark and reprioritize all intersections in favour of the cyclist.

4) **Reallocation of carriageway space:** Where volume and speed reduction cannot be achieved to the degree required, and the road still remains the best route option (in terms of demand and desire lines) then a shared road approach (such as a bicycle boulevard) would not be an option. In that case reallocation is necessary to provide either a Bike Lane or Cycle Track. The type of facility and degree of protection required will depend on the road traffic, amount of heavy trucks or buses and road speeds. Consideration of ‘Think 20’ thresholds will also determine whether additional measures are required for the slowest and least experienced cyclists.

This reallocation must not come at the expense of more vulnerable road users (pedestrians) or amenity spaces, and requires a reallocation of carriageway space, either by narrowing or removing traffic lanes and/or on-street car parking. Only where that is not an option would the next in the hierarchy be considered.

5) **Cycle (Bike) Paths away from roads:** There are limited areas where the existing road reserve can provide an opportunity for a dedicated bike path without conflicting with other accesses and crossovers or the general streetscape. Nevertheless, as an alternative to diverting a route away from the demand or natural desire lane, this remains an option for consideration. In relatively short lengths, such as along a verge or wide central median, a bike path could provide an acceptable link between staggered intersections or other crossing locations.

There are some clear exceptions that support the use of a bike path: One, is where the road network is interrupted by, or detours around, large open spaces. In those cases, because there is no road along a natural route (often highly suitable because there is an interruption for motor vehicles), a bike path can provide an essential link between non-connecting quieter streets. Another situation is where large road reserves exist alongside freeways and other primary arterial roads where, because the speed and volume is incompatible with cycling, and the access points are few and far between, the provision of a bike path becomes the first available option and can offer a highly desirable direct route with minimal conflicts.

6) **Shared Paths:** Whilst these are the choice of last resort for exclusive use as a route, and should not be used in isolation along a significant route, they do still have a very important function and can be considered as an ancillary or supporting facility, for less experienced cyclists, until or unless road cycling becomes more established and accepted by motorists (safety in numbers), when installed alongside an on-road route.

Providing the adjacent road is otherwise suitable for use by faster cyclists, less experienced utility cyclists may be catered for by an adjacent shared path where
they form part of a local trip (typically up to 3 Km) to activity centres and multimodal interchanges (stations etc).

Shared paths are also acceptable, and can have a significant function where cyclist numbers are relatively low, when providing short links along PAWs within the tertiary cycling environment. By linking local streets, and in particular cul de sacs, they can provide connectivity for cyclists (and pedestrians) that is far more direct than driving a car.

There are many locations where the legitimate place for cyclists, on the road, is still too hostile for a significant proportion of cyclists. Until there is a generational change in attitudes, and greater safety in numbers improves the relationship between cars and cyclists, shared use of the pedestrian space will continue to be necessary, providing it is conducted in a manner and at a speed that respects the pedestrian as the priority user.
7.3 Cycling Facilities – What Type of Facility is Suitable? (The Main Tools)

This sub-section provides information on the main infrastructure types (or primary tools) that can be used to facilitate cycling. In some locations this may be entirely on-road, in others entirely off-road, although often a combination of two types may be required. The available tools fall into two categories: Off road paths, generally within the road reserve above the kerb, and those that are on the road, on or at carriageway level and ranging from full integration to segregation from the main traffic lanes.

7.3.1 Off Road paths

(i) Footpaths (FP)
While these are provided primarily for pedestrians, they also have a key function as a shared path for primary school age children under 12. They may also function as ‘de facto’ shared paths, as an alternative to the road, for less confident bike riders at slow speeds, particularly where the road environment is unsupportive.

Suitable for: Group A and some Group B cyclists:
• Providing a slow speed alternative to the road within the Tertiary environment (50 km/h residential streets).
• Catering for primary school aged children but acceptable for use by less confident cyclists who prefer safety over speed; these involve crossing roads, essentially as pedestrians, and deferring to vehicular traffic at intersections.

Unsuitable for: All Group C and most Group B cyclists:
• Footpaths should not be relied on for secondary routes and/or where the number of adult cyclists is likely to exceed normal neighbourhood residential levels (up to 10 per hour).
• Limited to slow speeds (<10 km/h) with frequent stopping at intersections and hazards related to vehicle crossovers.
• The unresolved conflicts generally prove unacceptable to faster cyclists, who retain priority cycling on road, and can induce poor behaviour if the adjacent road is compromised.

(ii) Shared Paths (SP)
These are provided as an alternative to the road for less experienced cyclists with a functional 20 km/h design speed. They are generally unsuitable for higher speed cycling unless located in areas where there is limited pedestrian demand and few if any vehicle crossovers. Further caution is needed as there is substantial evidence to show that the rate of accidents and injuries is increased at intersections (up to eleven times greater than cycling on the priority road) while decreasing mid-block where crossovers remain the main risk.

Suitable for: Group A and most Group B cyclists:
• While shared paths are not without risk and can pose greater dangers than the road, they will continue to provide an important facility where the adjacent road has differential speeds, between cyclists and motor vehicles, of more than 20 km/h.
• Acceptable where lateral visibility (between cyclists and intersecting or crossing traffic) exceeds 2.5m. Recommended that formal signage includes a 20 km/h speed limit (section 3.3).
• Recommended where lateral visibility (between cyclists and intersecting or crossing traffic) exceeds 4.5m. Where that is achieved the formal signage need not include a speed limit (section 3.3).
• Required on secondary routes where road speeds are too high for on road cycling by one or more design cyclist groups (note it is preferable to improve the road where practicable). Consideration of a speed limit signage in accordance with lateral visibilities above.

Unsuitable for: Most Group C and some Group B cyclists:
• Shared paths are unsuitable for faster cyclists as a significant proportion are likely to exceed safe speeds and suffer increased risk at road crossings, access points and drive crossovers.
• Not suitable where there is no adjacent road or the road is not suitable for Group C cyclists.
• Unsuitable without significant secondary measures (tools) where high conflicting pedestrian use is expected or lateral visibility is below 2.5m or otherwise compromised (section 3.3). In these cases it is recommended that formal signage includes a 10 km/h speed limit.

(iii) Principal Shared Paths (PSP)
These are primarily provided alongside major transport routes (particularly freeways and railway corridors), often without an alternative route, and promoted for high speed cycling with average speeds of 30 km/h and maximum speeds exceeding 40 km/h, even on the flat. These should not be located within the normal residential environment where the constraints of conflicting users, frequent interaction and differential speeds are incompatible with the desire for unimpeded use. The high volume and speed of cyclists means that PSPs should not form part of the pedestrian path network serving the local community and should be designed and constructed using the same engineering principles as for roads in relation to alignment and visibility.

Suitable for: All Group B and C most Group A cyclists:
• When located within main arterial transport corridors (such as freeways and railways) these may be acceptable providing they are not also serving substantial numbers of pedestrians.

Unsuitable for: Some Group A cyclists:
• With speeds significantly in excess of 40 km/h, some cyclists that are slower than 20 km/h (some Group A) may feel intimidated by, and can pose a hazard for, fast passing cyclists.
• Owing to the consistent high vehicle speeds these paths are unsuitable for use by pedestrians retaining ‘right of way’.

Note: Austroads guidelines are clear that shared paths should only be used where an alternative road route exists for faster cyclists and path speeds do not exceed 20 km/h (Section 4.2). If that is not achievable then segregated or separated paths should be used. Pedestrian volumes, and hence conflicts, can be reduced by the provision of a separate path system which is progressively being achieved through the strategic footpath program. To be effective this alternative path should be reasonably close (<200m) and parallel to the PSP. Where that is not achieved then segregation or
separation of path functions, within the corridor, becomes highly desirable if not essential. A further measure, which warrants consideration, is clear speed signage to the PSP which serves two purposes. One is to use that posted speed as both a warning and deterrent to pedestrians, thus promoting any alternative route, while the other legitimises the faster cycling speeds thus serving to differentiate the principle paths from regular shared paths (something which is absent in the minds of many cyclists). Of course the optimum solution should be to provide new Principal Bike Paths (PBP) while progressively converting existing PSPs to PBPs as the alternative paths become available or can be duplicated (Section 5.3).

(iv) Recreational Shared Paths (RSP)
With high scenic and tourism potential these are generally located alongside the coast and river systems and through regional parks. Intended for relaxed recreational riding and walking, including families with young children, these have a functional design speed of 20 km/h which may need to be as low as 10 km/h in high activity/conflict areas. These paths are provided specifically for recreational use where enjoyment of the scenery and environment, away from roads, allows for a more relaxed use. Pedestrians and cyclists become distracted which, together with integral activity areas (beach accesses, BBQs, picnic, play spaces, and off lead areas), is incompatible with fast speeds.

Suitable for: All Group A, most B and some Group C cyclists:
• Integration of sedate bicycle riding on shared paths through these areas can add to the enjoyment, increase the range (distance covered) and provide a valuable ‘learning to ride’ experience.

Unsuitable for: Some Group B and many Group C cyclists:
• Cyclists travelling at speeds exceeding 20 km/h can pose an unacceptable hazard for pedestrians and children learning to ride and, where forward vision is obstructed, even each other.
• These paths are, by design, intended to distract users by virtue of their location, interaction with the environment and related activities. For this reason care must be taken to ensure that fast cyclists (training and aerobic exercising) are directed elsewhere and not encouraged onto these facilities.

Note: Austroads guidelines are clear that shared paths should only be used where an alternative road route exists for faster cyclists and path speeds do not exceed 20 km/h. One of the problems with RSPs is that they may appear attractive to fast cyclists, owing to the absence of intersections and drive crossovers, while having more conflicting interactions with uncontrolled path users, picnic areas, unsupervised children at play and beach accesses. For this reason it is essential that a good alternative fast cycling route is clearly signed and secondary tools employed to direct slow and fast cyclists to the appropriate facility by choice rather than proscription (‘carrot’ before ‘stick’).

(v) Segregated Paths (SeP)
These are dual facilities where pedestrians and cyclists are separated from each other, preferably by a level difference or an intermediate verge, in situations where there is likely to be significant demand by both pedestrians and cyclists thus leading to conflict. These may provide a solution for short sections along a PSP, where the path also forms part of the community pedestrian network, or through smaller parks and reserves where through cycle routes are required.
When located within the road reserve, the cyclist part should be located nearest to the carriageway and, where road speeds are 60 km/h or more, an intermediate verge is recommended. A change in level, between the different users, is particularly beneficial for those with mobility or visual impairments that are accustomed to the pedestrian concept that ‘up equals safe’.

Suitable for: All Group A, B and C cyclists:
- Providing the ‘terminal arrangements’ at each end are adequately configured, to direct cyclists and pedestrians in the desired direction, these can be effective in resolving localised conflicts.

Unsuitable for: Some non-conforming cyclists and pedestrians:
- Long lengths may prove ineffective in retaining separation between pedestrians and cyclists. Whilst that will not preclude their use, supporting ‘tools’ may be required to reinforce the separation (for example a direct route with steps for pedestrians with an indirect route at grade for cyclists).

