NO. 21 - JUNE 2010

Cycle Notes

Widths of Off-Road Shared Use Paths

Welcome to CYCLE NOTES No. 21. The purpose of CYCLE NOTES is to provide information on the design of bicycle facilities for engineers and planners.

CYCLE NOTES should be read in conjunction with:

- **Austroads Guides to Traffic Management and Road Design.**
- **Australian Standard 1742.9, Manual of Uniform Traffic Control Devices, Part 9 Bicycle Facilities.**
- **VicRoads Traffic Engineering Manual Volumes 1 and 2.**

Introduction

The purpose of this edition of *Cycle Notes* is to provide guidance on the width of off-road shared use paths. In particular, it relates the widths of paths to the volume of cyclists and pedestrians who use the path.

Guidance is also provided on the circumstances under which consideration should be given to separating cyclists from pedestrians.

Shared Use Paths

Shared use paths are the most common form of off road path in Australia and are based on cyclists and pedestrians sharing the path (Figure 1).

As the volumes of cyclists and pedestrians using shared use paths increase, there is often a reduction in the level of service and safety for all path users.

To address this situation, paths may be widened or cyclists may be separated from pedestrians by providing a bicycle only path and a footpath.

Passings and Meetings

When cyclists and pedestrians are using a shared path, they will often "meet" other cyclists and pedestrians travelling in the opposite direction or "pass" slower cyclists and pedestrians travelling in the same direction.

Delayed Passings

Delayed passings occur when faster cyclists must slow down to pass other path users travelling in the same direction. This usually occurs when a "passing" happens at the same time as a "meeting" and there is insufficient room for the faster cyclist to pass the slower path users.

The number of delayed passings that occur along a path is dependent upon the volume of path users, cyclist speed, direction of travel and path width.

In particular, the number of delayed passings increase significantly as the volume of pedestrians increase due to the speed differential between cyclists and pedestrians.

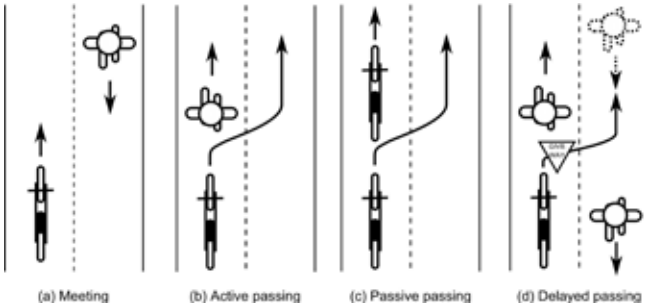

Figure 2 – Typical interactions of path users on shared use paths.

Figure 1 – Off-road, shared use paths are common in Australia and provide maximum separation for cyclists.

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Assessing Path Capacity and Selecting Path Widths

Introduction

The following procedure can be followed to assess the capacity of existing paths, to determine if existing paths need to be upgraded and to select an appropriate width for a new path.

The three basic inputs that must be considered when assessing path capacity are the numbers of pedestrians and cyclists using the path in the "design hour" and the "directional split".

Step 1

Determine the "design hour" for the path

The design hour for the path is the hour during which it is most desirable to minimise delays for cyclists.

The design hour may be the AM peak hour on a weekday for commuter paths, it may be sometime on a weekend for recreational paths or it may the hour during which the most numbers of people are using the path. It is up to the designer or the path manager to determine the design hour.

Step 2

Count the numbers of pedestrians and cyclists using the path a the design hour and their direction of travel.

While pedestrians are normally counted manually, cyclists may be counted manually or by automatic counting methods such as tube counters or inductive loops.

Step 3

Determine the directional split of path users.

"Directional split" is an indication of the proportion of path users that are going in each direction. This can be calculated by dividing the numbers of path users going in each direction by the total number of path users. It is usually expressed as a percentage.

Commuter paths typically have a directional split of 90/10 which means that 90% of path users are going in one direction and 10% are going in the other direction.

Recreational paths are more likely to be 50/50 where path users are going in both directions in equal amounts and the directional split is a more even or balanced.

