A Guide to the Design of Cycle Track

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Jabatan Kerja Raya
Cawangan Jalan

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KERAJAAN MALAYSIA

A GUIDE TO THE DESIGN OF CYCLE TRACK

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FOREWORD

Through the cooperation and support of various bodies and engineering institutions in Malaysia, the Arahan Teknik (Jalan) on "A Guide On The Design Of Cycle Track" is updated towards the cycle track requirement. The aim of this Arahan Teknik (Jalan) is to in line with the current international standards and practices.

The productions of this document are carried out through several stages. The documents are initially compiled / drafted by the relevant Technical Committee and finally endorsed by Technical Committee and Road Authorities at the workshop before publication. The Technical Committee welcomes feedback and suggestions, which can update and improve these documents.

This Arahan Teknik (Jalan) on "**A Guide On The Design Of Cycle Track"** is a document produced for use by planners and engineers in Malaysia. It is hoped that this guide will address the issues on planning and designing for cycle track and will be accepted by the engineering fraternity in the country. This ATJ will be reviewed and updated from time to time to cater and incorporate the latest development in design of cycle track, as and when necessary.

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1.0 INTRODUCTION

Cycle tracks refer to all non-motorized two-wheel transportation systems incorporating paths, trails, lanes and routes, cycle crossings and intersections, overpasses and other related facilities. Some cycle facilities are separated from motor traffic by physical constraints such as barriers or bollards, but others are separated only by road markings.

A cycle track or segregated bicycle lane is designed to provide a separated path for cyclists to ride on the road. The terminology used for cycle track vary across regions.

The definition of cycle track also vary from region to region but the functions and designs remain the same.

1.1 Overview

The significance and usage of cycle tracks are very limited compared to motorcycle lane due to low number of bicycles on the road in Malaysia. Nevertheless, its implementation has become more popular recently and need to be revised as per today's demand.

Therefore, a committee has been organised to revise the present guideline of JKR ATJ 10/86: A Guide to the Design of Cycle Track.

The installation of cycle track is not a new practice in Malaysia as there are already implemented in Kuala Lumpur, Putrajaya, Penang and other cities.

(Sumber: Foto Laluan Basikal sediada di Persisiran Pantai Timur Pulau Pinang)

(Sumber : Foto Laluan Basikal Eksklusif di Kuala Lumpur (DBKL))

FIGURE 1.0: EXCLUSIVE CYCLE TRACKS

(Sumber : Foto Laluan Basikal (shoulder) di Jalan Masjid Kapitan Keling Pulau Pinang)

(Sumber : Foto Laluan Basikal di Kuala Lumpur (DBKL))

FIGURE 1.1: NON-EXCLUSIVE CYCLE TRACKS

1.2 Scope of Guidelines

a) This guideline covers the design of cycle track which is applicable to newly designed roads as well as for existing roads where conditions are complied;

b) Any provisions in other documents relating to the content of this guideline that are contradictory are hereby deemed superseded;

c) This guideline is prepared with the concern and reference from other countries practices but appropriately adapted to suit the local requirement;

1.3 Objectives

a) To help designer in deciding the minimum values of design criteria to be used when designing cycle tracks;

b) To provide a safety design of cycle tracks; and

c) To provide warrant for installation of cycle tracks.

1.4 Types of Cycle Tracks

The types of cycle tracks are shown as per figure below:

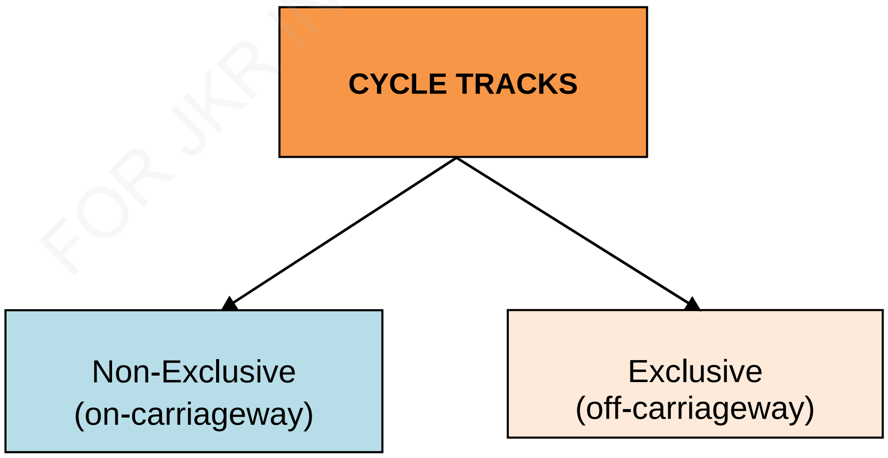


FIGURE 1.2: TYPES OF CYCLE TRACKS

2.0 GENERAL CONSIDERATIONS

When planning for a cycle track, certain principles should be taken into consideration. Apart from that, the designers should also have an understanding of the targeted users' needs and characteristics.

2.1 The Common Principles That Should Be Adhered To When Designing Cycle Tracks.

a) **Convenient:** Cycle tracks should allow people to go where they want, and new facilities should usually offer an advantage in terms of directness and/or reduced delay compared with previous provisions.

b) **Accessible:** Cycle tracks should form a network linking trip origins and key destinations. The routes should be continuous and as direct as possible. There should be proper provision for crossing busy roads and other barriers.

c) **Safe:** Not only must facilities be safe, but for the wellbeing of users, they must be perceived to be safe.

d) **Comfortable:** Facilities should meet appropriate design standards, and cater for all types of user. The design should incorporate gentle gradients, avoid complicated maneuvers and reduced need to stop.

e) **Attractive:** Aesthetics, noise reduction and integration with surrounding areas are important. Cycle track facilities should be attractive and interesting to help encourage their use.

Consideration should also be given to the physical aspect of cycle tracks regarding the following:

i. Suitable material and construction to provide a comfortable and skid resistant travelling **surface**.

ii. Adequate **signings and markings** which are clear and comprehensible.

iii. Proper **lighting** to facilitate night time travelling.

iv. **Road furniture** that do not pose as an impediment or hazard to users.

v. Provisions for **maintenance and monitoring**.

2.2 Understanding User Needs

Designs should send the message that cyclists are important as other road users. To design the best cycle track, designers should considered the categories of cyclist and their characteristics, as referred to in **TABLE 2.0**:

TABLE 2.0 :CATEGORIES OF CYCLIST AND THEIR CHARACTERISTICS

Category	Rider characteristics	Riding environment
Primary school children	Cognitive skills not developed, little knowledge of road rules, require supervision.	Off-road path, footpath (where permitted) or very low volume residential street.
Secondary school children	Skill varies, developing confidence.	Generally use on-road facilities or off-road paths where available.
Recreational	Experience, age, skills vary greatly.	Desire off-road paths and quiet local streets, avoid heavily trafficked routes, more experienced will prefer to use road system for long journeys.
Commuter	Vary in age, skill and fitness, some highly skilled and able to handle a variety of traffic conditions.	Some prefer paths or low-stress roads, willing to take longer to get to destination, others want quick trips regardless of traffic conditions, primarily require space to ride and smooth riding surface, speed maintenance.
Utility	Ride for specific purposes (shopping), short length trips, and routes unpredictable.	Not on highly trafficked roads, needs include comprehensive, low-stress routes, appropriate end-of-trip facilities.
Touring	Long distance journeys, may be heavily equipped, some travelling in groups.	Often route is similar to that of other tourists.
Sporting	Often in groups, two abreast occupying left lane, needs similar to commuters.	Travel long distances in training on arterials, may include challenging terrain in outer urban or rural areas, generally do not use off-road routes because of high speed and conflict with other users.

Source : Cycling Aspects of Austroads Guides, 2014

3.0 PLANNING FOR CYCLE TRACK

3.1 Route Location

Locating suitable cycle track routes for initial development requires investivigation into the potential purpose of cycling within a community. Planning principles for the choice of routes are:

a) In giving priority to those areas where the existing or potential demand for cycling is highest such as schools, residential, commercial and recreational areas.

b) In ensuring the location is integrated within overall transport and land use planning, urban development, building rules, traffic management and community planning.