(vi) Separated (exclusive) Bicycle Paths (BP)
These are most appropriate where cyclists desire uninterrupted travel at speed, away from the road and where pedestrian desire is very low or can be accommodated by a separate pedestrian footpath network. Where they interact with pedestrian paths they should ideally appear as if a ‘road’ with localised kerbing and pram ramps at the footpath terminations. These are the only realistic option where fast cycling (average speeds of 30 km/h and maximum speeds exceeding 40 km/h) is promoted or consistently likely. In most cases the high volumes and faster speeds would generally be associated with primary or principal cycling routes in which case these would become PBPs (see PSP notes in (iii) above)

Suitable for: All Group B and C most Group A cyclists:
- When located within main arterial transport corridors (such as freeways and railways) these should be the preferred option as they should be free of pedestrians and cyclists are the ‘right of way’ vehicles.
- Acceptable where vehicle crossovers and footpath crossings are infrequent and alternative pedestrian routes are in place. Recommended that formal signage includes an appropriate speed limit (Section 3.3) and additional measures may be required to ‘remind’ intersecting vehicles and pedestrians where they are required to stop or give way.
- Recommended where high cycling volumes are anticipated and crossings are few and far between and alternative pedestrian routes are in place. Recommended that formal signage includes an appropriate speed limit (s 3.3).
- Desirable on primary routes where adjacent road speeds are more than 60 km/h, crossings are few and far between, good lateral visibility can be achieved and alternative pedestrian routes are effective. Desirable that formal signage includes an appropriate speed limit of 40 km/h. (Section 3.3). May be suitable for classification as, and integration with, a PBP/PSP route.

Unsuitable for: Some Group A cyclists:
- With speeds often significantly in excess of 40 km/h, some cyclists that are slower than 20 km/h (some Group A) may feel intimidated and can pose a hazard for fast passing cyclists.
- Owing to the consistent high vehicle speeds these paths are unsuitable for use by pedestrians. These paths should be unattractive to pedestrians by virtue of their
location (away from pedestrian demand areas) or by providing a superior pedestrian alternative (such as a good independent strategic path network serving pedestrian demand areas) which will also cater for the slower less experienced Group A cyclists.

7.3.2 On Road Facilities

(i) Carriageway (unmodified)
The ideal location for cyclists, as a vehicle, is integrated on the road. While this can be both safe and attractive where road speeds are low, such as 30 km/h speeds within residential areas (which is common in much of Europe), as the road speed increases so the utility decreases. Normal 50 km/h residential streets are only attractive to competent cyclists with many less able seeking alternatives.

Suitable for: Group C and some Group B cyclists (Group A only in low speed environments):
- Local Roads in residential areas provide a relatively safe cycling environment for more confident cyclists, which is preferable to riding on shared paths and footpaths.
- Where speeds are lower (for example in cul de sac) then even Group A cyclists will comfortably use the carriageway providing there are good transitional or terminal arrangements between facility types.
- Where a footpath is available this will be used by less confident cyclists which, providing numbers and speeds are low, is acceptable in the tertiary environment.

Unsuitable for: Group A cyclists and some Group B cyclists (subject to road speeds):
- Where this is on a secondary route the numbers and potential speed of displaced cyclists would place an unacceptable burden on footpaths. This would require alternative provision to be made such as a shared path.
- Where this is not a route, but within the tertiary environment, then the more diffuse and low numbers of displaced cyclists can be sustained on the adjacent footpath.

(ii) Carriageway (modified)
There is no specific single measure to modify any road as each one should be assessed on the particular prevailing conditions and environment. Measures include modifications to parking provision, alignment, widths, forward visibility, speed limits and intersection priority to create a ‘Bicycle Boulevard’ or ‘Shared’ cycling road. Use of ‘Self Explaining Roads’ concepts and/or modified visual appearance can also assist in reducing vehicle speeds and increasing cyclists comfort. Strong affirmative measures (secondary tools) to reinforce the cyclists’ right to use the road and an expectation that they will be encountered are essential. It is a combination of individual treatments which are sustained that makes a road suitable as part of a route.

Suitable for:
- All groups where speed limit, or 85th percentile speeds where available, is 30 km/h or less.
- Most cyclists for whom road speeds are in accordance with ‘Think 20’ principles (section 5.5) which may be applicable for some cyclists on roads up to 50 km/h.
Unsuitable for:
- Some Group A cyclists where road speeds are between 30 and 40 km/h (adjacent footpaths may provide an acceptable alternative).
- Most Group A and some Group B cyclists where road speeds are between 40 and 50 km/h (where this is a route, which promotes increased bicycle traffic, then additional provision of a shared path should be considered).
- Some ‘fast’ Group C cyclists where road speeds are lower than 30 km/h (although this may be acceptable where alternative faster roads provide an equally convenient alternative).

Generally, where carriageway modification enables a route to be provided, it is through a combination of secondary tools although there are some sub groups that are worth mentioning:

A. Bicycle Boulevards
A low speed road (preferably 30 km/h but with appropriate treatments up to an absolute maximum of 50 km/h) where signs, markings and contrasting surfaces are used to create a distinctive look to alert motorists and advise cyclists that this is a priority route for cycling.

Figure 97: Bicycle Boulevard (USA) clearly marked to highlight function as a bike route.

Free flow for cyclists, by assigning right of way to the boulevard at intersections (see section 7.4.1 (v)), should be employed and this can be augmented by ‘Volume Management’, which involves measures to reduce or discourage through traffic and speeds, such as partial closures, or traffic diversions, with bicycle bypasses.

Figure 98: Volume management (USA) by diverting other vehicles and providing bicycle exemption.

Whilst applicable to streets with traffic volumes below 1500 vehicles per day (vpd) in exceptional cases this can be extended to 3000 vpd for short sections or where road speed is below 40 km/h. Where a bicycle boulevard crosses major roads traffic control should be considered to enhance good crossing facilities although substantial median refuges (which limit crossing to no more than two lanes at a time) may suffice. This is particularly effective where a full median prevents crossing of the major road by motor vehicles at left in/left out intersections.
B. Greenways
A relatively new term, these are essentially Bicycle Boulevards, and subject to the same design requirements, but with greater emphasis on landscaping and trees to reinforce the ‘self-explaining’ nature of the street. The concept of a Greenway is not just restricted to the road but may also include off road sections, through parks and reserves, to create a longer continuous ‘Greenway’.

C. Shared Streets
Quiet and slow: These are informal often relatively short streets, in recreational, commercial or high density residential areas, where linear features, such as kerbs, are eliminated or minimised and pedestrian, parking and vehicle manoeuvring areas are more discreetly defined with ‘zig-zag’ alignment for motor vehicles. Similar to Bicycle Boulevards this approach may be viable even with traffic volumes of up to 1500 vpd (3000 vpd in exceptional cases) where speeds between 10 and 30 km/h can be delivered. (Source: Bicycle Network – Bike Futures).

D. Living Streets
Also known as ‘Home Zones’ (UK) and Woonerf (Netherlands): Designed primarily with the interests of pedestrians and cyclists in mind and as a social space where people can meet and where children may also be able to play legally and safely. Whilst these roads are still available for use by vehicles, their design aims to reduce both the speed and dominance of motor vehicles. Ideally this should be legally defined by the use of Shared Road zoning, with greatly reduce demarcations between vehicle traffic and pedestrians and default 10 km/h speed limits. Vehicle parking should be restricted to designated bays only. With pedestrians having priority and motor vehicles not, the environment may become constrained to the extent that, other than at entry ‘gateways’, there is no requirement for additional affirmative measures or markings for cyclists.

Figure 99: Informal integration of activities providing a slow speed environment (Germany).

Figure 100: Living street treatments applied to an existing residential street to create a Home Zone (Wonford UK).
In conclusion:
While 30 km/h is the ideal speed for full integration, even in tertiary areas subject to the current 50 km/h speed regime, facility types A, B and C (above) are capable of providing a safe and attractive route for most users. With sufficiently legible carriageway modifications, ‘Volume Management’ and affirmative road treatments (providing these collectively constrain excessive speed) the ‘Think 20’ thresholds may be increased by up to 10 km/h thus enabling most Group B cyclists to tolerate roads up to 50 km/h.

*Note: Unless, or until, suburban speeds are reduced (or these facilities are subject to lower speed limits), the least experienced cyclists will still need to be accommodated on adjacent paths.*

(iii) Bike Lanes (traditional kerbside)
A formal lane marked on an existing roadway or carriageway and generally restricted to cycle traffic, includes both coloured (contrasting paint or asphalt) and plain, with painted lines delineating the bike lanes. It can be mandatory (marked with a solid line, entry by motor vehicles is generally prohibited with some exceptions) or advisory (marked with a broken line, entry by motor vehicles is permitted). The use of bike lanes provides more of an encouragement for cyclists than a significant increase in safety.

Figure 101: This bike lane provides some separation between cyclists and motor vehicles but places riders in the ‘door zone’ of parked cars (Kirribilli, Sydney).

The main benefits come from a reallocation of road space, to cyclists, but will normally preclude or severely limit on street parking as parking in a mandatory bike lane is prohibited. In the image above, from Sydney NSW, the bike lane is 1.5m wide alongside a 3.0m road lane. A reduction in width to 1.2m would have provided sufficient room for a 600mm door zone buffer to be provided adjacent to (narrowed) parking bays. This would provide a positive contribution to reducing door zone risks without any further reduction in motor vehicle space.

Main benefits of bike lanes:
- Shows a clear commitment to improving cycling conditions.
- Cyclists generally feel safer using a bike lane (in reality safety may be illusory).
- Raised driver awareness to cyclists (especially at side road entry).
- Enables cyclists to more easily bypass queuing traffic.
- May improve cyclist’s safety and visibility when continued through intersections (except roundabouts).
- Provides excellent way finding when properly articulated as part of a route and with clear transitions to other facilities.
Main disadvantages of bike lanes:
- Problems for cyclists rejoining main carriageway where lanes terminate (roundabouts etc).
- Allocates cycling space to the less visible secondary (kerbside) location.
- Reduces driver allowances (passing distance and speed) as the cyclist is outside the driver's lane or area of perception.
- Encourages faster differential speeds, by cyclists, when bypassing queuing traffic increasing collision risk with pedestrians and turning vehicles.

If bike lanes are provided adjacent to parked cars (on street or embayed) then a minimum 900mm ‘door zone’ buffer (absolute minimum 600mm) should be provided between the bike lane marking and the bay markings.

Bike lanes should be provided in accordance with Austroads guidelines and no less than 1.2m wide (absolute minimum of 1.0m for very short sections only in exceptional circumstances) and consideration given to wider lanes on uphill sections (gradient > 5%) to allow for ‘uphill wobble’.

Note: Currently in WA most existing bike lanes are only informal and cannot be enforced, as they ‘apparently’ do not meet the legal requirements for a bike lane, often leading to obstruction by parked vehicles. As many cyclists consider they are unsuitable, and many motorists believe cyclists must use them, they may create more conflict than benefit. For that reason the City only supports the use of fully compliant mandatory legal bike lanes.

Given the fact that ‘informal’ bike lanes are not subject to the stopping and parking prohibitions that are applicable to bicycle lanes, further consideration may need to be given to differentiating fully compliant mandatory legal bike lanes. Regulation 142 (RTC 2000) prohibits stopping on a carriageway marked with a continuous yellow edge line. Also, Regulation 157 prohibits stopping in both a bus lane (a) and bicycle lane (d). Given that both are ‘defined purpose’ lanes under the same regulation, and bus lanes are marked in yellow, it is logical to conclude that marking bicycle lanes with yellow lines will assist in their conspicuousness and reinforce the no stopping requirement. Bus lanes, by many drivers, are understood to be a forbidden lane (for both driving and parking) and this degree of consistency and intuitive recognition could be extended to bicycle lanes.