Step 4

Determine the appropriate path width for the number of pedestrians and cyclists using the path and the directional split.

To determine the appropriate path width:

(a) select the graph to use – Figure 3 for paths with a 90/10 directional split or Figure 4 for paths with a 50/50 directional split;

(b) locate the number of pedestrians on the left side or "y-axis of the appropriate graph and draw a horizontal line across the graph from this point;

(c) locate the number of cyclists along the bottom or "x" axis of the graph and draw a vertical line.

The zone within which these two lines intersect corresponds to the width that the path should be.

Commuter Path – Directional Split – 90/10

Example – Main Yarra Trail (north bank) at Morell Bridge

This path is 3.0 metres wide. It carries 550 cyclists and 80 pedestrians during the AM peak period. The "directional split" is 90/10.

As shown the intersection of the two lines is within the zone for a 3.0m shared path.

As a result it could be concluded that the capacity of this path exceeds its demand.

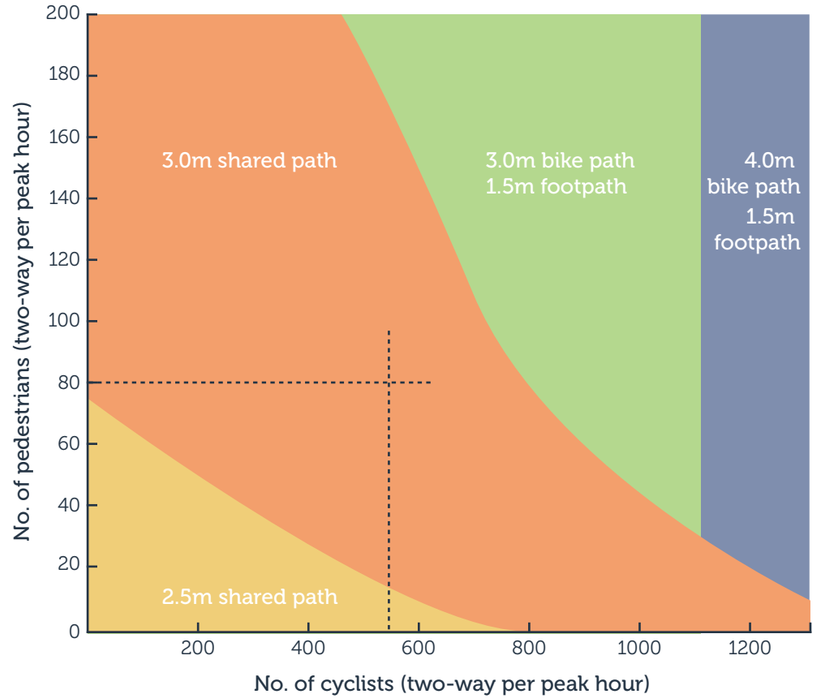

Figure 3 - Path capacity for paths with 90/10 directional split.

Recreational Path – Directional Split – 50/50

Example – Bay Trail, St Kilda

This path consists of a 2.5 metre wide bicycle path and a 1.5 metre wide footpath.

It carries 200 cyclists and 100 pedestrians during the weekend peak hour. The "directional split" is 50/50.

As shown the intersection of the two lines is just outside the zone for a 3.0m shared path and just inside the zone for a separated path.

As a result it could be concluded that the capacity of this path also exceeds its demand at this location. .