3.2 Consideration of Provision

The following steps are ordered in hierarchy (first to last) that should be taken into consideration for the provision of either non-exclusive or exclusive cycle track:

a) Traffic reduction
b) Speed reduction
c) Junction or hazard site treatment, traffic management
d) Redistribution of the carriageway (bus lanes, widened nearside lanes etc)
e) Cycle lanes, segregated cycle tracks constructed by reallocation of carriageway space, cycle tracks away from roads
f) Conversion of footways to unsegregated shared use cycle tracks alongside the carriageway

The following chart in **FIGURE 3.0** may be used in determining the type of cycle track to be provided for cyclists taking into consideration the conditions of existing traffic. (AADT refer to condition existing traffic of main carriageway)

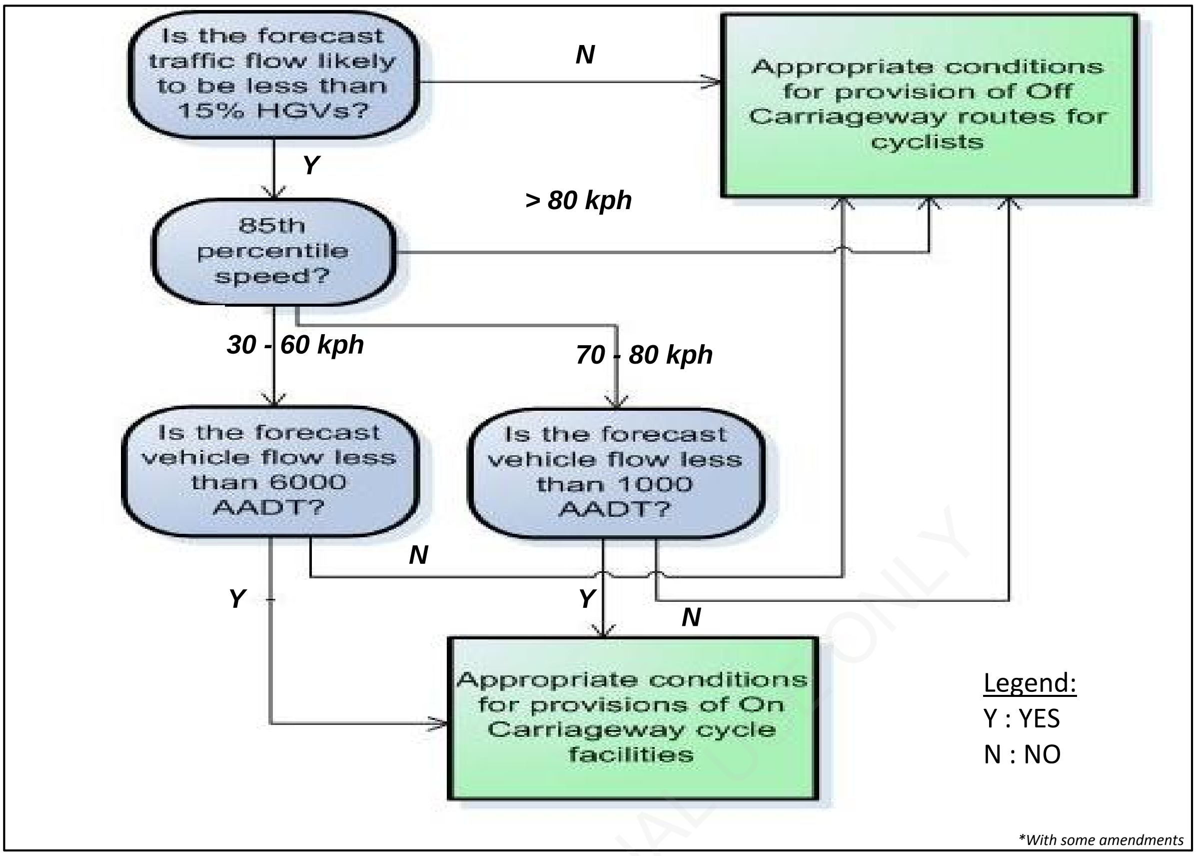


FIGURE 3.0: PROVISIONS OF ON OR OFF CARRIAGEWAY CYCLE FACILITIES

Source : Design Manual For Roads And Bridges Part 4 Ta 91/05
There are some amendments for **FIGURE 3.0 to suit the environment of the country*

Note: These criteria should not be applied rigidly, but in conjunction with judgment based upon the vehicle speed limit, volume/content of motorised traffic, volume of cycles and other local issues.

4.0 ELEMENTS OF DESIGN

4.1 Design Speed

The speed a bicyclist travels is dependent on several factors, including the type and condition of the bicycle; the purpose of the trip; the condition, location and grade of the path; the speed and direction of any prevailing winds; the number and types of users on the path; and the physical condition of the bicyclist. Shared use paths should be designed for a selected speed that is at least as high as the preferred speed of the faster bicyclists.

In general, design speed of 30 km/h should be used. Although bicyclists can travel faster than this, to do so would be inappropriate in a mixed-use setting. Design and traffic controls can be used to deter excessive speed and faster cyclists can be encouraged to use the roadway system. Lower design speeds should not be selected to artificially lower user speeds.

4.2 Sight Distance

Adequate sight distance is required to facilitate safe stopping at junctions with other travel model as shown **FIGURE 4.0** below:

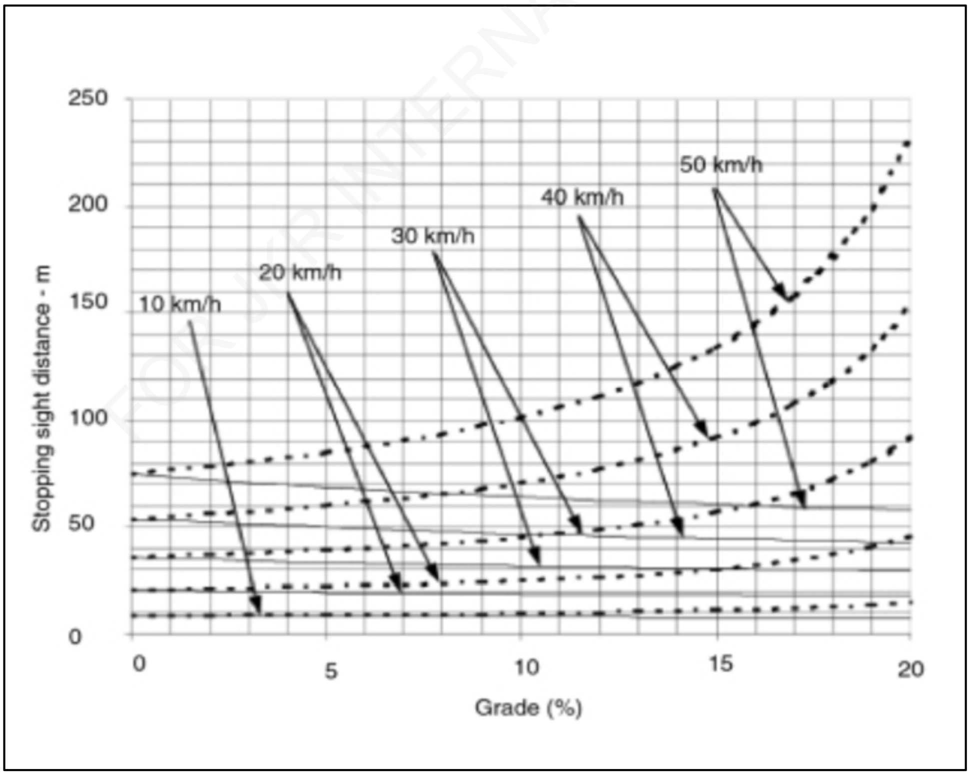


FIGURE 4.0: MINIMUM STOPPING SIGHT DISTANCE VS. GRADES FOR VARIOUS DESIGN SPEEDS

Source: AASHTO 2011

4.3 Horizontal Alignment

4.3.1 Minimum Radius

The formula used in determining the required minimum radius for the curve is:

$$R = \frac{V^2}{127\ (e + F)}$$

Where,

R = Minimum radius of curvature (m)
V = Design Speed (km/h)
e = maximum rate of superelevation
f = maximum allowable side friction factor

Based upon various design speeds of 30-50 km/h and a (desirable maximum lean angle of 20°), minimum radius of curvature for a paved path can be selected from **TABLE 4.0.**

TABLE 4.0: MINIMUM RADIUS

Design speed (km/hr)	Minimum radius (m) e = 0.03 , f = 0.21
30	30
40	52
50	82

4.3.2 Curve Treatment

In designing two-way cycle track there is a need to increase the width through curves in order to allow for cyclists to lean on curves. The amount of widening is however limited to 0.6 to 1.2 m.

4.3.3 Superelevation

The maximum superelevation to be used is 3%. Super elevation should be applied from tangent point to its required value at the point of maximum widening.

4.4 Vertical Grades

4.4.1 Grades

Generally longitudinal gradients on paths for cycling should be as flat as possible. Road planners and designers should strive to minimise gradients on paths as excessive gradients on hills can be unpleasant to cyclists and act as a deterrent to bicycle riding. It is recommended to select the flattest alternative path to minimise the amount of climbing.

The maximum grade allowed is 10% subject to Desirable Uphill Gradients for Ease of Cycling (Austroads 2009). However, it is desirable to design the maximum at 5% with a minimum grade of 0.5%. At very flat areas, the minimum grade can be reduced further but with prior approval. However, the design of the storm water drainage outlet should be considered carefully to ensure that flooding of the travelled lane is avoided. **FIGURE 4.1** gives the length of gradients for percentage of desirable uphill gradients for ease of cycling.

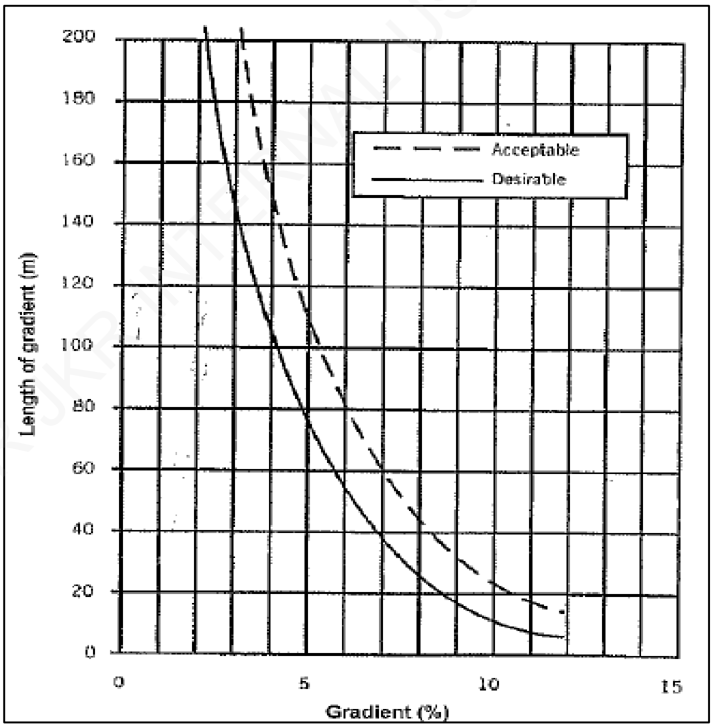


FIGURE 4.1 : DESIRABLE UPHILL GRADIENTS FOR EASE OF CYCLING
Source: Austroads, 2009

4.4.2 Vertical Curves

The minimum vertical curve length to be used is 15 m. On sag vertical curve, the design should be such to avoid any ponding of surface water.