Formal legally enforceable bike lanes may enable the ‘Think 20’ thresholds to be increased by up to 20 km/h, especially if buffered, thus enabling some Group A cyclists to tolerate 50 km/h speeds and Group B cyclists up to 60 km/h speeds. With a speed differential generally exceeding 40 km/h, except for very experienced cyclists, unprotected bike lanes are not considered suitable for urban roads where the speed limit is 70 km/h or more.

Suitable for:
- All Group B and C and some Group A cyclists where speed limit, or 85th percentile speeds where available, is 50 km/h or less.
- Most Group B and all Group C cyclists where speed limit, or 85th percentile speeds where available, is 60 km/h or less.
Unsuitable for:

- Some Group A cyclists where road speeds are 50 km/h (adjacent footpaths may provide an acceptable alternative).
- All Group A and some Group B cyclists where road speeds are between 50 and 60 km/h (where this is a route, which promotes increased bicycle traffic, then additional provision of a shared path should be considered).
- For all Groups (as a designated route) where speeds are 70 km/h or higher.

(iv) **Bike Lanes (buffered)**

Similar to the above, these are bike lanes which are enhanced by painted hatched medians separating the bicycle lane from general traffic lanes. Where the road is, or can be constructed wide enough, a substantial hatched area (600mm wide) can be provided between the outer bike lane marking and the adjacent carriageway edge line. Where additional space is not available then an absolute minimum of 200mm (50 km/h) or 300mm (60 km/h) width may suffice (subject to posted speed limits).

![Figure 102: Buffered Bike Lanes providing additional protection to cyclists along a busy arterial road (‘Bikesmart’ Seattle).](image)

This can be applied in two ways:

- Normal carriageway lane widths are retained with the buffered area provided in addition to the lanes. While this will increase the separation, and hence safety of cyclists, as well as greater toleration of differential speeds (up to 40 km/h) it may have little impact on general vehicle speeds.
- Alternatively all or part of the hatched area can be reallocated, or ‘taken’, from the adjacent carriageway lane. The presence of the hatched buffer, together with the reduction in normal lane width is likely to cause a reduction in general vehicle speeds while the hatched area will enable buses and trucks to remain predominantly in the reduced lane width with some ability to ‘overhang’ the buffer lane with mirrors.

*For example:* A 3.0m lane (on a bus route) with a 200mm or 300mm painted buffer will provide the same ‘space’ for the bus (in relation to the bike lane) as a 3.2m or 3.3m lane does. The visually reduced lane width should passively reduce speeds while also actively increasing separation from passing cars and vans.

![Figure 103: In this example a bike lane, which is protected by a 200mm buffer crosses an intersection with the route defined by a coloured band between ‘elephant’s feet’ markings. (Barcelona, Spain)](image)
Suitable/Unsuitable as for ‘traditional’ bike lanes with some additional tolerance by less experienced cyclists and, when matched with improved continuity through intersections, an overall increase in safety.

(v) Bike Lanes (protected)
As a further measure, the hatched buffer is replaced with a solid kerbed median with intermittent breaks at drive crossovers and intersections. This ensures that slower cyclists are physically separated from motor traffic and distinct from the footpath. In this case the bike lane must be a minimum 1.2m wide, may need to be wider to cater for cyclists overtaking and the adjacent carriageway lane width generally retained.

![Figure 104: Protected one-way bike lane ('streetsblog' Temple City, LA)](image)

Note: The minimum width for a bike lane between medians should be defined by the operating width of existing street sweeping/cleaning plant. Narrower lanes could well require additional or specialist equipment.

There are two ways in which a protected bike lane can be located:
- The safest forms are kerbside bike lanes with protective medians and no parking. Visibility is maintained at crossings, intersections and terminations. Where the adjacent carriageway has more than one lane in each direction then the protective median may need to increase to at least 1.2m width to provide a suitable refuge at locations where pedestrians cross. At bus stops and formal pedestrian crossings consideration should be given to increasing the median width to provide a suitable boarding, waiting and arrival area for pedestrians prior to crossing the bike lane.
- Kerbside bike lanes with a protective median separating cyclists from cars parked adjacent to the main carriageway pose an additional risk as visibility is compromised at crossings, intersections and terminations. This requires careful consideration including possible additional measures to alert motorists to the presence of cyclists that may have previously been unseen. The minimum ‘door zone’ buffers specified above are required and these should be retained across pedestrian crossing locations and will also be sufficient where all or part of the bay width should additionally form part of the pedestrian refuge. This ‘widening’ ensures that the pedestrian can both see and be seen when entering both the bike lane and main vehicular carriageway. Note: Because of the inherent risk of shielding cyclists from the view of turning cars parking should be restricted on the approach side of vehicle crossings and intersections through ‘Parking Denial’. 

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Suitable for:
- All Groups A, B and C cyclists where speed limit, or 85th percentile speeds where available, is 50 km/h or less.
- Most Group A and all Group B and C cyclists where speed limit, or 85th percentile speeds where available, is 60 km/h or less. (*In order for the least experienced cyclists to be accommodated very careful attention at intersections is required to minimise the risks from motor vehicles*)

Unsuitable for:
- Some Group A cyclists where road speeds are between 50 and 60 km/h (as numbers are likely to be low adjacent footpaths may provide an acceptable alternative).
- For all Groups (as a designated route) where speeds are 70 km/h or higher unless alternative provision is made at intersections.

*Note: Bike lanes have at least two flaws:*
- Cyclists are required to cycle in what is normally the secondary (less visible) position where primary ‘taking the lane’ position is denied (where the cyclist position is more equal to the normal ‘threat’ position posed by general road users). This reduces the visibility for the more assertive faster riders requiring consideration of compensatory measures (such as extending the lanes across intersections and warnings on approaches on side streets).
- The other is that it is generally less safe to extend lanes into roundabouts and many signalised intersections. In these cases clear terminal measures are required to ensure that cyclists can merge visibly and safely with traffic and, for less experienced cyclists, consideration should be given to providing alternative ‘shared path’ routes (offering ‘pedestrian familiar’ crossing options).

(vi) **Cycle Tracks (One or Two-way segregated bike ‘lanes’)***
This is a collective term for a form of protected bike lanes, as above, which is also sometimes referred to as a ‘Copenhagen Lane’. It may also be called a ‘Danish’ Cycle Track (NZ), to differentiate from bush tracks and trails, and shares some of the better attributes of both a bike lane and a bike path. In its simplest form there is either a raised median or kerb between the general carriageway and the ‘bike lane’. In many cases the ‘Copenhagen Lane’ is at normal carriageway level although, particularly in northern European countries, it may be elevated behind a kerb. Even when raised behind the kerb, it should still retain the common distinction from a bike path, in that it is still separated by a second kerb (level difference) from the adjacent footpath (in effect to form an upper carriageway rather than a bike path).

In some cases (not preferred) the Cycle Track may be at the same level as the footpath in which case a visually distinctive difference in surface treatment is required with a verge, or textured strip (cobbled), between the pedestrian and bicycle sections.

*Figure 105: Use of contrasting surface treatment and divisive landscaping to Cycle Track (Copacabana Beach, Rio de Janieiro).*
To be effective the bike lane should continue to be elevated, or at least very well and distinctly marked, as it crosses intersecting streets to sustain the vehicular right of way for bicycles over turning vehicles that is the key differential between a bike lane (which retains priority as it passes the intersecting street) and a bike or shared path (which gives way as it crosses the intervening street).

**Figure 106:** A typical Copenhagen Cycle Track (courtesy of Alta Planning).

The most common form of ‘Copenhagen Lane’ provided is one-way ‘with flow’ (in the same direction as the adjacent traffic lane) in which case cyclists meet crossing vehicles and pedestrians from the ‘normal’ (expected) direction. These, therefore, pose little or no additional risk over a protected bike lane.

The alternative two-way ‘Copenhagen Lane’ may offer some advantages but this is counterbalanced by disadvantages. While it is the most efficient in terms of road space, and in particular allows for unimpeded car parking to be retained on the opposite side of the road, it introduces cyclists coming from the opposite (wrong) direction at crossovers and intersections and also creates an unexpected hazard for pedestrians crossing the road. For these reasons two-way lanes are most suitable for shorter roads, where there are few (if any) intersecting streets and limited numbers of crossovers. To ensure that all conflicting crossing traffic (including pedestrians) are properly alerted to the contra flow cyclists, much greater care is required to ensure that signage, markings and surfacing conveys a distinctive message.

**Figure 107:** Two-way Cycle Track installed on street while retaining double sided parking. (Unknown location UK)

Note: It is worth commenting that, in some countries particularly in the Netherlands, one way cycle tracks are now being replaced with two way tracks as experience has shown that contraflow cycling is hard to control and two way flows avoid cyclists having to cross the road, sometimes twice, to access the cycle track. In essence the less apparent benefits may actually outweigh the more obvious risks. The City has a functioning two way ‘Cycle Track’ along Telford Crescent in Stirling.
A Cycle Track should, with appropriate intersection treatments or alternative bypass facilities, be suitable for all ‘design cyclist’ Groups.

(vii) **One way ‘Contraflow’ Bike Lanes**
Contra-flow bike lanes enable cyclists to travel in both directions on a one-way street, or at a two-way street with a one-way exit, thus providing a more direct route without detours and should, ideally, be provided to all one-way urban streets. Ideally they should be visually distinctive protected bike lanes, similar to a two-way Copenhagen Lane, although with good visibility and lower speeds buffered bike lanes may be appropriate.

![Figure 108: Contraflow bike lane to one-way street (Marine Terrace, Fremantle).](image)

Terminal arrangements at each end require careful consideration to ensure that conflicts are minimised and the configuration is legible and self-explaining to all road users. This has been successfully achieved in Fremantle where entry to the harbour from the roundabout on Marine Terrace is only available for cyclists.

(viii) **One Way ‘Contra-flow’ Exemptions**
Where a road terminates, or turning movements are prohibited, consideration should be given to exempting bicycles by the provision of an appropriate short bike lane. This is one element of ‘Volume Management’ whereby the addition of one-way roads (where network capacity for diverted traffic is available), together with exemptions for cyclists, may be a valuable mechanism for promoting cycle routes and reducing traffic volumes by diverting cars (and more so heavy trucks) from bicycle routes.

![Figure 109: Contraflow exemption at prohibited entry to two-way street (London Borough of Camden).](image)

In some cases a simple ‘Except Bicycles’ sign may be the only thing needed.

![Figure 110: In this case a narrow ‘advisory’ bike lane serves to alert drivers to contraflow cycling. On many streets only the sign is provided (Montmartre, Paris).](image)
There is a substantial case for providing bicycle exemptions, to allow contra-flow cycling along low speed one-way streets, with nothing more than exemption signage or, as illustrated, an ‘Advisory’ bike lane (with dotted lines). Whilst this approach is not yet implemented or recognised in WA, it is widely used in other metropolitan areas (in particular Paris on 30 km/h streets), and would legitimise behaviour that is already in evidence along the smaller low speed one-way laneways and streets in Perth CBD.

(ix) Service Streets or Cycle Streets
These are situations where normally residential accesses would otherwise conflict with an exclusive Bike Path or Bike Lane. In this situation (not dissimilar to a pedestrian/cyclist shared path) the motor vehicle is permitted to use the (shared) Bike Path, giving way to bicycles and at appropriate speeds, to access parking bays or adjacent properties.

Figures 111 & 112: Residential Service Street (Henry Lawson Walk, East Perth).