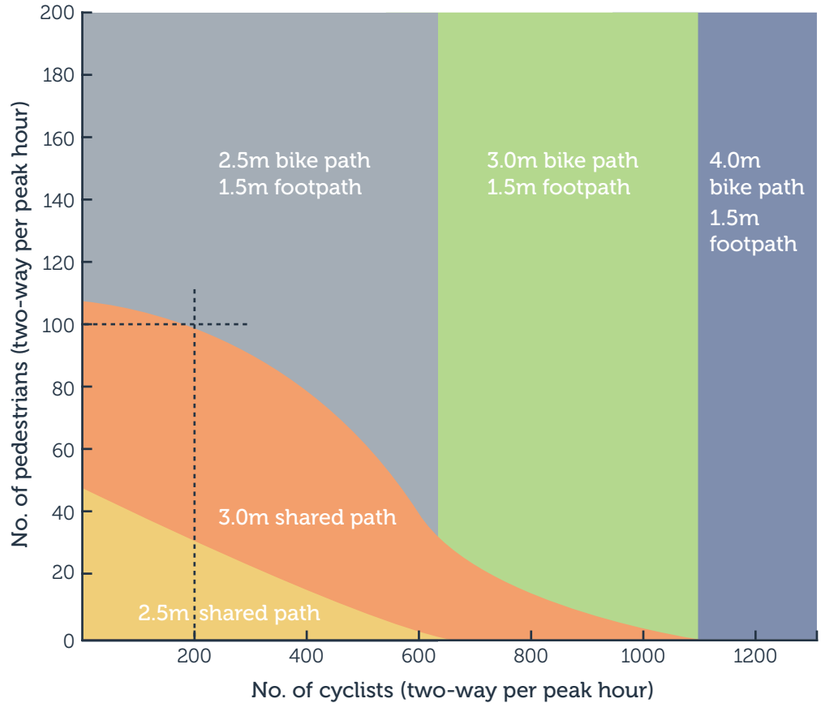

Figure 4 - Path capacity for paths with 50/50 directional.

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Width of Cyclists and Pedestrians and Clearances to Other Path Users

For the purposes of estimating path widths, cyclists and pedestrians are assumed to be about 0.7m wide and require a minimum clearance of 0.15m on each side. When passing or meeting other path users, this results in a minimum clearance of 0.3m between users.

As a result, the minimum width for a shared use path to allow a meeting or a passing is 2.0m (Figure 5). The minimum width to allow a passing and a meeting is 3.0m (Figure 6) and the minimum width to allow passings in both directions is 4.0m (Figure 7).

A consequence of this is that paths that are between 3.0m and 4.0m allow greater clearances between path users (and a slightly higher LOS), but are unlikely to reduce the number of delayed passings.

Also, if there is sufficient space for a 4.0m wide shared path, the provision of a 1.5m wide footpath and a 2.5m wide bicycle path may provide a better outcome.

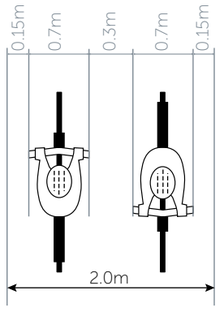

Figure 5: Minimum path width to allow a passing or a meeting.

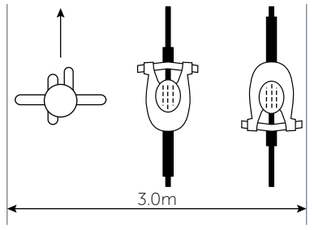

Figure 6: Minimum path width to allow a passing and a meeting.

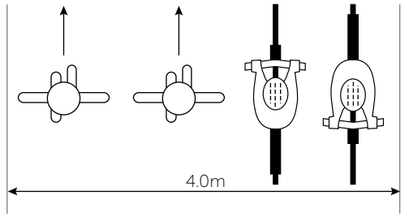

Figure 7: Minimum path width to allow passings in both directions.

Modelling Path Use – Cyclist and Pedestrian Volumes and Path Width

The frequency of meetings, passings and delayed passings that occur along a path is dependant on the volumes of path users and the direction of travel (split). The frequency of delayed passings is also dependent upon the width of the path.

Probability theory allows path use to be modelled to estimate the number of meetings, passings and delayed passings that are likely to occur. These can be estimated as a function of the volumes of path users, the directional split and the width of the path as shown in Figure 8.

It has been assumed that 12 delayed passings per hour represents the upper limit of cyclists' tolerance for being delayed. This is equal to 24 delayed passings for a 30 minute trip or 1 delayed passing every 5 minutes.

If the combination of user volumes and path width cause the number of delayed passings to exceed 12 per hour, then widening the path and/or separating pedestrians from cyclists should be considered.

In practice, many cyclists may avoid delayed passings by predicting a meeting ahead and slowing down in advance.