4.5 Cross-Section Element

4.5.1 Lane Width

The required width for the cycle track is determined by the types of the facility as shown in **TABLE 4.1**. The non-exclusive cycle track shall be separated from main carriageway for at least 0.7 m by a separator (normally chevron marking). A guide of installation for bicycle lane can be referred to the Standard Drawings for Road Works Section 9: Motorcycle Lane and Facilities.

TABLE 4.1: WIDTH OF CYCLE TRACK

Types cycle track		Width (m)	
		Minimum	Desirable
Exclusive	one way	1.5	2.0
	two way	2.5	3.0
Non-exclusive	one way	1.5	2.0

4.5.2 Pavement

The smoothness of the riding surface affects the comfort, safety and speed of bicyclists. Pavement surfaces should be smooth, and the pavement should be uniform in width. Two types of standard design for cycle track have been selected and are to be used as indicate in **FIGURE 4.2** and **FIGURE 4.3** which are flexible pavement and rigid pavement. However it is recommended to use flexible pavement as such it will reduce the severity of injury during fall when accident happened. For cycle lane, it will follow the structure of main carriageway.

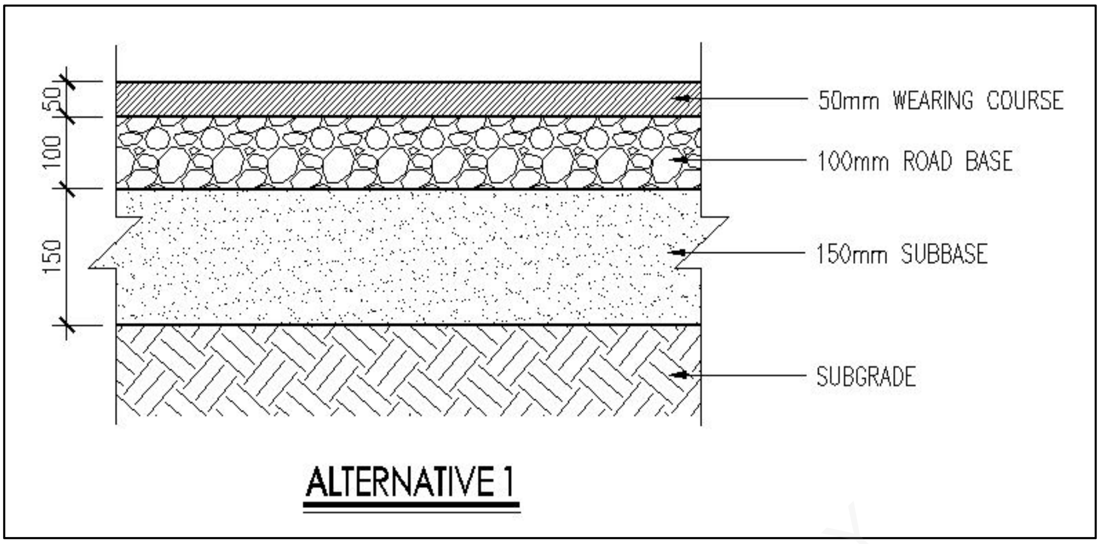


FIGURE 4.2: FLEXIBLE PAVEMENT STRUCTURE

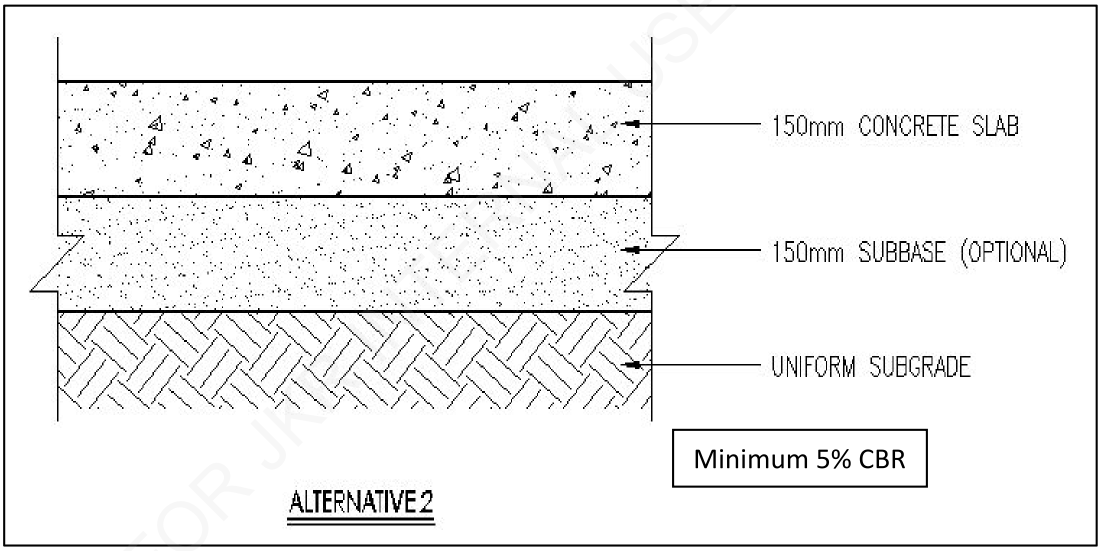


FIGURE 4.3: RIGID PAVEMENT STRUCTURE

4.5.3 Crossfall

Water ponding on paths has a significant impact on the level of service provided to cyclists as spray leads to grit on both bicycle and rider. On sealed surfaces the normal cross fall of 2.5% should be adequate to effectively dispose of surface water.

4.6 Bridges and Other Structures

4.6.1 Bridges

Parapet height (h)

- 1.1 m preferred for cyclists, but many existing bridges operate well with lower heights

Effective width

- Minimum 0.5 m wide clear area shall be added at each parapet

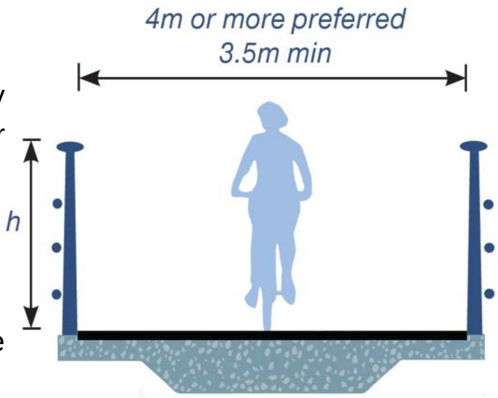


FIGURE 4.4: PARAPET HEIGHT

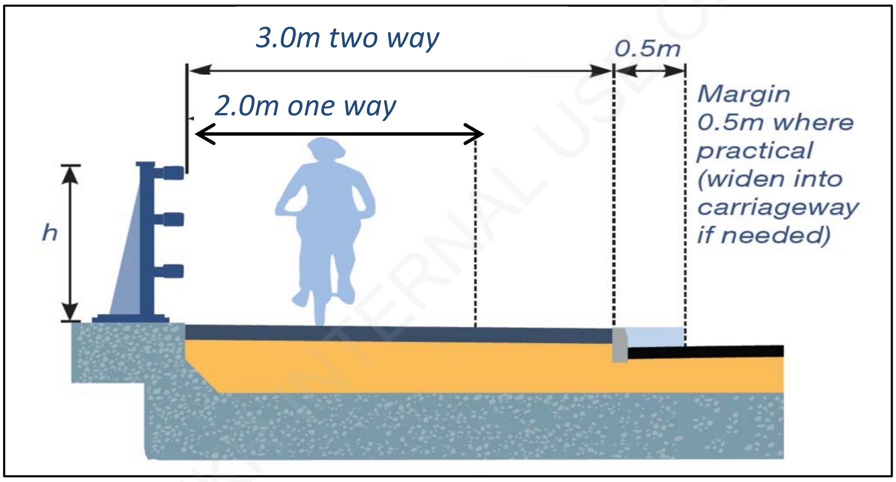


FIGURE 4.5: EXCLUSIVE CYCLE TRACK

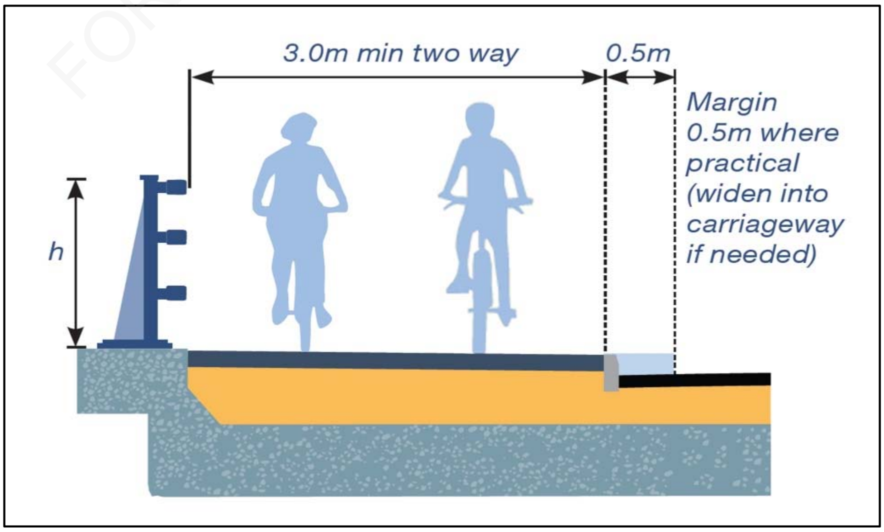


FIGURE 4.6: EXCLUSIVE CYCLE TRACK (TWO WAY)