The images above, from East Perth, demonstrate how a street can be provided such that motor vehicles would be prepared to defer to cyclists. Although these streets have been constructed with slow speed and integration in mind, it would also be possible to retrofit similar treatments on existing streets.

A Cycle Street, with ‘self-explaining’ traffic calming measures and low speeds (by alignment or regulation), should be suitable for all ‘design cyclist’ Groups.

(x) Bus Lanes
These provide fast and unimpeded lanes for the exclusive use of public transport over private vehicles. They are also capable of acting as a good quality wide bike lane with minimal constraint on bus traffic and, particularly in Perth where buses run at much lower frequency than more urbanised cities, may even be capable of carrying as many bicycle passengers as bus passengers. For this reason the default for bus lanes should be to include bicycles.

Figure 113: Bus lane also functioning as bike lane for peak time (commuter) cycling (Beaufort Street, Inglewood)
As they are wider, and shared with public service vehicles, they will have a lower acceptability for less experienced cyclists although, because of their continuity and more direct routing, may have a correspondingly higher level of service for more experienced cyclists. These characteristics may mean that they might only provide an appropriate route for ‘commuting’ cyclists rather than the wider cycling community.

**Suitable for:**
- All Group C, many Group B but few if any Group A cyclists where speed limit, or 85th percentile speeds where available, is 50 km/h or less.
- All Group C, but only some Group B cyclists where speed limit, or 85th percentile speeds where available, is 60 km/h.

**Unsuitable for:**
- Most Group A and a few Group B cyclists where road speeds are 50 km/h (where this is a route, which promotes increased bicycle traffic by all design users, then additional provision of a shared path should be considered).
- All Group A and some Group B cyclists where road speeds are between 50 and 60 km/h (where this is a route, which promotes increased bicycle traffic by all design users, then additional provision of a shared path must be considered).
- For all Groups where speeds are 70 km/h or higher as differential speeds with public service vehicles would be too high – Under these conditions they should remain Bus Only lanes.

(xii) **Shared Breakdown/Bike shoulders**
These can be described as a reserved area outside of a normal carriageway, separated by a solid barrier line, but within the road right-of-way. Road shoulders (a) are a buffer area between the roadway and possible off-road hazards intended to prevent accidents in the event of a temporary loss of vehicle control, (b) provide emergency access for ambulances and police cars and (c) provide a space for inoperable vehicles so that they do not block the travelled way. In addition, bicyclists may use road shoulders when other bicycle-specific facilities are absent or inferior.

Generally these are only provided on the faster principal roads (such as Reid Highway) and are prohibited on freeways. Whilst this strategy does not seek to limit their use by experienced cyclists, the speed differential is such that, for inclusion as a route, they generally would not meet the applicable criteria for a Bike Lane: “With a speed differential generally exceeding 40 km/h, except for very experienced cyclists, bike lanes are not considered suitable for urban roads where the speed limit is 70 km/h or more”. They are, therefore, not recommended for use on a Bike Route.
7.4 Measures and Interventions to Assist Cycling (Additional Tools)

This sub-section provides guidance on the secondary treatments and controls (or tools) that can be used to facilitate cycling along a particular type of infrastructure, or between infrastructure types. In some locations this may be to on-road facilities, in others off-road and, where there is more than one, at the transition between combinations of types.

The first grouping is for linear treatments that can be applied along a route, or that may already be in place on intersecting (priority) roads thus providing an enhanced environment or ‘opportunity’ for cycling. Some treatments, such as narrower road widths and chicanes, are appropriate for new roads (subdivisions and redevelopment areas) but may also be feasible by modifying existing wide roads.

The second grouping is for lateral treatments along a route, that relate to intersections or specific locations, which also cater for transitional features which are intended to direct cyclists between different facilities, or provide a connection which is preferential for cyclists or even acts as a barrier or diversion for motor vehicles. Importantly, in some cases in shared areas, the treatment may be preferential for pedestrians with a traffic calming or diversionary function for cyclists.

The third group is regulatory, advisory or directional signs and/or markings.

Finally, in the fourth group, is a set of assessment tools, concepts and reference documents that provide valuable information on how to combine the treatments (secondary tools) to provide a comprehensive route through one or a combination of facilities (primary tools).

The available treatments, which can be used in retrofitting existing roads as well as for new subdivision roads, are as follows:

7.4.1 Physical Infrastructure (Linear LATM Treatments)

(i) Narrow two way Roads
Many residential streets are too wide, which not only induces higher speeds but also encourages other vehicles to pass cyclists, while remaining on the left of the road (passive) rather than overtaking, by moving into the right hand side (active). This leads to dangerously close passing, which may be perceived as aggressive, and tends to marginalise cyclists as they move to a defensive secondary position riding close to the kerb. This reduces cyclist’s visibility, places them on the most uneven part of the road, and into conflict with any parked cars.

Local streets in new developments should always be provided at the minimum width required to maintain their function and this is supported almost universally in design guides and, in WA, through ‘Liveable Neighbourhoods’.

To avoid any confusion, the use of narrow roads in this section does not include dividing the road using medians. It is essential that two way traffic is maintained, allowing for easy overtaking, so that cyclists can ride comfortably in primary position.
This treatment can be particularly effective, by modifying existing roads, when the core road width is reduced to 6.0m (range 4.5 to 6.5m) in conjunction with a reallocation of road space. That could be through increased path or verge widths or build outs that then offer spaces for landscaped areas, tree planting, seating and alfresco dining, and even car parking. How adjustments to existing on-road parking can assist is covered in (ii) below.

\textbf{Figure 114:} Informal paving and flush kerbing with ‘controlled’ parking provision encourages slower speeds and better integration.

At road widths up to 6.0m (6.5m max) motorists need to modify their path to overtake cyclists (active) and cyclists should feel more comfortable riding more assertively in the primary position (where they become more visible).

\textbf{Figure 115:} In this example the wide road has been effectively narrowed to 6.5m by converting uncontrolled parking into embayed parking with build-outs (Brown Street, East Perth).

Similarly in Northbridge narrow roads, together with the street ‘clutter’ and trees which break up the visual horizon, all contribute to slower speeds and safer passing which is encouraging on street (urban) cycling as well as providing a ‘calmed’ pedestrian environment.

(ii) Embayed parking and ‘Parking Denial’

As referred to above, a significant hazard for cyclists is intermittent parking, which requires cyclists to alternate between a kerbside position (secondary) and well out into the road (primary) to pass parked vehicles, with constant ‘switching’ between primary and secondary riding positions. Many motorists do not tolerate, and inexperienced cyclists are uncomfortable, riding primary and ‘keeping the lane’ on these roads.

\textbf{Figure 116:} Provision of alternating embayed parking providing for a consistent riding position. (Dundas Road, Inglewood)
The solution is to formalise the existing parking, with embayment between build outs, to reduce the residual road width and provide a consistent riding position. This assists in reducing road speeds and lateral conflicts between cars and cyclists. When alternated, between each side of a street, this also reduces forward visibility perception further moderating vehicle speeds.

This treatment can be particularly effective when reducing the core road width to 6.0m (range 4.5 to 6.5m) where existing road widths are sufficient to provide 2.15m (minimum) parking bays.

The use of a kerbed extension or ‘bulb out’ is used to deny parking in areas that are required for visibility (such as each side of a road crossing or at an intersection) and to provide effective control at alignment changes (such as at chicanes).

**Figure 117:** In this example, from the USA, a ‘bulb out’ is used to keep visibility at an intersection clear, while shortening a road crossing and providing some additional amenity space for pedestrians.

(iii) **Bends and Chicanes**
Bends and chicanes are an effective measure for reducing general vehicle speeds on two way roads without narrowing to create choke points where cyclists may be ‘squeezed’ by passing vehicles. Care must be taken to ensure that these are used to reinforce, or maintain, a low speed environment as, when used to initiate slower speeds, they can bring fast vehicle paths into conflict with slower cyclists.

**Figure 118:** Creation of a chicane using street art to visually reinforce traffic deviation (Perth WA)

While the provision of tight bends is mainly applicable to new roads, the introduction of chicanes to an existing wide road is feasible and may even be desirable proving very effective in reducing speeds to below conflict levels (speed differential below 20 km/h).
Figure 119: Low cost road treatment creates a low speed 30 km/h (20mph) 'self-explaining road' environment through landscaped chicanes.
(Newcastle under Lyme, UK)

(v) Solid medians and median refuges
Medians along a bicycle route can assist cyclists (and pedestrians) by reducing vehicle speeds and providing crossing and turning refuges, however, this requires careful consideration as a central median can also reduce clearance by passing traffic which under certain conditions can deter cycling (section 7.5).

Medians are important, if not essential, on multilane roads where pedestrian and cyclist permeability is required and at least two lanes in each direction means that passing vehicles can overtake cyclists in the slower lane. The problem arises with a solid kerbed median where there is only one lane in each direction, as this requires a passing manoeuvre that is often too close for comfort. For that reason the lane width becomes critical (see section 7.4.2 (ix) below) and adequate lengths of road are required, where the solid median is replaced by a barrier line, to assist in overtaking by removing ‘kerb shyness’.

When provided along intersecting major (priority) roads, wide medians can restrict intersection movements for motor vehicles while providing safe crossing refuges for cyclists. This is a significant tool to enhance a Bicycle Boulevard or Bike Lanes, where the route crosses a priority road and can also provide additional 'Volume Management' functions by reducing the accessibility of, and hence level of traffic on, the minor streets.

(v) Flush medians and rumble medians
Where lane width is to be restricted, to constrain vehicle speeds, or the vehicle path needs defining, to reinforce the ‘safe’ vehicle alignment, the provision of a flush median should be considered. This can be through contrasting (paved) surface or, where additional control is required, with a profiled or ‘cobbled’ surface to provide a tactile response.

The essential characteristics are that they are durable, contrast with the normal carriageway surface, and will define the normal vehicle path without preventing their use when wide or overtaking vehicles need to enter or cross to manoeuvre past cyclists and other obstructions.

Figure 120: Use of flush paved median to provide ‘narrow’ lanes while permitting vehicles to safely overtake bicycles (South Terrace, Fremantle)
In appropriate locations a paved median could be used to define a 2.7–3.0m lane (that is, an effective visual tool to reduce speeds) even on a road that carries buses or to cater for other wide vehicles. As the paved area can be entered to pass obstructions or slow cyclists, the ‘normal’ (3.2m) minimum lane width, is not constrained by a dividing line, and remains available if and when required. In Fremantle lane widths have been visually reduced to reinforce road sharing and a 30 km/h speed limit.

A rumble or ‘cobbled’ median should be considered where vehicles are to be encouraged to remain on the intended alignment but are permitted to enter or cross the rumble median rather than passing cyclists to close and dangerously. For example, on a chicane, a tactile median will be more effective than barrier lines without the need for a regulatory marking that prohibits crossing or entering.

![Figure 121: Use of rumble bars to control turning vehicles thus reducing conflict speeds (Cromwell Street, Hobart).](image)

Under certain circumstances it may be more appropriate and cost effective to use barrier lines, to define a median (particularly at intersections), reinforced by a tactile treatment or rumble bars to ‘encourage’ motor vehicles to stay on track as is done in Hobart, Tasmania.

(vi) Changes to intersection priorities
As cyclists are highly motivated to conserve (retain) energy, route selection by faster cyclists is often predicated on avoiding streets with frequent give way and stop signs.