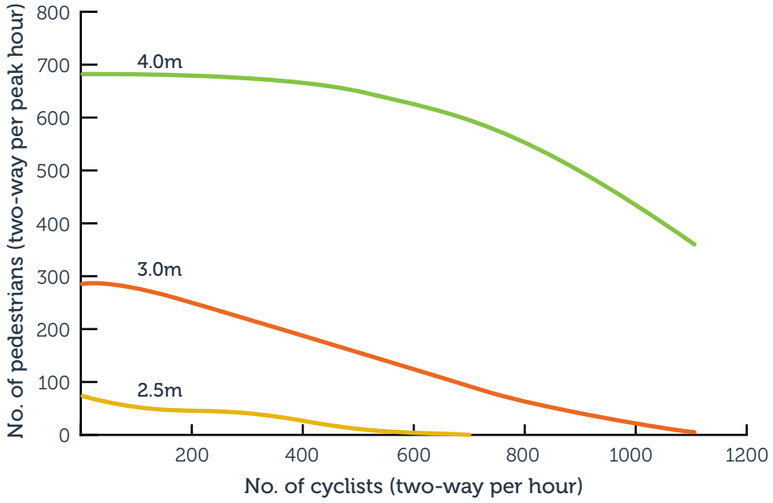

Figure 8: Volumes of pedestrians and cyclists that can be accommodated on various shared use paths before cyclists experience 12 delayed passings per hour. Directional split - 90/10.

Commuter Paths and Recreational Paths

Commuter Paths – 90/10 Directional Split

Paths that have a 90/10 directional split produce fewer delayed passings and have a higher capacity than paths with a 50/50 directional split.

This is because the number of passings and meetings that occur at the same time are fewer when most path users are travelling in the same direction.

Figure 9 provides an indication of the volumes of pedestrians and cyclists that are using some of Melbourne's more popular shared use commuter paths and the width of those paths.

As indicated, most of these paths have sufficient capacity for the volumes of cyclists and pedestrians that are using the paths at the moment.

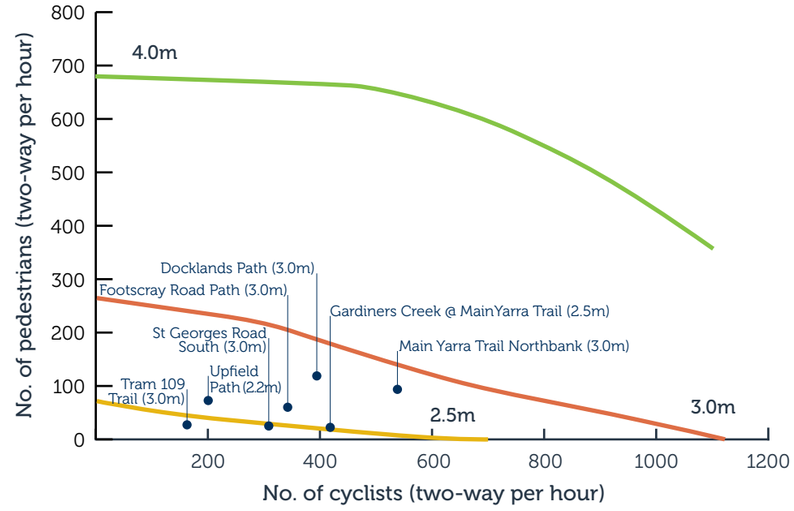

Figure 9: Volumes of pedestrians and cyclists on various shared use commuter paths in Melbourne. Directional split - 90/10.

Recreational Paths – 50/50 Directional Split

Paths that have a 50/50 directional split produce more frequent delayed passings and have a lower capacity than paths with a 90/10 directional split.

This is because the number of passings and meetings that occur at the same time are more frequent when the numbers of path users are travelling in the same direction are about the same.

Figure 10 provides an indication of the volumes of pedestrians and cyclists that are using some of Melbourne's more popular shared use recreational paths.

As indicated, most of these paths have sufficient capacity for the volumes of cyclists and pedestrians that are using the paths.