Source: Sustran Design Manual, April 2014

4.6.2 Underpass

- Dimensions shown are minimum recommended for new underpass
- Dimensions in brackets apply to underpass lengths > 23 m
- Many existing underpass operate well with lower clearance and appropriate warning signs
- A greater width or walls receding towards the top increases natural light

One way Two way

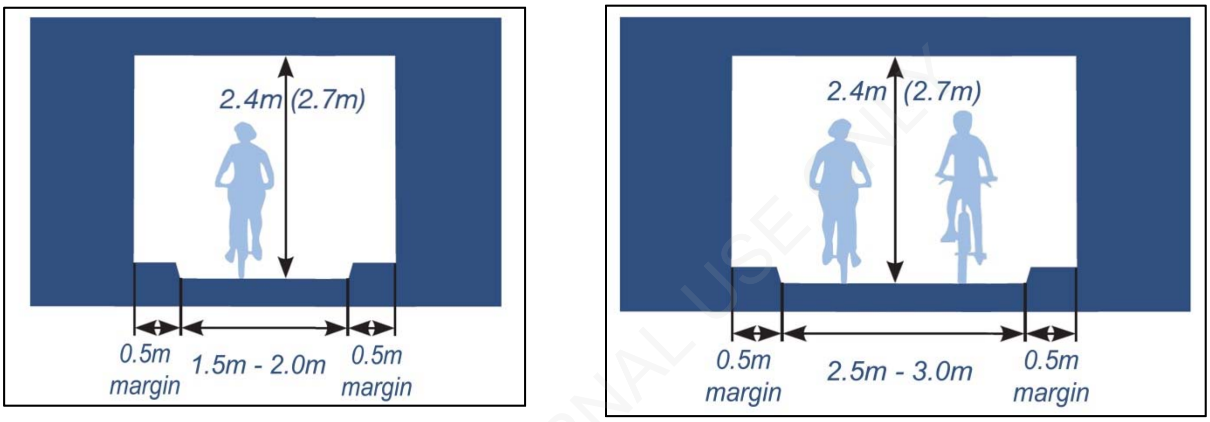


FIGURE 4.7: TYPICAL SECTION (EXCLUSIVE)

One way

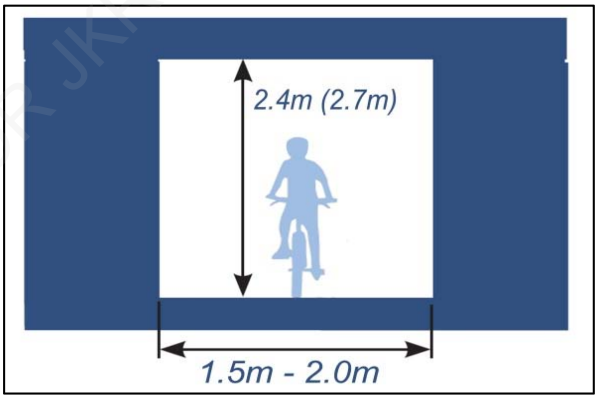


FIGURE 4.8: TYPICAL SECTION (NON-EXCLUSIVE)
Source: Sustran Design Manual, April 2014

4.6.3 Bicycle Path at Bus Stop

At bus stops where pedestrians are habituated to wait at the kerb, it is desirable to divert the bicycle space to the rear of the bus stop. Refer to diagram as per below:

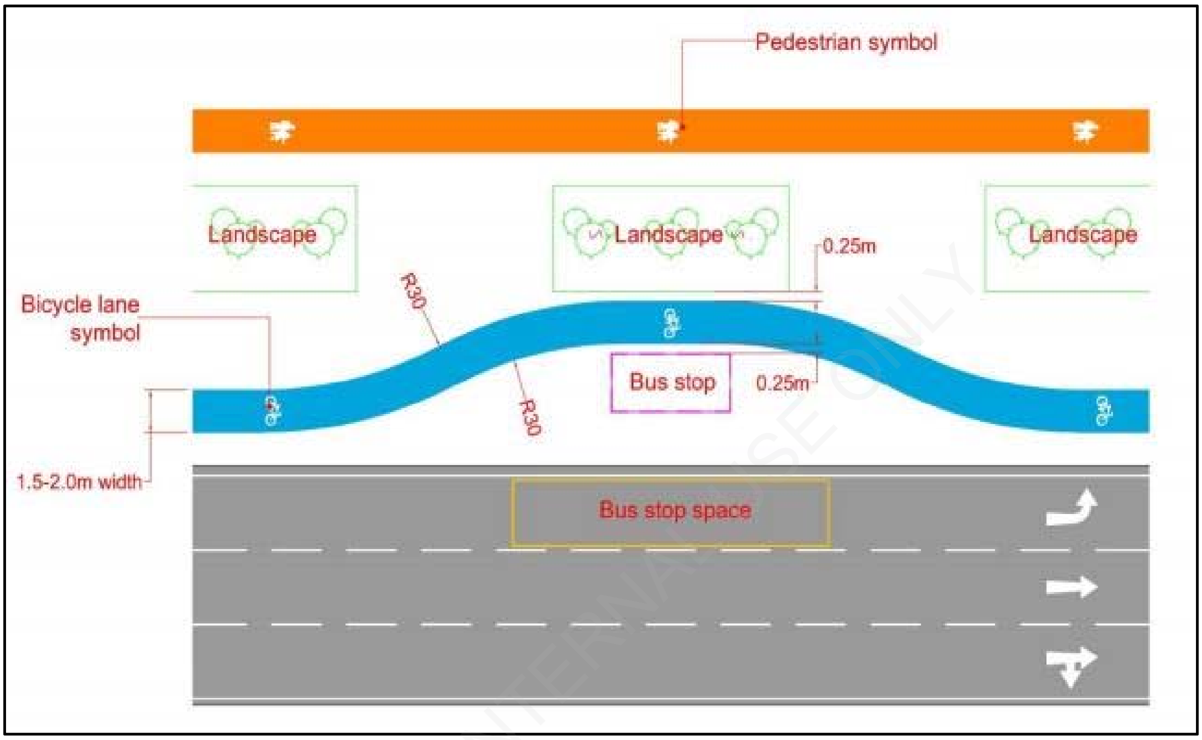


FIGURE 4.9: BICYCLE PATH ALIGNMENT AT BUS STOP AREA
Source: MIROS, 2014

5.0 JUNCTION AND CROSSING

At junction and crossing, some form of channelisation with specific routes for the cyclists should be provided to minimize conflicts that will arise. Types of crossing at junction can be classify as:

i. Priority junction
ii. Mid-block crossing
iii. Crossing with median refuge
iv. Signalized junction
v. Roundabout junctions

Where dedicated cycle crossing is provided, push button should be considered.

5.1 Priority Junction

Where exclusive cycle track pass priority junctions, care should be taken to ensure the design fully considers the needs of bicyclists wishing to join the cycle track from the side road, and vice versa.

i. Where a cycle track crosses a side road that the crossing is placed on a flat-top road hump, and that corner radii are tightened, to reduce the speed of turning vehicles.

ii. This type of design also benefits pedestrians by reducing the distance to be crossed at minor roads and reducing the speed of motor traffic they are likely to encounter whilst doing so.

iii. Two types of crossing can be used at priority junction i.e. bent out crossing and straight crossing.