![Figure 122: This road on a bike route would both restrict use and encourage cyclists to ignore the stop signage placing them in greater danger. (Sydney, NSW)](image)

To avoid routes that deter faster cyclists (or encourage risky behaviour) bike routes should take priority over intersecting streets wherever possible. In some cases, particularly where bike lanes are employed, the route selection may be made where that already applies. However, many of the best routes, particularly for Bicycle Boulevards, could use quieter back streets that may otherwise require frequent stopping.

In those cases it is essential that every possible intersection, where the priorities can be switched, is modified to suit. To avoid creating a ‘rat run’ for all vehicles other LATM treatments, with some form of bicycle permeable barrier to motor vehicles, will be required to provide volume management.
7.4.2 Physical Infrastructure (Lateral LATM treatments)

(i) Intersection treatments
Turning vehicles, failing to give way at intersections, pose a significant risk to both pedestrians and cyclists. In particular large radius corners, intended to allow heavy vehicles to remain entirely in their ‘half’ of the road, allow many car drivers to turn at speed, posing a risk to pedestrians and cyclists alike. Particularly where heavy vehicle turning movements are infrequent, an effective measure can be to reduce the corner radii. At residential intersections a 6.0 radius is more than adequate and radii as low as 4.0m can be considered (these smaller radii also reduce the setback for pedestrian crossing ramps reducing crossing distances). An additional measure, that further reduces crossing distances and turning speeds, is to narrow the minor road with kerb extensions or bulb-outs.

Figure 123: Radius reduction and kerb ‘build out’ (London UK).

Kerb build outs can act as parking lane terminations along the major street, for example on a Bicycle Boulevard, to reinforce the visual narrowing of the street, or on the minor street to constrain entry/exit from the major street (which also greatly improves pedestrian safety and amenity along the main street footpaths). Where drainage pathways need to be retained they can be constructed as edge islands retaining a narrow kerbside channel.

Raised table intersections are where the carriageway is raised throughout the intersection on every approach. These may be used in conjunction with any of the above measures or on their own. They are of particular benefit where the two intersecting streets have similar traffic levels or have been reprioritised. These can significantly reduce speeds for all vehicle movements and greatly improve pedestrian amenity as the carriageway is raised close to or at the same level as the footpaths and verges.

Figure 124: Raised table intersection. (Bethnal Green, London UK)
In this image above, the whole intersection has been raised to footpath level which, apart from providing for better pedestrian crossings, also constrains vehicle speeds along all four arms of a staggered intersection.

![Figure 125](image)

**Figure 125:** Tight radii, bollards and a ‘bell’ all further constrain vehicle movements and speed (Bethnall Green, London UK).

(ii) **Speed tables, speed cushions and speed bumps**

Intersections are not the only locations where vertical displacement can calm or slow traffic. An alternative to a raised intersection and/or reduced radii may be to provide a raised table at each tangent point. This will effectively reduce through and turning speeds and, if drainage pathways permit, also provide an elevated crossing for pedestrians.

![Figure 126](image)

**Figure 126:** Mid-block speed table (Angove Street, North Perth).

Raised tables are also effective mid-block and potentially where other paths or tracks cross the street. Where they are short they are referred to as speed humps. Another alternative is a speed cushion, which is reduced in width to reduce the impact on wider track vehicles. However, the preponderance of wider cars and 4WDs, with similar tracks to ambulances and buses, renders their use less effective. In the above image, a speed table reduces road speed which, for many cyclists, is preferable to riding in a door zone bike lane.

With all vertical traffic management measures they are most effective when used at regular frequency along a route with other similar (or even horizontal deflection) measures. The degree to which speeds are reduced is dependent on the frequency. Speed cushions or humps (generally no longer than a car in total) are more aggressive and may reduce speeds well below 30 km/h whereas speed tables (generally longer than a car along the flat top) may only reduce speeds to 40-50 km/h. Aggressive speed bumps (less than the wheelbase of a small car) such as are used in car parks etc, are not suitable for streets and can be a hazard to cyclists.
(iii) **Shared Path bypasses**
Roundabouts in particular pose significant problems for less experienced cyclists who may find even simple single lane roundabouts confronting. An effective solution may be to allow slip lanes to join a shared path ‘ring‘ which enables cyclists to cross, where they are familiar and have experience, at the normal path crossing locations.

![Figure 127: Slip lanes termination to bike lane (Grand Ocean Entrance, Burns Beach).](image)

Figure 127: Slip lanes termination to bike lane (Grand Ocean Entrance, Burns Beach).

The bypass needs to visually and functionally attractive to the novice cyclist that, by their nature, may inadvertently lead motorists to believe that cyclists must use that route. It may, therefore, be necessary to install compensatory measures (such as ‘Sharrows’) to affirm the cyclists’ right to the road and to advise motorists of their possible presence.

![Figure 128: Bike route continuity through roundabout. (Grand Ocean Entrance, Burns Beach).](image)

Figure 128: Bike route continuity through roundabout. (Grand Ocean Entrance, Burns Beach).

(iv) **Bike Lane bypasses at signalised intersections and roundabouts**
These may take the form of a protected bike lane which enable cyclists to bypass (avoid) the normal controls at signals and roundabouts and keep cyclists away from pinch points and some turning conflicts. At three way intersections they may also enable cyclists to utilise the fourth leg, unavailable to motor vehicles, which may be a closed road or PAW.

![Figure 129: Bicycle bypass on approach to roundabout (South Terrace, Fremantle).](image)

Figure 129: Bicycle bypass on approach to roundabout (South Terrace, Fremantle).
(v) **Physical Barriers (terminations and diversions)**
Roads may be ‘stopped’ or terminated in a cul de sac, where they meet a major road to prevent traffic from entering local streets. In those cases they may provide an excellent route, into a calmed local street network, which may be suitable for cyclists or capable of functioning as a bicycle boulevard. Providing suitable bike lane bypasses are provided, and integrated into the intersection (as above) they can open the barrier for cyclists.

Additionally, to provide ‘Volume Management’ and prevent excessive speeds from building up along a proposed bicycle boulevard, or even a route with bike lanes, it may be effective to ‘stop’ or close a road to motor vehicles, mid-block, or to only permit opposing left or right turns into side streets at a crossroads, to ensure that motorists cannot take the straight or direct route.

![Figure 130: Volume management by diverting other vehicles and providing bicycle exemption (USA).](image1)

In the image above a four way intersection has been modified so that only cyclists can continue along a bicycle boulevard and all other vehicles are diverted into adjacent streets. Providing a ‘bike lane bypass’, or ‘cycle gap’, is provided, and the adjacent road network can accommodate the motor vehicles, this enables the street (route) to be open for cyclists only and is often one of the most effective measures for a bicycle boulevard.

(vi) **Cycle Gaps**
These are effectively short bike lane bypasses, usually one way but in pairs, that provide a gap through central medians on primary streets, or through introduced physical barriers (above), to provide a continuous route for cyclists. These are recommended to be at least 1.5m wide (absolute minimum 1.2m) and, where wider, may need a central bollard to prevent motorists from illegal use.

![Figure 131: Simple bike gap from blocked off road (London UK)](image2)

A road level cycle gap retains connectivity for cyclists where a road intersection has been blocked for all other vehicles. As the gaps remains at carriageway level, bounded by kerbs and pram ramps this ensures that the normal caution exhibited by pedestrians crossing an intersection is retained.
Figures 132 & 133: Cycle gaps (London UK).

In the images above, the example on the left shows an offset bike lane providing a link across the road to a bicycle bypass while all other vehicles are required to turn left. The example on the right shows two gaps ensuring that cyclists are able to continue across a road 'closure' between two cul de sacs.

(vii) Offset crossings at intersections
At staggered intersections, along a cycling route that crosses a major road, the verge may be wide enough, and free of accesses, to enable a bike path to be provided between points where safe crossing median refuges, or 'cycle gaps' can be facilitated. Where a wide median is available, such as along Alexander Drive or Morley Drive, it may even be possible to provide the bike path along the central median with road crossings facilitated, across no more than two lanes, away from turning vehicles.

Figure 134: An illustration of how as offset crossing, using a bike path, can be provided (Netherlands).

Within the tertiary cycling environment, or on local streets, where the majority of faster competent cyclists can use the intersecting road, a linking, offset, shared path may be a suitable solution for less experienced cyclists (for example as a link between a quite side street or cul de sac and a mid-block PAW path).

(viii) Pinch Points or Chokers
Although these can place cyclists into conflict with faster cars merging from behind, appropriately located they can be effective in limiting vehicle speeds on approaches to, or at, intersections. When used in conjunction with other treatments they are effective in maintaining a lower speed environment and, with bike bypasses can provide a preferential route for cyclists or an effective and safe transition from a bike lane to the main carriageway (where the motor vehicle has been diverted away from the kerbside bike entry position).
Figures 135 & 136: In these images pinch points are used as part of a continuous treatment that calms traffic while still accommodating cycling (South Terrace, Fremantle).

Where cyclists will be sharing the road through the narrowing care must be taken to ensure that the width is not within the range of 3.1 to 3.9m. Below 3.1 m vehicles are inhibited from attempting to pass a cyclist and at more than 3.9m, providing relative speeds are low, most can do so with a reasonable degree of clearance (1.0m minimum).

(ix) Build outs and ‘Parking denial’
As discussed in section 5.3 and 7.4.1, this is an effective measure in ‘making parking permanent (even when the cars are not there)’. Additionally, the build outs ensure that visibility is retained at intersections and footpath crossings by providing a raised and/or landscaped area to prevent parking.

Figure 137: An otherwise wide road remains narrow (even when cars are not parked) enabling cyclists to maintain a consistent riding position. (Marine Parade, Cottesloe)

(x) Cycle track deflection behind bus stops
Where bike lanes are provided along a bus route a potential conflict exists at bus stops. By locating the bus stop on the main carriageway alignment and widening the buffer to provide an effective bus stop area, pedestrians waiting for, or alighting from buses, can cross the bike lane with clear inter-visibility and normal road crossing ramps.

Figure 138: While sacrificing some of the footpath cyclists can be deflected behind the bus stop (London UK).
(xi) Priority road crossings
While likely to be contentious under current road environments, they nevertheless are an option that warrants consideration, especially where the environment, or combination of other measures, creates a more favourable regime. In essence they delineate, by surface treatment and/or raised tables, a corridor where crossing cyclists have priority over vehicles on the main carriageway.

**Figure 139:** In this image an elevated bike path crosses the minor road approaching an intersection. Drivers are required to give way both at the bike crossing and the subsequent road intersection (NSW).

In some instances (as illustrated) this may be across intersections (where pedestrians already have priority) or across the intersecting street. These are not currently suited to higher speed roads, most appropriate at locations or roads where speeds are below 30 km/h, and the affected carriageway would require Give Way signage.

**Figure 140:** A more common application seen throughout Europe where familiarity enables a more ‘low key’ approach to be used (Netherlands).

(xii) Point of No Entry or False one way street
This is where a road is two-way throughout its length except for a short length at one end and is often applied to inhibit through traffic (volume management), while allowing normal two way function to the property frontages on the remainder of the street.

**Figure 141:** Median island closes street to incoming traffic while cyclists are provided a bypass lane (South London UK).
In most cases either entry to or exit from the road is prohibited and, unless provision is made, this will deny cyclists use of the quieter streets. By providing a short gap, or contraflow bike lane, cyclists are allowed to travel past (bypass) the no entry signs.