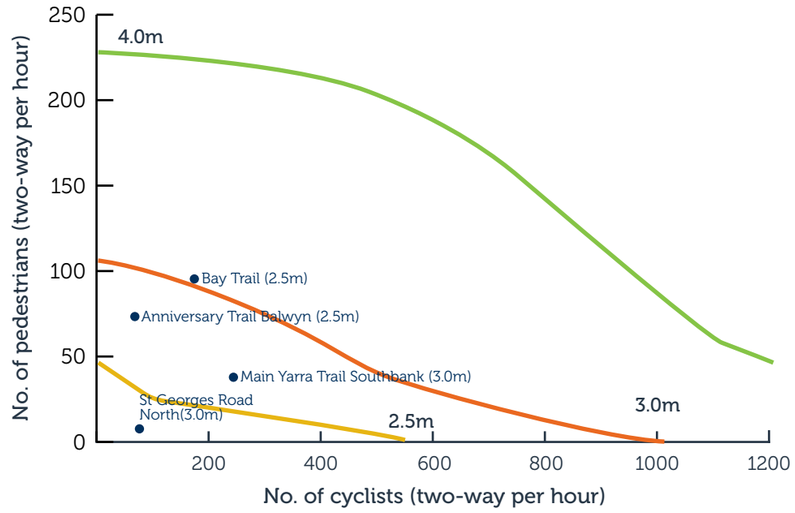

Figure 10: Volumes of pedestrians and cyclists on various shared use recreational paths in Melbourne. Directional split – 50/50.

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Capacity of Commuter and Recreational Paths in Melbourne

Table 1 provides an indication of the estimated capacity of some of Melbourne's off-road commuter and recreational paths.

As shown, the number of delayed passings are highest on recreational paths and narrow paths such as the Upfield path.

While cyclists using these paths may have a higher tolerance for delayed passings than cyclists on commuter paths, widening these paths or separating cyclists from pedestrians would improve the capacity of the path and the LOS for all users.

Summary of Path Widths and Guidelines for their Use.

Table 2 provides a summary of the widths of shared use paths and some guidelines for their use based on user volumes, locations, intended use and estimated speed of cyclists. In proposing these widths, it is assumed that intermediate widths (such as 2.4m and 3.7m) are unlikely to be considered.

		Peak Hour Volume (two-way)			No. of delayed passing events per hour (2010)
Path[1]	Width	Cyclists[2]	Pedestrians[3]	Directional split[3]	2010 (estimated)
Main Yarra Trail (Northbank)	3.0 m	552	87	90%	5.0
Main Yarra Trail (Southbank)	3.0 m	252	38	77%	1.0
Bay Trail	2.5 m	188	101	54%	66.3
Anniversary Trail No. 1	2.7 m	73	76	66%	32.3
St. Georges Road No. 1	3.0 m	315	26	88%	0.5
St. Georges Road No. 2	3.0 m	73	7	75%	0.9
Upfield Path	2.2 m	199	50	85%	15.3
Tram 109 Trail	3.0 m	177	39	80%	0.5
Footscray Road Path	3.0 m	347	55	87%	1.4
Gardiners Creek No. 1	2.5 m	417	14	90%	8.5
Docklands Path	3.0 m	404	99	80%	6.8

Table 1 - Capacity of Commuter and Recreational Paths in Melbourne.

Width of Path	Type of Path	Guidelines for Appropriate Use
2.0 m	Local access only. Regional paths such as rail trails.	Passings and meetings between path users is rare to very infrequent, bicycle speeds are less than 15 km/h and a minimum clearance of 0.3m is required between path users. This width is also considered appropriate for short sections of path that are less than 500m that connect local destinations.
2.5 m	Recreational and regional commuter paths.	Passings and meetings between path users is likely and bicycle speeds are between 15 km/h and 25 km/h. This width may be appropriate for commuter and recreational paths within outer suburban areas and regional cities and towns.
3.0 m	Recreational and urban commuter paths. At these widths it is assumed that passings and meetings between path users is frequent, bicycle speeds exceed 25 km/h and higher clearances are required between path users.	In most circumstances, new shared use paths should be 3.0m wide.
3.5m		A 3.5m path provides increased clearance between path users and may be used by cyclists to reduce the number of delayed passings if:
4.0 m		A path that is 4.0m wide will allow simultaneous passings to occur in both directions. However, if there is sufficient space for a 4.0m wide shared path, the provision of a 1.5m wide footpath and a 2.5m wide bicycle path that separates cyclists from pedestrians may provide a better outcome for all path users.