5.1.1 Bend Out Crossing

i. To allow storage space for turning vehicle entering or leaving the side road.

ii. Where the side road is a major road or side road has higher priority than the through road.

iii. Priority can be allocated to cycle track, if it is parallels to the major road.

iv. Priority can be allocated to intersecting road, if this road has the priority in the normal road hierarchy. The example as the **FIGURE 5.0.**

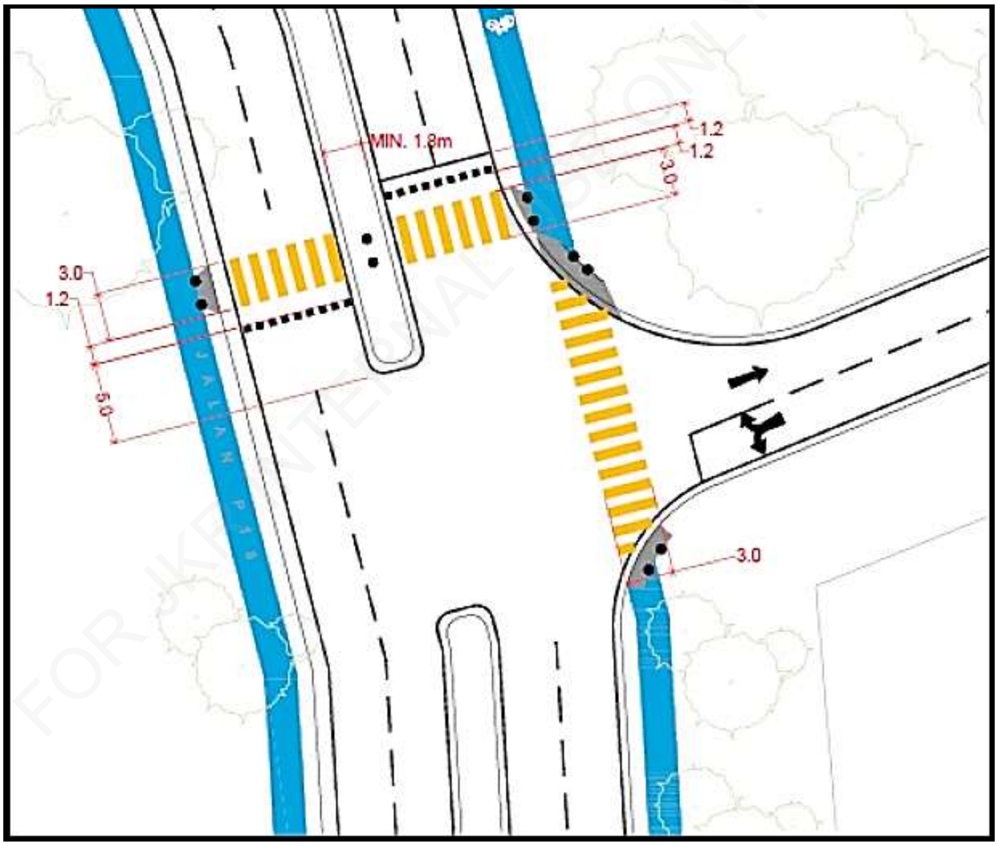


FIGURE 5.0: BEND OUT DIAGRAM
Source: MIROS, 2014

5.1.2 Straight Crossing

i. Off-road cycle track crossing side streets or cross roads in straight approach where space is limited.

ii. This type of crossing provides higher visibility for road users.

iii. To maintain route continuity and bicyclist comfort, this crossing may be placed on a flat-top road hump.

iv. Suitable where traffic volume on side streets are low.

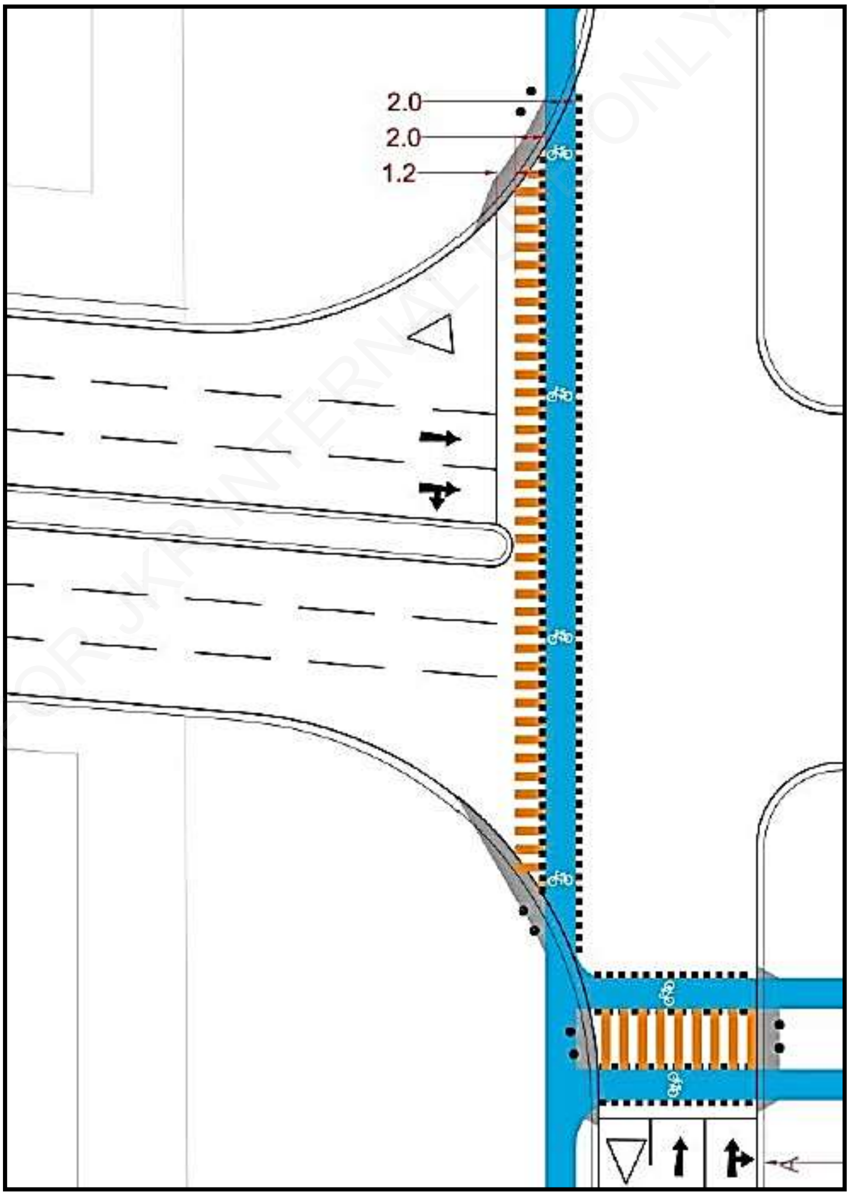


FIGURE 5.1: STRAIGHT DIAGRAM
Source: MIROS, 2014

5.2 Mid-block Crossing

i. Should be design far enough away from existing intersections between roadways to be clearly separate from the activity that occurs as motorists approach these intersections (such as merging movement, acceleration/deceleration or preparations to enter turn lanes).

ii. Some variables to be considered when designing this type of intersection are; right-of-way assignment, traffic control devices, sigh distance for bicyclists and motor vehicle operators, refuge island use, access control and pavement marking.

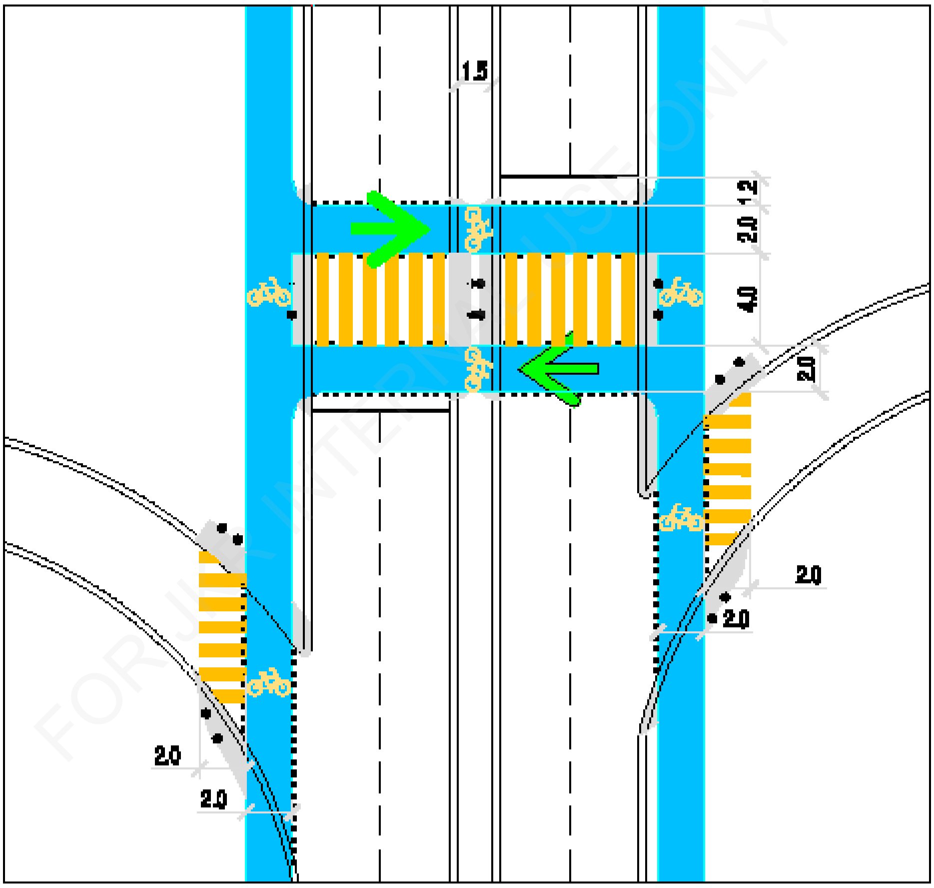


FIGURE 5.2: MID-BLOCK DIAGRAM
Source: MIROS, 2014

5.3 Crossing With Median Refuge

i. A refuge is a place where pedestrian/bicyclist can stop before finishing crossing a road. Usually it is being used when a street is very wide, causing the crossing time to be too long. It allows a path user to cross one direction of traffic without waiting until both directions are clear.

ii. The minimum width of refuge to meet the needs of bicyclists should be at least 3 m as indicate in the figure.

iii. If large numbers of bicyclist can be anticipated, a storage space of 3.5 – 4 m is preferred.