Unless there are very good reasons, a bicycle bypass should be the default whenever a restriction is applied, even when not on a bike route. Every street is a cycling street.

(xiii) **Hook (Jug handle turns) and right turn pockets**

Cyclists can be very vulnerable when stopped at intersections waiting to turn. By providing a space that is clearly marked as a bicycle waiting area, the riding environment can be greatly improved. In this image right turning cyclists can wait in a hook turn pocket prior to crossing the street they are leaving.

![Figure 142: Cyclists proceed straight (on green) to enter turn pocket waiting at red to complete hook turn (image courtesy of ‘bikecalgary’).](image)

In the next image medians are used to provide effective refuges and signage clearly defines the function of the infrastructure. On higher volume or speed roads a wide central median is also required as an intermediate waiting area.

![Figure 143: Cyclists wishing to turn left (right in Australia) can pull in and wait until both the bike and traffic lanes are clear (image courtesy of ‘bicycledutch’).](image)

*Note: The cyclist above is going straight through and any turning cyclist would wait in the vacant turn pocket.*
(xiv) Bollards, Posts, Barriers (including kerb islands), Hoops and Rails
There are a number of measures available to do this and, in the case of hoops and rails these may also be appropriate to assist cyclists and pedestrians when waiting to enter of cross the road. To be effective the available width should not exceed 1.5m.

**Figure 144:** Post and island to deny motor vehicle access to shared pedestrian bridge (Canada).

Where speeds are low, the devices may also be as low as 900mm. However, if the potential exists for them to be struck at speed by cyclists, at least one of the bollards and posts should be at least 1.8m high, to allow for any following cyclist to see over the cyclist in front.

**Figure 145:** Whilst this type of rail creates a pinch point the smooth curves and overhang tend to deflect cyclists and are preferable to a vertical post.

Just as they are applicable to control vehicles on roads, there will be circumstances on shared or exclusive bike paths, where they are required to slow the vehicle (cyclists) for their own or pedestrian safety. For example: to slow for sightlines; path and road intersections; and to provide additional control of cycle speeds at pedestrian conflicts.

**Figure 146:** Speed control ‘gate’ retains pedestrian permeability while constraining cycling speeds (Trigg island SLSC).
In conclusion: The additional LATM measures shown in this sub-section are by no means comprehensive and are intended to suggest options that are in use and effective elsewhere. There may well be many other options available for the designer and not all have been described here. The key is to retain an open mind and be prepared to use any device that may have the desired effect. However, at the same time the responsibility is to ensure that the unintended consequences are identified, managed appropriately and pose a lower residual risk.

7.4.3 Road Markings Signage (Regulatory, Advisory and Directional) to Paths and Roads

The only agency with authority to provide formal regulatory signage (which includes road markings) is Main Roads WA; accordingly, some of the options listed below may not be unilaterally applicable by the City. Notwithstanding this, and where the City considers it to be appropriate, serious consideration should be given to the recommendations made in this document with strong advocacy employed to enlist the support of MRWA in their use, either on a case by case basis, or by revision to any standards or guidance.

In many situations using an alternative measure, which induces similar behaviour without the need of a sign or marking, may achieve the same effect. For instance a rumble median may provide the same desired effect as a solid barrier line and can be installed unilaterally by the City.

Figure 147: Kerbed chicane, surface treatments and signage on PSP to force cyclists to slow at pedestrian crossing (City West train station).

Figure 148: A flush central dividing median ensures car drivers do not have a clear lane while cyclists do in primary position (Netherlands).
(i) Stop and Give Way signage
Consideration should be given for providing ‘Stop’ or ‘Give Way’ signage and road markings at every intersection where roads join with bike routes.

Where the road speeds are such that the differential, between cyclists and other road users exceeds 20 km/h, then the additional visibility constraint (that the turning vehicle driver needs to check two distinct ‘threat zones’) warrants consideration of ‘Stop’ signage.

The image alongside shows a typical bicycle boulevard with intersecting streets either subject to an appropriate LATM measure or, where unconstrained, provided with Stop signs.

(ii) Use of solid (barrier) lines and centreline marking in general
A solid, generally white, line is intended to prohibit crossing by any vehicles (including bicycles) except where limited exemptions apply. Their use can assist in reinforcing locations where correct lane path is required or to define the extent of carriageway or road space available to vehicles. In the case of bike lanes a solid line defines a mandatory bike lane, which other vehicles must not use and which prohibits parking. Where a broken line is used then this denotes an advisory lane, which permits use by other vehicles and does not prohibit parking.
Where a two-way street becomes part of a formalised route, such as a bicycle boulevard, it is recommended that centreline markings are installed (even where that would not normally be warranted) to define the respective sides of the road and assist with enabling cyclists to ride primary and to ‘own the lane’. This aligns with markings on shared and bike paths which assist in promoting the keep left (unless overtaking) message as well as alerting traffic that joins the path or road that there are additional functions. This can be especially effective when used in conjunction with sharrows or bike route markings.

(iii) Shared Lane ‘Sharrows’ and/or Bicycle Boulevard markings

Figures 151, 152 & 153: Typical installation of ‘Sharrows’ in primary riding position (USA).

Where, as part of a route, cyclists will be sharing the road, either at intersections where the bike lanes have been suppressed, or (section 7.3.2 (ii)) on a definitive shared road environment which has been modified to provide a cycling street, then ‘Sharrows’ (shared lane markings) should be considered.

The simplest form is a large bicycle symbol with two arrows although the alternative of ‘BLVD’ for Bicycle Boulevard or a route number may be worth consideration. The use of this symbol is recommended wherever a bicycle route is established along a road and at locations where cyclists need to be empowered to own the lane, and motorists to be reminded they may do so (such as pinch points and roundabout entries).

(iv) Contrasting coloured, paved or textured surfacing across intersections

Cyclists are particularly vulnerable when crossing intersections, whether from adjacent paths or roads, and it may also be unclear to cyclists where the route they are following should go. To both advise all other vehicles to be aware of cyclists and to assist in way-finding, it is recommended that bike ‘pathways’ are clearly defined. In the case illustrated the bike lane, which continues dotted across the intersection, has been reinforced by the addition of a contrasting colour.

Figure 154: Bike lane (solid line) extending across intersection with advisory markings (dotted line) reinforced through contrasting road surface (South Terrace, Fremantle).
Elephants Feet and other advisory markings

Visual continuity can be further reinforced by additional markings often where buffered or protected bike lanes cross intersections. Where a bicycle route crosses the carriageway, in particular but not exclusively at signalised intersections, additional road markings can be provided to advise road users of the increased likelihood of cyclists being encountered.

Figure 155: Two-way cycle track crossing intersection enhanced by Elephants Feet markings (Barcelona, Spain).

In this image from Barcelona (above), Elephants Feet markings are used in conjunction with a contrasting road surface to reinforce a 300mm two-way buffered cycle track where it crosses an intersection. In the distance, beyond the intersection, the two way buffered cycle track is reinforced by rumble bars to inhibit entry by motor vehicles.

In other European jurisdictions where cyclists are granted even greater priority, in addition to Elephants Feet delineating the buffered bike lane, Give Way markings are installed to give priority to cyclists at intersections.

Figure 156: One-way buffered bike lane crossing with additional Give Way markings (Netherlands).
(vi) **Exemptions for cyclists**
A valuable tool, in volume management along a bicycle route, is to restrict some manoeuvres for motor traffic which cyclists are then exempted from. In the case below all vehicles, except cyclists and residents, are prohibited from a shared pedestrian street.

![Figure 157: Use of ‘Except Bicycles’ signage at No Entry (Montmartre, Paris).](image)

This approach, however, is not only applicable along formal bicycle routes but should be considered (unless there are valid safety reasons not to) at other restrictions to improve cycling permeability. In Paris many one way streets are two-way for cyclists, as the No Entry sign includes the exemption ‘Except (Sauf) Bicycles’, both with and without any contraflow markings.

![Figure 158: Road marking to advise motorists on a one-way street that contraflow cyclists should be expected (near Arc de Triomphe, Paris).](image)

As the image above shows, even on what is a fairly significant street leading from the Arc de Triomphe, all that advises oncoming motorists along a one-way street, that they may meet oncoming contraflow cyclists, is a series of bike arrows.

(vii) **Share the Road signs**
Given the fact that many motorists do not appreciate that a bicycle is a legal vehicle and entitled to use the road, there is a very strong case to provide additional signage particularly along bike routes where on-road cycling is intended.

![Figure 159: Share the Road signage used in WA (MRWA sign no MR-GC-14)](image)
Whilst the sign (above) is an approved guide sign many cyclists do not feel comfortable with its use as it reinforces the ‘keep to the side of the road out of my way’ message and fails to empower cyclists to ride appropriately. The message arrows here ‘push’ the motorist out to pass but also ‘push’ the cyclist to the road shoulder. Is that sharing?

![Figure 160](image)

**Figure 160:** An alternative form of ‘share the road’ message (USA).

In some parts of the USA this signage has been removed or replaced with ones that convey the ‘share the road’ message very differently. It not only advises that cyclists are entitled to use the full lane but instructs motorists to change lanes when overtaking.

There are, however, a range of signs in use worldwide that convey a much more appropriate message. Serious consideration of their use, even as informal signage, is therefore recommended.

![Figure 161](image)

**Figure 161:** Various signs indicating road sharing without constraining lateral placement.

All of the above signs convey a very clear message that cyclists are at least equal road users as does the sign below warning motorists at an intersection that they are entering a street used as a bike route.

![Figure 162](image)

**Figure 162:** ‘Shared Road’ ahead sign (Hudson Parade, Clareville).
The sign above is located in the Northern Beaches, Sydney and warns vehicles joining a local street that it is also a shared cycle route. This is preferable to the sign below, used to indicate where the PSP joins Excalibur Way in Carine, which fails to convey the shared function.

![Figure 163: General sign used wherever cyclists (and/or pedestrians) may be encountered joining or crossing a road (MRWA sign no MR-DP-5).](image)

**(viii) Parking controls**
The presence of parked vehicles is often a significant risk factor for cyclists and consideration should always be given, on a recognised cycling route, to whether any parking controls are required. Bike lanes by themselves prohibit parking, however, they do not preclude parking where bays are marked, either between the bike lane and the kerb or the bike lane and main traffic lanes (and where ‘door zone’ buffers are provided). Similarly, on bicycle boulevards and other forms of ‘shared road’ car parking would generally be embayed or otherwise marked or denied.

It is recommended, therefore, wherever parking along a bike route might place cyclists at risk, that all suitable parking opportunities, out of the cyclists path or conflict areas, are affirmatively marked as bays (as a positive way of discouraging parking in less desirable areas). Prohibitive signage should only be used as a last resort (in those areas that have not been physically denied), once other measures have proven ineffective. Well-designed cycling streets should be self-enforcing rather than require enforcement by rangers.

**(ix) Tactile paving and line replacement**
There are situations where the same function may be achieved by replacing a regulatory line or marking with a tactile surface. This may have the same effect as a solid barrier line, in constraining vehicle movement, while providing the lawful ability for vehicles to cross over or into when necessary to avoid conflict with cyclists.

![Figure 164: Use of flush paved median to provide ‘narrow’ lanes while permitting vehicles to safely overtake bicycles. (South Terrace, Fremantle)](image)
Although both the above have been highlighted previously it is worth restating that this form of treatment may be provided locally, in lieu of road markings, as the desirable effect of a barrier line can be provided by a paved median without the undesirable constraint that otherwise prohibits entry or crossing.