Table 2 - Summary of Path Widths and Guidelines for their Use.

Separating Pedestrians from Cyclists.

The Benefits of Separation – Increased Capacity, Safety and Level of Service

As indicated above, one of the most effective ways to increase the capacity of shared use paths for cyclists is to separate cyclists from pedestrians by providing a separate footpath and a separate bicycle path.

Separating cyclists from pedestrians recognises the speed differential between cyclists and pedestrians and reduces the number of delayed passings that cyclists experience along a path. Separation also allows cyclists to maintain higher speeds, reduces the potential for conflict between cyclists and pedestrians and improves the level of service for pedestrians, especially elderly or disabled pedestrians.

Effective Separation Requires Effective Design

The key to separating pedestrians from cyclists is to use visual clues to make it clear to all path users which path they should use.

This can best be achieved through the use of appropriate surface types and textures that are supported by signing, linemarking, pavement symbols and fencing (Figure 11).

Most commuter cyclists will chose the most direct routes where they can maintain high speeds and a comfortable ride. As a result they prefer smooth surfaces such as asphalt or concrete and will avoid paved and gravel surfaces.

Most pedestrians are seeking an enjoyable walking experience are more likely to use paved or gravel surfaces, particularly if they are separated from faster moving cyclists.

The provision of a separating line and/or pavement symbols to designate the bicycle path from the footpath is not considered a sufficient visual clue to separate pedestrians from cyclists (Figure 12).

Figure 11 – Cyclists and pedestrians are separated by fencing and contrasting surface.

Figure 12 – Linemarking and pavement symbols are not considered sufficient to separate cyclists from pedestrians.

Case Study - Separating Pedestrians from Cyclists - Copenhagen.

Figure 13 – Surface texture and colour are used on these paths to separate pedestrians from cyclists and to make it clearer as to which paths cyclists and pedestrians are required to use. In one case a spoon drain made of cobble stones provides this separation. In the other case, the separation is achieved by a grassed division.

Path Safety – "Clear Zones" and Safety Audits.

This section outlines the issues that should be considered in terms of hazard identification for cyclists and safety audits.

"Clear Zones" for Cyclists

It is important that a clearance of 1.0m (0.5m minimum) is provided between the edge of a shared use path and any obstacle that is visible, if possible. If it is not possible to provide this clearance, these obstacles should be clearly marked to make them more conspicuous for cyclists (Figure 14).

It is also important that all invisible obstacles and hazards within a "clear zone" of at least 2.0m of the edge of the path are either identified by hazard markers, protected or removed. These obstacles include open drains, drainage pits, culvert end walls and loose gravel or sand.

Safety Audits for Shared Use Paths

Safety audits of off-road shared use paths are considered an important component of an effective path management and operation strategy.

The purpose of safety audits is to identify potential hazards for cyclists along paths and to develop an appropriate response to these hazards. An appropriate response may include marking out the hazard, protection of the hazard or removal of the hazard.

Typical hazards include:

(a) obstacles (visible and invisible) that are within the width of the path or are too close to the edge of the path;

(b) gravel or sandy surfaces that are deep enough to result in cyclists coming off their bicycles (Figure 15);

(c) perpendicular and parallel cracks along paths that result in cyclists coming off their bicycles (Figure 16);

(d) insufficient horizontal and vertical sight distances at critical locations.

Figure 14 – It is critical that all invisible obstacles and hazards are identified or removed.

Figure 15 – Deep sand such as this can be hazardous to cyclists, especially in shaded areas.

Figure 16 – Longitudinal cracks near the edge of a path can also be hazardous to cyclists.

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