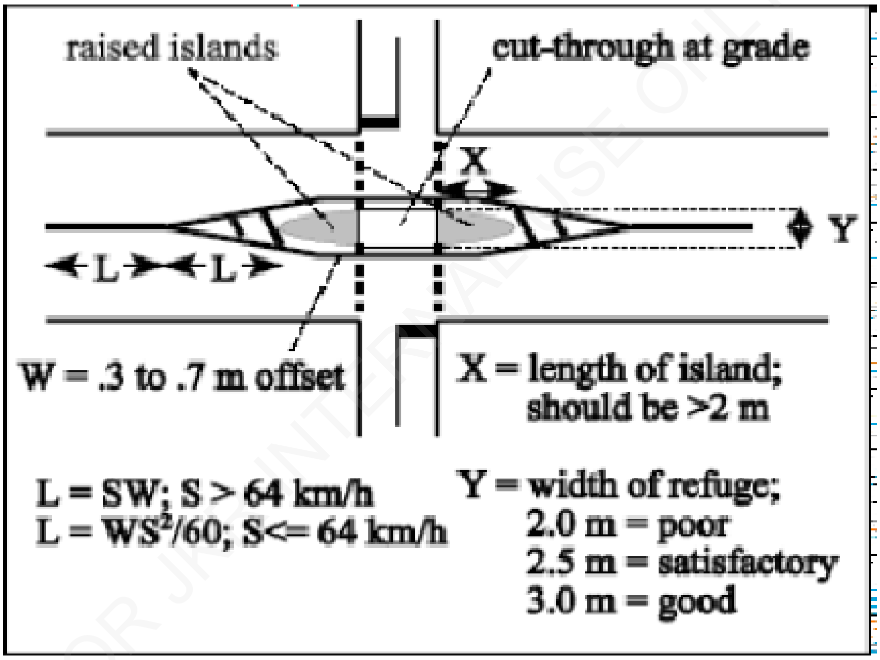


FIGURE 5.3: CROSSING WITH MEDIAN REFUGE DIAGRAM
Source: MORPC, 2006

5.4 Signalized Junction

i. At signalised junction, advanced stop line should be used wherever possible.

ii. Allocation for extra time and space for bicyclist and pedestrian should be considered.

iii. A report by Alta Planning and Design on cycle Track: Lesson Learn stated that any right-turn on red/left-turn on red (on the left side driving country) should be prohibited as they posed danger to the bicyclist.

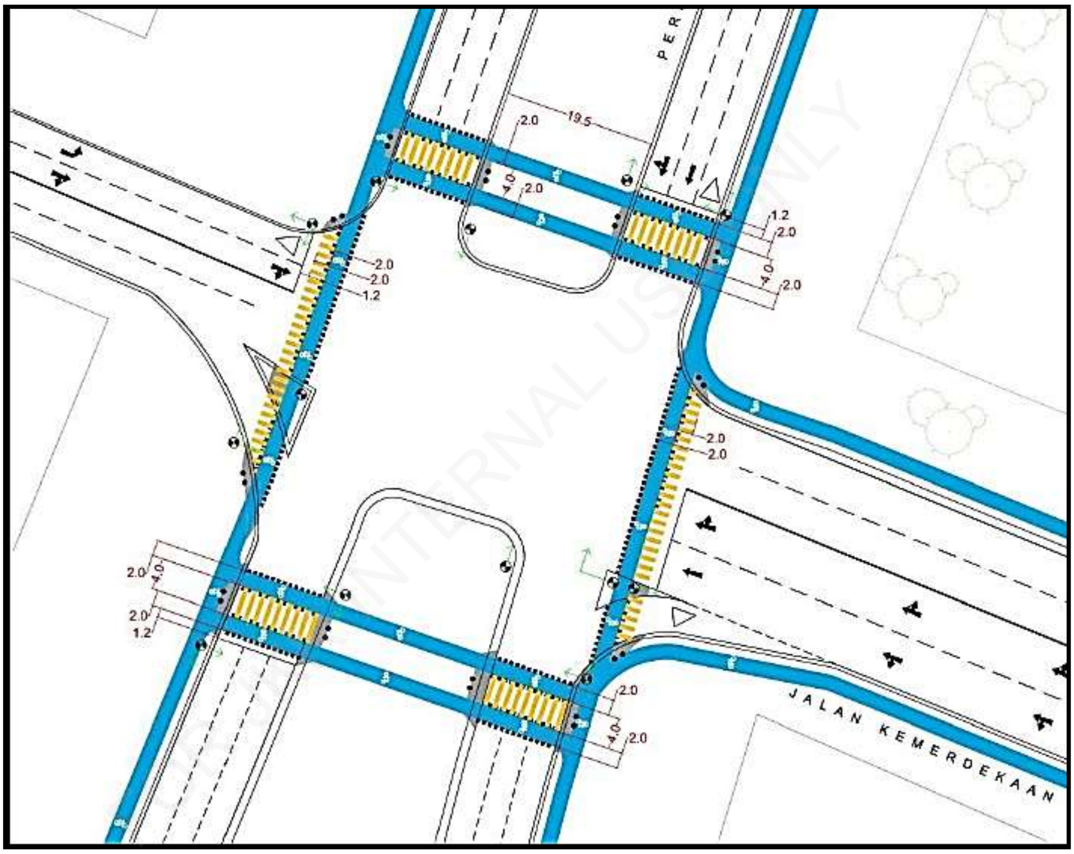
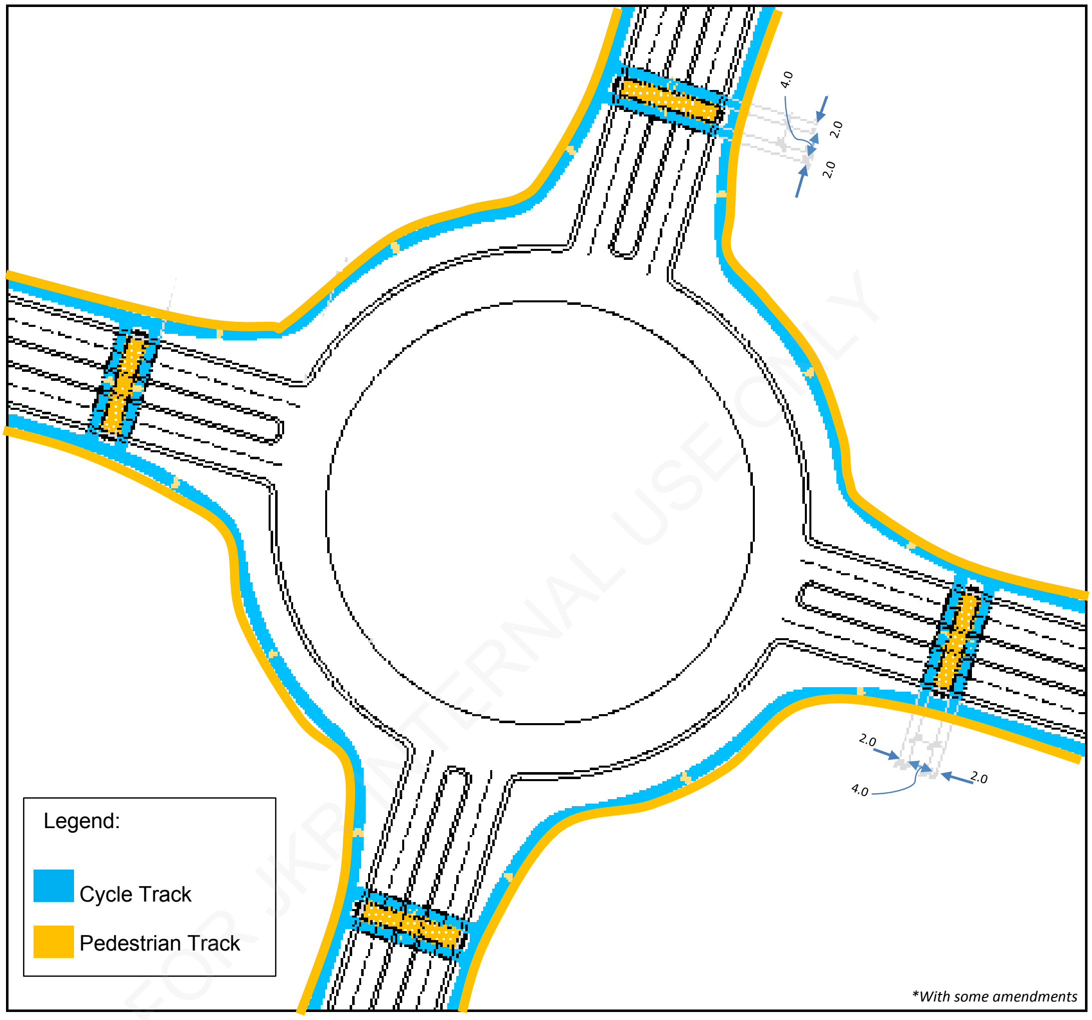


FIGURE 5.4: SIGNALIZED DIAGRAM
Source: MIROS, 2014

5.5 Roundabout Junctions

Any crossing at roundabout should be prohibited, provision of crossing should follow mid block at distance 60m before approach roundabout.



There are some amendments for **FIGURE 5.5 to suit the environment of the country*

FIGURE 5.5: ROUNDABOUT DIAGRAM

Source: MIROS, 2014

6.0 DRAINAGE

No special drainage treatment is required for an exclusive or non-exclusive cycle track forming part of an existing carriageway. In steep sloping terrain where it is necessary for the cycle track to be cut into the hillside, a continuous gutter should be provided along the cut face with approximately placed sumps and drains to divert storm water run-off beneath the cycle track.