Increasing the surface irregularity, such as cobbled strips or medians, is also effective in maintaining separation from pedestrians and can further assist in compliance by light vehicles by restricting the available space, while providing the overrun area necessary for larger and heavier vehicles to manoeuvre.

(x) **Line reinforcement – Rumble Bars and Armadillos**
While a significant number of road users do recognise barrier lines there are, nevertheless, a significant number of drivers that do not. For this reason it may be desirable to reinforce the line markings (rather than the option of a solid median) as a more effective use of space, funding or to retain (very low speed) access by larger and heavy vehicles.
The image (above) shows how a narrow buffer to two-way bike lanes has been reinforced by the provision of ‘armadillos’. This is particularly important mid-block on a two way cycle track, where cyclists are cycling towards vehicles (that otherwise may cross into the track) that are travelling the opposite direction.

![Figure 167: Close up of Armadillos from Barcelona (Courtesy of Camden Cyclists).](image)

(xii) **Controlled intersections and marked pedestrian crossings**
Generally cyclists do not have a clearly defined crossing at many locations where a shared path crosses the road. In most cases the cyclist is obliged to dismount in order to cross, the only exception being where a bicycle lantern is provided in addition to the pedestrian lantern. This means that cyclists have to use ‘second hand’ crossing facilities that are essentially provided for, and designed around, pedestrians.

Although, especially in the short term, this handicap could be rectified if cyclists were permitted to ride, at an appropriate speed not exceeding 10 km/h, on all footpaths (recommendation 1), the simple fact is that if there are going to be more bicycle specific facilities provided (such as bike paths and cycle tracks) then other alternatives will be required. For example, in Paris where a cycle track (Copenhagen lane) crosses an intersection, a modified set of sharrows is installed alongside the formal pedestrian crossing.

![Figure 168: Bicycle Track continued across intersection using ‘sharrows’ (Boulevard de Magenta, Paris).](image)

Note that the bicycle crossing markings act as an advisory to vehicles but remain outside of the pedestrian crossing which denotes the legal right of way for pedestrians.

The principle of ‘elephants feet’ markings, whether intentional or not, appears to function as a pedestrian crossing but with the central part of each band removed (along with the prohibition on cycling). Again this offers an effective and elegant solution for bicycle specific crossing points.
A very simple solution, used to great effect in Europe, is to provide a second parallel marked crossing.

(xi) Signal controlled intersections
At most signal controlled crossings, even where a bicycle lantern is provided, it may take as many as two signal phases to cross the intersection, by hopping from refuge to refuge at each light change. It is this poor provision given to cyclists, coupled with island refuges that are too small for the volume of cyclists, that leads to ‘red light’ running and places cyclists at greater risk. Generally it is the infrastructure and not the cyclist that is ‘wrong’.

If we are serious in driving the necessary modal shift, and in placing the needs of pedestrians and cyclists above motor vehicles, then pedestrian and cycle crossing phases should be adjusted so that a ‘green light’ is given across the whole intersection each phase.

Secondly, although normal vehicular traffic is detected, and phasing brought forward remotely ‘on demand’ when other approaches are quiet, the same does not apply to the manual pressing of a pedestrian or bicycle button. Again, the signal phasing should be made ‘on demand’ and delivered at the earliest opportunity (not latest once the cycle has completed and restarts).
Currently traffic signals ensure that the motorist, sitting in an air conditioned armchair listening to music can cross every phase, while the vulnerable user, sitting or standing in the sun or rain with no protection, waits for twice as long, and generally takes up to two phases to cross.

In urban centres, where signalised intersections occur frequently along a designated route, the application of a ‘Mexican Wave’ of green lights, timed to suit the average speed of cyclists, has proven very effective in maintaining cyclists momentum while also adjusting the speed, and expectations, of motorists much closer to that of the cyclists. This too warrants serious consideration.

Finally, at signals where cyclists and/or pedestrians may still be actively and legally crossing, and turning traffic is given a green light, this causes unnecessary conflict and danger. Consideration should be given to replacing the green arrow (or augmenting the green circle) with a flashing amber arrow. This means ‘proceed only if clear’ and reminds drivers of the obligation to continue to give way, not only to pedestrians but any cyclists that may also be crossing.
Recommendation 12:
Urge the State Government to incorporate pedestrian and cycling friendly phases to all new signals and to modify existing signal phasing where this forms part of a designated route.

(xiii) Advanced Stop Lines (ASL) at signalised intersections
Where a road is part of a designated bike route, or cycle traffic is likely to exceed an average of one cyclist, per signal phase, at peak times, then the provision of ASLs are recommended. These, coupled with a short approach bike lane, enable cyclists to advance ahead of stationary traffic, where they can wait in relative safety.

Additionally, particularly where cyclists following a route may need to turn right, or conflict with left turning traffic, consideration should be given to providing dedicated bicycle lanterns which can provide a dedicated bike crossing phase or at least a few seconds head start.

*Note: Where cycling numbers are likely to remain low (<10/hour at peak times) it may be unwise to install ASL as this may ‘train’ motorists to ignore them. Nevertheless it is worthwhile to include for their future installation in the design for addition if and when numbers increase.*

(xiv) Speed Limits
The state government’s own ‘Road Safety Strategy’, and in particular the concept of ‘Towards Zero’ that it is founded on, recognises that speed is a significant factor in serious or fatal accidents. Not only that but vulnerable road users (VRUs) are just that (very vulnerable) at speeds above 30 km/h. It is not unreasonable, therefore, to seek measures to ensure that in those areas where high volumes of VRUs are present appropriate speed limits are applied.

*Figures 170, 171 & 172: Reduced speed signage at entry to high intensity pedestrian areas (Bayview Terrace, Claremont / Sydney NSW / Reserve Street, Scarborough).*

In much of Europe, road speeds in residential and high VRU areas are restricted to 30 km/h (20mph UK equivalent). Recent moves in the UK, where the application of 20 mph speed limit signage only has been implemented (without any other supporting measures of LATM treatments), has found that accident frequency and severity has reduced significantly for vulnerable road users.
Figure 173: New signage to ‘20 Zone’ (30 km/h) has been responsible for a significant increase in cycling activity (London Borough of Hackney).

Serious consideration must be given to using speed limits to assist in driving change and lower speeds rather than the current policy of applying speed limits to match existing road speeds.

There is no doubt that, if the needs of pedestrians and cyclists are to be taken seriously in areas where there is a high activity, ‘30 is the new 40’.

**Recommendation 13:**

Urge the State Government to consider posting reduced speed limits to drive reductions in speed, rather than to reflect observed 85th percentile speeds.

Speed limits are not only applicable to the carriageway. In particular shared paths, which are the primary facility for the most vulnerable (pedestrians and children), should not have to suffer cyclists at speeds greater than 20 - 30 km/h.

In fact, by applying ‘Think 20’ principles, the maximum speed for most shared paths should not exceed 20 km/h and where large numbers of pedestrians are encountered (shopping malls, beach facilities, family recreation areas etc) shared path speeds should be signed as low as 10 km/h (the pedestrian default speed).

**Figures 174 & 175:** Locations where speed limits have been posted on coastal recreational shared paths (Manly Beach, NSW and Trigg SLSC, WA)

**Recommendation 14:**

Continue to use posted speed limits to shared paths within parks and reserves under the City’s local laws. Advocate for the State government follow suit and to use posted speed limits on shared paths to advise cyclists of the desired (appropriate) maximum speed.
7.4.4 Intangible Tools (Providing Assistance when Planning Routes and Detailed Designs)

(i) Route selection – consideration of gradients
The use of 0.25m lidar contours can provide great assistance when determining a suitable route. By plotting the contours within the road reserve boundaries onto a consistent scale, roads with steeper gradients can be visually identified and, where a suitable alternative exists, avoided.

If the contour density indicates the gradient may be more than desirable then a closer plot can be undertaken which will enable more detailed assessment of the suitability for inclusion on a route. Steeper gradients for relatively short distances are not a cause to avoid a route, as a detour away from the desire line is less likely to be accepted, but may require additional consideration (such as wider uphill bike lanes).

The following gradients are suggested as trigger points:
- Less than 3% is an ideal gradient and poses no constraints on use.
- Gradients between 3% and 5% do not pose an unacceptable burden to most cyclists and need not be considered a determinant in deciding a route.
- Gradients between 5% and 8% are becoming significant for some cyclists who may actually need to dismount and walk after about 100m. Where these gradients would be encountered on a route they should ideally be limited to lengths no greater than 100m and additional consideration is required.
- Gradients above 8% prove too difficult for many utility and vulnerable cyclists (groups A and B) and should be avoided wherever possible. If a route is provided that has these steep gradients then the need to dismount and walk has to be an additional consideration in the design of appropriate facilities.

(ii) Austroads Guidelines
Austroads Guidelines are an important starting point in determining what should be considered suitable and, in the event of a serious incident, what a magistrate or coroner might take into account in determining any contributory liability. The important thing to remember, however, is that they are only guidelines.

Because they are developed on the basis of existing Australian cycling facilities, there are many innovative measures (some of which are covered in this strategy) which will not be covered. Rigid application will see continued ‘Business as Usual’ which will tend to stifle innovation and advancement of cycling.

In order to deliver better cycling infrastructure, departure from Austroads Guidelines is inevitable if not essential. In order to ensure that risks are appropriately identified and mitigated, it is important that any departures are recorded, an assessment of any potential (unintended) consequences is undertaken, and the resultant residual risk identified and recorded.

(iii) Design Guides
Once this strategy has been endorsed and becomes Council policy it should become the basis of all future provision of cycling infrastructure. Detailed design would benefit from a WA specific ‘Design Guide’ which at this stage does not exist.
Building on from this strategy, based on international experience but adapted to local circumstances during the detailed design stage, the City will be able to develop a series of ‘Practice Notes’ relating to each infrastructure type which can then collectively become a working ‘Design Guide’. Thus, as each new type of facility is designed, constructed and becomes operational, providing this process is captured, the corresponding ‘practices notes’ can then be assembled into an iterative ‘design guide’.

Until the City either by itself, or ideally in collaboration with the appropriate state government agencies, has a working document, it is recommended that other sources are drawn on.

Many cyclists say “but Australia is so different to Europe that it won’t work here”. Whilst there are some truths to this the simple answer is that, if we do not apply lessons learnt elsewhere, it will become a self-fulfilling prophecy because important new developments will be avoided and that view will not be challenged.

Fortunately, there is one country that has risen to the challenge, has aggressively sought to apply much of the European lessons, and has done so in an environment that closely relates to Australia in terms of demographics, road types, vehicle types and similar environments.

Several states and major Cities in the USA have come together and, through the National Association of City Transportation Officials (NACTO), have produced the ‘Urban Bikeway Design Guide’. This document is extremely detailed and provides a design resource that is capable of providing the necessary advice and design guidance (based on worked, proven and highly successful projects throughout the USA) until such time as the City has its own document.

For that reason the NACTO ‘Urban Bikeway Design Guide’ will serve as the primary ‘Design Guide’ to be used as the basis for the detailed design of future bike route development projects.

(iv) **Design Audit and Post construction audits**
When designing all future cycling infrastructure, drawing on external references as necessary, a record of the design, construction and post completion evaluation will be maintained which will be documented as Practice Notes. Once sufficient experience has been gained the practice notes can be combined and can form the basis of a ‘design guide’. Ultimately, once the first version of that document has been drafted, it can be uploaded to the City’s website (alongside this strategy) and become the (WA specific) iterative Urban Cycling Design Guide.