For non-exclusive cycle track drainage should be outside the effective carriageway area (including the hardstrip). The front wheel of a bicycle can be trapped by drainage grate slots, and hence where grates are unavoidably within the cycle route, they should normally be outside the usable width of the cycle route.

Drainage grates and manhole covers are potential hazards as they are:

i. Slippery when wet;

ii. Not always flush with roadway surface;

iii. A prime location for the formation of potholes;

iv. A trap for bicycle tires.

Texturing can reduce the slippery quality of drainage grates and manhole covers. Potholes can be prevented by offsetting the grates so that they are not directly on the travelled roadway. Drainage grates should always be perpendicular to cycle track to prevent bicycle tires from getting caught. Collars can be placed on recessed drainage grates to bring them flush with the roadway.

7.0 TRAFFIC CONTROL DEVICE AND FACILITIES

Traffic control devices play an important part in allowing the smooth flow of traffic. It also helps to reduce or avoid accidents among users of the road. Basically there are four (4) types of traffic control devices and facilities namely:

7.1 Road Markings

Proper markings on the pavement regulate, warn and advise users on the dangers ahead of them. Road markings such as “LALUAN BASIKAL” and many other words can be painted on the surface of the pavement or bicycle symbol. Details on bicycle symbol on pavement as per **FIGURE 7.0** and coloured pavement referred to **TABLE 9.0**. Further details of the road markings can be found in the latest revision of JKR’s Arahan Teknik Jalan 2D/85 Manual on Traffic Control Devices: Road Marking and Delineation.

FIGURE 7.0: BICYCLE SYMBOL ON PAVEMENT

7.2 Traffic Signs

Just like road markings, traffic signs regulate, warn and advise users on the dangers ahead of them. There are many signs and their location is a fundamental importance for the road users to act on them. For cycle track with design speed of 30 kilometers per hour, the signs need to be put at least 30 metres away from the conflict point or danger. This is to give the cyclist ample time to act on seeing the signs.

Traffic sign's dimension and colour for bicycle are per **FIGURE 7.1** and **TABLE 7.0** below, further details of the standard traffic signs can be found in JKR's Arahan Teknik (Jalan) 2A/85: Manual On Traffic Control Devices - Standard Traffic Signs. Meanwhile, separated path for pedestrian and cyclist sign shown in **FIGURE 7.2**.

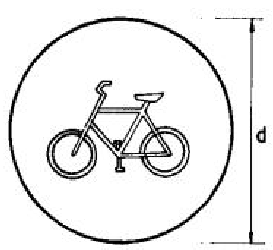


FIGURE 7.1: BICYCLE SIGN

FIGURE 7.2: SEPARATED PATH FOR PEDESTRIAN AND CYCLIST SIGN

TABLE 7.0: SIGNBOARD DIMENSION

SIGN	DIMENSIONS d
Minimum	600
Normal	750

RM2: Compulsory Cycle Track

Colour:
Background - Blue
Symbol - White

7.3 Traffic Signals

Where cycle track crosses a major road, adequate junction treatment need to be considered, particularly on the safety aspects. Here traffic signals can be used whereby a separate phase can be introduced for the cyclist. The examples of traffic signals as per figures below:

Source : Foto Laluan Basikal di Kuala Lumpur (DBKL)

Source : Foto Laluan Basikal di Kuala Lumpur (DBKL)

FIGURE 7.3: EXAMPLE OF TRAFFIC SIGNAL FOR CYCLIST

7.4 Roundabouts

Exclusive cycle track treatment, such as bicycle roundabouts provide an alternative to traditional trail intersections by not requiring one or more legs of the intersection to stop. Bicycle Roundabouts can handle a significant amount of bicycle traffic and can also create a place for plantings and other amenities. Bicycle roundabouts allow bicyclist to travel through an intersection without stopping. This creates a more comfortable route for cyclist by using less energy and effort stopping and starting. Bicycle roundabouts also can handle significant numbers of bicyclist where volumes are high. It is recommended that the roundabout diameter designed to allow at least 20 km/h bicycle. The drawing as **FIGURE. 7.5** shows a proposed roundabout at intersection.

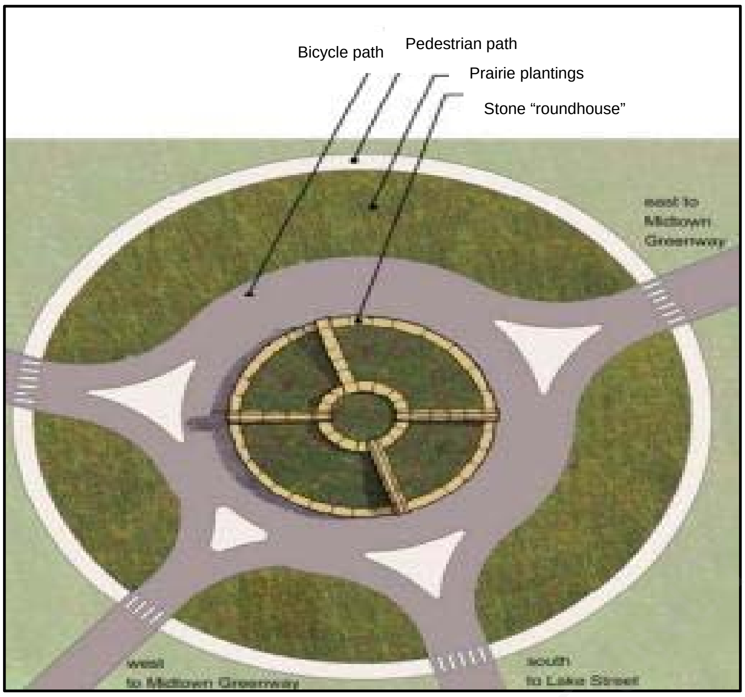


FIGURE 7.4: BICYCLE ROUNDABOUTS DRAWING
Source: Shaw, J. & Moler, S. (2009)

7.4.1 Bicycle Roundabout Criteria:

i. Bicycle Roundabouts are ideal for two high volume intersecting trails, improving safety and mobility.

ii. Bicycle Roundabouts should only be used if there is adequate right-of-way available.

iii. Bicycle Roundabouts should consider design speed and pedestrian volume when setting the inner radius.

iv. Bicycle Roundabouts should be treated as a traffic control device and not as a traffic calming device.

v. Bicycle Roundabouts should be designed so that users travel in a counterclockwise direction.

vi. Good sightlines must be preserved near the roundabout; kiosks, benches, and other amenities should be placed outside the roundabout.

vii. Trail Roundabouts may be used to improve safety by sorting bicycles and pedestrians thus reducing conflicts.

viii. Capital and operating costs must be considered and compared to a traditional trail intersection.

8.0 MAINTENANCE AND MANAGEMENT

8.1 Overall principles

i. A route that is kept in good condition will be more popular than one allowed to deteriorate.

ii. Having invested in the route’s construction it is important that it remains attractive to users.

iii. Design should minimise maintenance liabilities such as coloured pavement marking, road furniture, etc and consider whole life cost of scheme.

iv. Maintenance should be considered as part of the route development process long before work to build it starts.

v. A high standard of design will mean less maintenance in the future. For example a path surfaced with tarmac will have a long life and require little maintenance.

vi. Secure funding for maintenance at project development stage.

vii. Pre-plan cycle network enhancements as part of network management programme.

8.2 Principles for Exclusive Cycle Tracks

i. Maintenance for the route should be undertake by relevant authorities within the Right of Way (ROW) or else can be done by developers or land owners or any parties which responsible for the route development with mutual agreement or legal agreement.

ii. The scope of maintenance should be but not limited to the following:

a) Repair surface damage
b) Clear drainage channels and culverts
c) Sweep debris
d) Mow verges / remove edge creep
e) Cut encroaching trees and other vegetation
f) Repair / replace damaged / lost signs
g) Maintain lighting, furniture, structures

9.0 OTHER REQUIREMENTS

9.1 Cycle Parking

Cycle parking is an essential element of a cycle network. It should cater for all destinations where it can be observed by passers by and the building occupier. The preferred type of public cycle parking is the Round-stands, in conjunction with shelters where bikes are left for long periods. Care should be taken when siting cycle parking to avoid obstructions to pedestrians including those with visual impairments.

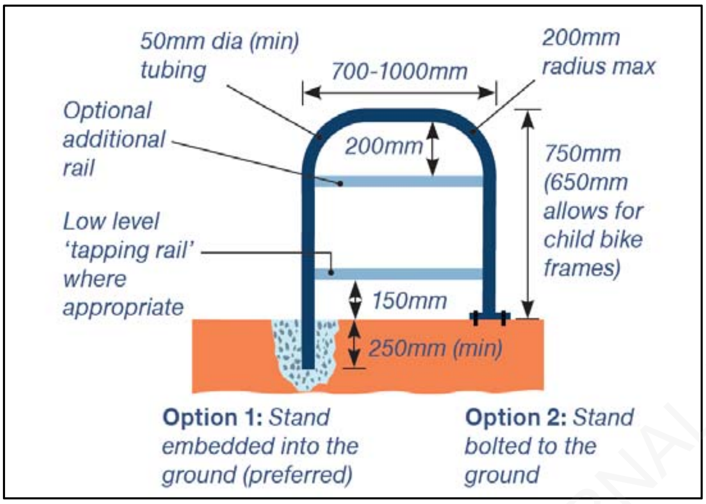


FIGURE 9.0: ROUND- STANDS

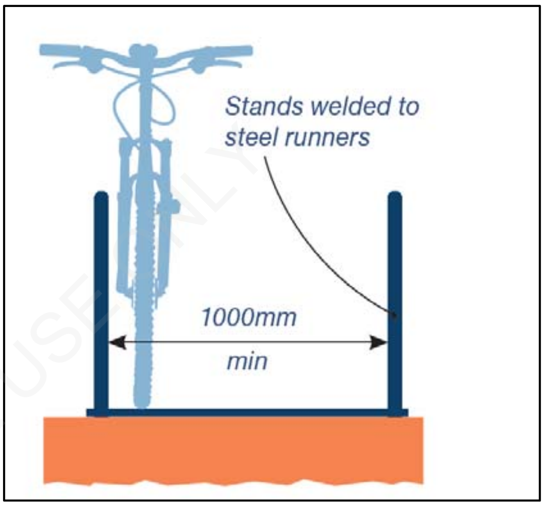


FIGURE 9.1: 'TOAST RACK' OF ROUND-STANDS

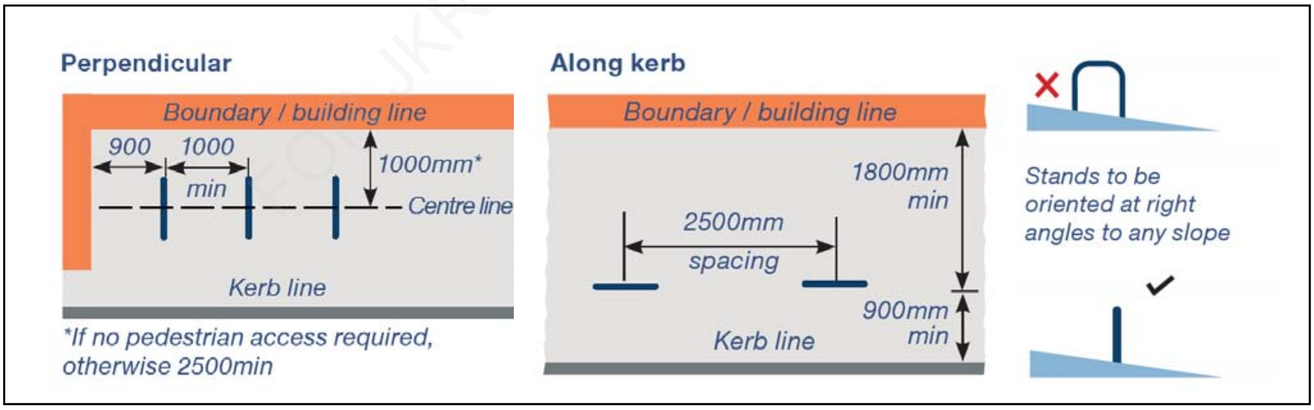


FIGURE 9.2: LAYOUTS

Source : Sustran Design Manual, April 2014

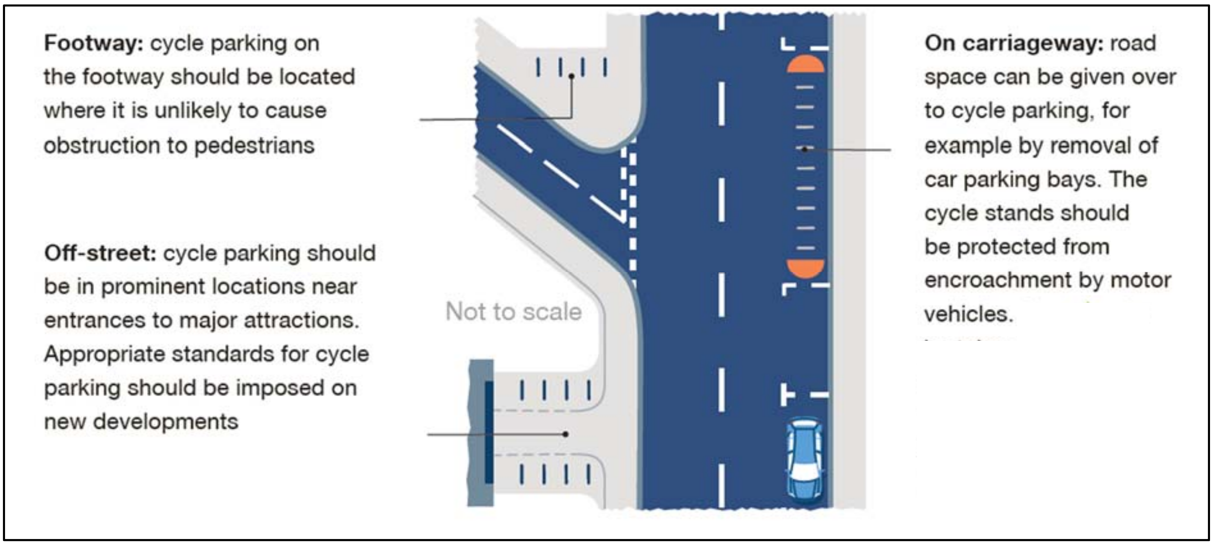


FIGURE 9.3: SITING DETAILS
Source : Sustran Design Manual, April 2014

9.2 Surface Coloured, Materials and Skid Resistance

Where relevant or suitable location identified, the details for surface coloured, materials and skid resistance as per **TABLE 9.0** below:

TABLE 9.0: SURFACE COLOURED, MATERIALS AND SKID RESISTANCE

Item	Description
Surface Coloured	Maroon. Help to provide sufficient contrast to pavement and therefore increased visibility
Skid Resistance	55 Skid Resistance Value (SRV)
Material (Common in market)	Thermoplastic paint, resin based materials with coloured chips, coloured macadam and slurry seal

GLOSSARY

i. Collars: A patented structure and the "S" reversibility connection, allow an easy and reliable execution of the fixed or sliding point on the piping to be bracketed.

ii. Potholes: Holes and loss of pavement material caused by traffic loading, fatique and inadequate strength as well as poor drainage. (*PASER Manual Asphalt Road, Wisconsin Transportation Information Centre*)

iii. Heavy goods vehicle (HGV): Heavy vehicles are those with a total weight above 3,500 kg. (vehicle + load). Heavy goods vehicles are over-involved in fatal crashes, since their high mass leads to severe consequences for other road users in crashes. *(European Road Safety Observatory).*

iv. Non-motorized: Includes Walking and Bicycling, and variants such as Small-Wheeled Transport (skates, skateboards, push scooters and hand carts) and Wheelchair travel. *(Traffic Demand Management, TDM Encyclopedia).*

v. Skid resistan~~t~~ce: the force developed when a tire that is prevented from rotating slides along the pavement surface (Highway Research Board, 1972).

vi. Road furniture: Refers to all fixtures in the road and road reserve. The term includes fixtures on the road surface such as steel covers and traffic domes (silent cops) or lane markers, all of which can create a hazard for a motorcycle. (*Motorcycle Council of NSW).*

vii. Traffic control: Directing vehicular and pedestrian traffic around a construction zone, accident or other road disruption, thus ensuring the safety of emergency response teams, construction workers and the general public.

viii. Road marking: Marking that used to regulate traffic, warn or guide road users. They either may be used alone or supplement other traffic control devices. (*REAM GL 4/2008: Guidelines on Traffic Control and Management Devices*).

ix. Traffic sign: signs erected at the side of or above roads used to regulate, warn or guide road users. It generally classified into regulatory, warning, temporary, guide and other signs. (*ATJ 2E-87, Pindaan 2011: Guide Signs Design and Application*).

x. Traffic calming: The combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behavior and improve conditions for non-motorized street users. (*Institute of Transportation Engineers, Washington DC*).

GLOSSARY (continue…)

xi. Annual Average Daily Traffic (AADT): the total volume for the year divided by 365 days.

xii. Cycle Lane: Also known as Bike Lane, is a portion of a roadway which has been designated by striping, signing and pavement markings for the preferential or exclusive use of bicyclists. (*FHWA Course on Bicycle and Pedestrian Transportation*).

xiii. Cycle Track: two-wheel and three wheel transportation systems incorporating paths, trails, lanes and routes, cycle crossings and intersections, overpasses and other related facilities. (*ATJ 10/86: A Guide to the Design of Cycle Track*).

xiv. Exclusive Cycle Track: A roadway meant exclusively for use by bicycle, and physically separated from main carriageway. (*ATJ 8/86, Pindaan 2015: A Guide on Geometric Design of Roads*).

xv. Non-Exclusive Cycle Track: Extra lane or verge/paved shoulder or marginal strip on the left hand side of a road where bicycle are encouraged /required to use while riding along a road. (*ATJ 8/86, Pindaan 2015: A Guide on Geometric Design of Roads*).

REFERENCES

1. ATJ 10/86: A Guide to the Design of Cycle Track

2. Cycling Aspects of Austroads Guides, 2014

3. Design Guidelines for Bikeways, TRANSPORTATION, OPERATIONS & ENVIRONMENT DIVISION, Canada (December 1999)

4. Design Manual For Roads And Bridges Part 4 Ta 91/05 (PROVISION FOR NON-MOTORISED USERS)

5. Development and Improvement of Bicycle Path in Putrajaya Design Criteria, Malaysian Institute of Road Safety Research (2014)

6. Sustran Design Manual, Handbook for Cycle-Friendly Design (April 2014).