(v) **Non-Motorised User (NMU) audits**
The City intends to develop a very simple NMU audit that can be used to assess any proposed road works, either by the City (when providing cycle routes or upgrading streets) or by consultants and developers (for new subdivisions, redevelopment areas and where modifications to the road reserve are required).
PURPOSE OF THE NMU AUDIT

- Identify existing provision (service level)
- Identify where a priority exists (FP strategy, PBN route, COS Bike Plan)
- Minimum: Ensure that current level of service is maintained
- Desirable: Provide a significant improvement of facilities or LOS in accordance with goals.
- Ranking (importance) is from TOP down.

FOR EXAMPLE

- Installation of shared path MUST ensure that the pedestrian facility is enhanced or at least retained.
- Road improvements MUST ensure that facilities for both pedestrians and cyclists are enhanced or at least retained.

Figure 176: NMU hierarchy of importance (top down)

This audit needs to be both as short and simple as possible (as complex processes tend to be ignored) while capturing the essentials. For reference, a link is provided to a document on the UK government’s Department of Transport website, which provides a valuable insight into the parameters to be considered and a process to be followed: http://www.dft.gov.uk/ha/standards/dmrb/vol5/section2/hd4205.pdf
7.5 Measures that can Increase Risk and/or Deter Cycling (to be used with Care or with Compensatory Measures)

This sub-section provides guidance on the types of infrastructure, treatments or configurations that may have potentially harmful effects on the safety or amenity of cyclists. Often provided as part of a road improvement or street upgrade they may have unintended consequences for cyclists and pedestrians. It is, therefore, recommended that any works undertaken on roads, take into account these factors and that they are either eliminated or their effects are compensated for.

The overriding responsibility here, which can be assessed through a Non Motorised User (NMU) audit, is to ensure that any works undertaken have (at worst) no adverse effect on cyclists (and pedestrians) and preferably improve safety and amenity for all vulnerable road users. The starting premise is that every road is a cycling road and, with very few exceptions, that cyclists should have the same choice that a motorist has in selecting their most appropriate route. Whilst the provision of good primary and secondary routes should mean that those routes become the preferred option for the majority of cyclists, this should be a matter for individual choice and not proscription.

In general, when undertaking any road works, existing road function must be maintained (at the same or an improved level of service) by avoiding, or compensating for adverse, measures that impact on cyclists and, where that cannot be achieved, the project should be re-evaluated or even abandoned unless an overriding need can be demonstrated.

In those cases, where the need is demonstrated and cycling becomes more hazardous, there may be no other option but to prohibit cycling (a case in point being freeways and possibly LRT or tram corridors). This, however, should always be the exception, rather than the rule, and alternative provision should then be considered. That alternative should be at the same or higher level of service as previously existed and funded as an integral part of the primary project.

(i) Medians and pinch points
Many street improvements and localised traffic management measures have been undertaken which have involved the provision of central median islands. Whilst these are important in providing crossing refuges on major roads, and will still have a role to play, they should be avoided on wherever possible on normal residential streets as they generally reduce the cycling amenity of that street. Where they are still desirable it is important to avoid lane widths of 3.1m to 3.9m, when providing pinch points, deflections, or medians, as this encourages ‘squeezing’ of cyclists.

Almost all cars will be able to pass a cyclist, while maintaining a minimum (safe) passing distance of 1.0m, when the carriageway width exceeds 3.9m. Larger vehicles, however, such as buses and trucks, will require additional room. Where significant numbers of these wider vehicles are to be accommodated then greater widths (4.2 - 4.5m dependent on road speed) are required and/or substantial lengths between kerbed islands to allow sufficient scope for ‘safe’ overtaking.

Once the available road space reduces below 3.9m then cyclists become progressively more at risk until, by 3.1m, passing clearance is reduced to virtually zero, however, some drivers will still attempt to pass. Critically, once the restricted width falls below 3.1m, the reduced width is so inhibiting that dangerous passing is no longer an option.
(ii) **Obstructive street furniture and signage**

When considering any path facility for cyclists it is important to ensure that street furniture is not located in the ‘cycle path’ as this poses a significant risk and increases conflict. Similarly routes that would be impeded by existing infrastructure (power poles, streetlights, traffic signs, etc) should be avoided.

Where compromised routes are still proposed then the obstructive infrastructure should either be relocated, or diverted around. It will also be necessary to consider whether any additional hazard marking, or the provision of barrier lines, is required to ensure that the ‘safe path’ remains visible.

Routine auditing of routes is required to ensure that obstructing infrastructure is not subsequently installed and (for example) that bus stops are not established or modified that compromise the level of service and safety of a cycle facility. It is important; therefore, that an open dialogue and form of partnership is established or maintained with those agencies (PTA, MRWA and Western Power) that otherwise might compromise the City’s ability to discharge its ‘duty of care’ to all road users and particularly for pedestrians and cyclists.

(iii) **At grade conflicts between cyclists and pedestrians**

Unless it is a shared path, where cyclists, whether through a cycle track, bike path or segregated path, are introduced into the pedestrian domain, then it is essential to install some form of physical segregation to avoid ‘mixing’ of the two groups. As can be seen in the following image, even where the visual definition is quite clear, cyclists and pedestrians are able to cross over to avoid other users, often at the very time or location that it is most undesirable.

**Figure 177:** Lack of restraint allows a cyclist to overtake into the path of a pedestrian.

The restraint need not always be vertical. In the following image landscaping and street furniture provide a pleasant obstacle to errant cyclists.

**Figure 178:** Use of divisive landscaping between a Cycle Track and pathway reinforces the contrasting surface treatment (Copacabana Beach, Rio de Janeiro).
Consequently, all cycle facilities in or abutting a pedestrian space or path, should be provided with a level difference or kerb, a rumble median (cobbled strip), or a sufficiently landscaped verge, to deter intermixing at conflict speeds.

![Image](figure179.jpg)

**Figure 179:** A classic Cycle Track in Copenhagen (courtesy of cycling-embassy Denmark).

The above is an example of probably the best cycling infrastructure in the world. From left to right:
- A vertical kerb keeps cars from the pathways.
- A rough paved or cobbled median encourages cyclists to avoid the door zone.
- A smooth asphalt running surface to the cycle track.
- A second vertical kerb assists in keeping cyclists and pedestrians separate.
- Additional paving serves to reinforce the boundaries of the pedestrian path.
7.6 Application – How the Strategy is Used to Develop a Route and the Subsequent Design Process?

This sub-section provides advice on how the strategy (policy) should be used when developing an appropriate route and, once a route has been determined, what type or combination of infrastructure facilities are most appropriate and what secondary measures can be employed to ensure that the route functions safely and effectively for all ‘design users’.

Whilst there is a large body of expertise and experience available internationally, which provides valuable insight into detailed designs that are proven to be effective and that should form the basis of detailed design, the prevailing conditions in WA will always need those solutions to reflect the regulatory and environmental conditions encountered within the Perth metropolitan area. Thus these reference documents are capable of providing design guidance until such time as the necessary experience, and the detailed designs which are then provided and implemented, enable a more specific ‘Design Guide’ (management practice) to be provided. In due course this design guide is intended to be published on the City’s website as a working draft and continually updated to ensure that developers, ratepayers and other key stakeholders are able to view, and more importantly provide comment on, designs that have been implemented and the guidance that will form the basis of future projects.

The iterative process of design, for each facility type (section 7.3) and the secondary measures employed (section 7.4) will be recorded and the process documented in a ‘Practice Note’ (procedure) which will better inform the design process and contribute to the ‘Design Guide’.

7.6.1 Cycle Facility Selection Table

This table represents the differing environments where the use of each facility type may be appropriate and which ‘design cyclist’ group will be catered for.

The use of A, B or C indicates that all of the particular group should be catered for by that facility. For example, A means that all Group A cyclists should feel comfortable and not pose an unacceptable risk to others).

The use of a, b or c indicates that while some of the particular group may be catered for by that facility, or accept constraints on use, others in that group may not and would need an alternative. For example, b means that only some Group b cyclists would feel comfortable and not pose an unacceptable risk to others).

The vertical columns describe the environment through which a cycling route is to be provided.

The horizontal rows identify the type of facility that could be applicable within any given environment. The first row, for an unmodified carriageway, indicates the baseline suitability for the ‘Do Nothing’ option.

A ‘Complete Route’ is achieved by a single facility that can provide for all design cyclist groups, such as ABC. Where that is not achieved or an option then a combination of facilities may suffice.
For example, a 50km/h Local Road (bC), combined with a footpath (Ab) may provide a viable alternative within tertiary areas. The absence of a B, however, may mean that this combination would not be suitable for a secondary route (as some aggressive B’s that lack road confidence may seek to ride the footpath. In that case the Local Road (bC) should be combined with a Shared Path (Abc) to provide an ‘ABC’ route.

<table>
<thead>
<tr>
<th>Cycle Facility Type</th>
<th>Environment</th>
<th>85th Percentile Speed 30km/h</th>
<th>40km/h</th>
<th>50km/h</th>
<th>55km/h</th>
<th>60km/h</th>
<th>&gt;60km/h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Carriageway Unmodified</td>
<td>Ab</td>
<td>AbC</td>
<td>bC</td>
<td>bC</td>
<td>c</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Carriageway Modified</td>
<td>N/A</td>
<td>AbC</td>
<td>aBC</td>
<td>bC</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bike Lanes</td>
<td>N/A</td>
<td>N/A</td>
<td>aBC</td>
<td>aBC</td>
<td>bC</td>
<td>c</td>
</tr>
<tr>
<td></td>
<td>Protected Bike Lanes</td>
<td>N/A</td>
<td>N/A</td>
<td>ABC</td>
<td>ABC</td>
<td>aBC</td>
<td>bC</td>
</tr>
<tr>
<td></td>
<td>Copenhagen Lanes</td>
<td>N/A</td>
<td>N/A</td>
<td>ABC</td>
<td>ABC</td>
<td>ABC</td>
<td>ABC</td>
</tr>
<tr>
<td></td>
<td>Service Street - Cycle Streets</td>
<td>N/A</td>
<td>N/A</td>
<td>ABC</td>
<td>ABC</td>
<td>ABC</td>
<td>ABC</td>
</tr>
<tr>
<td></td>
<td>Footpath</td>
<td>N/A</td>
<td>A</td>
<td>Ab</td>
<td>Ab</td>
<td>ab</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Shared Path</td>
<td>N/A</td>
<td>N/A</td>
<td>AbC</td>
<td>AbC</td>
<td>AbC</td>
<td>AB</td>
</tr>
<tr>
<td></td>
<td>Principal Shared Path</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>aBC</td>
<td>aBC</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Recreational Shared Path</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Ab</td>
<td>Ab</td>
<td>AbC</td>
</tr>
<tr>
<td></td>
<td>Separated Path</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>ABC</td>
</tr>
<tr>
<td></td>
<td>Exclusive Bike Path</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>ABC</td>
<td>ABC</td>
<td>ABC</td>
</tr>
</tbody>
</table>

*Figure 180: Cycle facility selection table.*

At this stage, the selection table provides initial guidance on which design cyclist group each type of facility may serve. While this may assist in initial selection it should not substitute for a detailed appraisal of the route as a whole including any terminal or transitional measures to direct cyclists onto appropriate facilities. As designs are implemented, and a better understanding is achieved, this table is likely to be updated.