NON SIGNALISED INTERSECTIONS

ZEBRA CROSSINGS

**Description**
Zebra crossings rely on the motorist seeing the pedestrian on the crossing and then slowing down or stopping to allow the pedestrian to cross the road.

Traffic regulations require the motorist to give way to pedestrians on the crossing, but having done so, the motorist may proceed without waiting for the pedestrian to clear the road.

Since the 1970’s, Main Roads has replaced a large number of zebra crossings on high volume roads with raised medians or pedestrian refuge islands. This action resulted in a reduced number of pedestrian and vehicular crashes after the zebra crossings had been removed. However, a major reason for the crash reduction was that the crossings had been installed on busy multi-lane roads which were inappropriate for this type of treatment. Zebra crossings should still be considered as viable crossing facilities where conditions are appropriate.

Good sight distance and lighting are required for the safe operation of this facility.

**Advantages**
- Relatively low cost to install and maintain.
- Less delays to motorists than signalised crossings.

**Disadvantages**
- Pedestrians exercising their right of way often inappropriately step out in front of approaching traffic, not leaving vehicles enough time to stop.
- Can be poorly respected by motorists, especially where pedestrian volumes are low.
- Good visibility required.
Main Roads Western Australia
Pedestrian Crossings – Warrants and Crossing Times

Preferred Locations:
- Two-lane roads with short crossing distances, low traffic speeds, low traffic volumes, consistent pedestrian usage throughout the day, street lighting and good visibility of the crossing.
- Left turn slip lanes (see Traffic Signal Controlled Crossings).
- Roundabouts with high pedestrian usage.

Inappropriate Locations
- On busy multi-lane roads.
- On high-speed roads (>60 km/h).
- Where sight distance is restricted.
- Where there is no street lighting.
- Where there is inconsistent pedestrian usage.

Warrant
A zebra crossing may be considered if in two separate hours on an average weekday:
- the number of pedestrians crossing in close proximity of the site (generally within 30 m) exceeds 60 per hour;
- the number of vehicles exceeds 600 per hour; and
- the product of the number of pedestrians crossing and vehicles passing the site exceeds 90,000 in the same hour.

Design Details
- The width of zebra crossings generally range between 3 m and 6 m.
- The white painted bars are approximately 600 mm wide spaced approximately 600 mm apart.
- Good lighting is essential to ensure visibility of pedestrian using the crossing at night.
Main Roads Western Australia  
Pedestrian Crossings – Warrants and Crossing Times

- Kerb extensions and/or a pedestrian refuge should be installed where appropriate.
- A road surface with a good skid resistance should be maintained on the approach to the crossing.
- Flashing lights should be considered at crossings on major roads or where visibility is less than preferred.

**Example**
Ensure that the zebra crossing is located on, or as close as practical, to the pedestrian desire line. In this example, the two underpasses are some distance from the crossing.

**Example**
A signalised crossing may be more appropriate where there is high pedestrian use and high vehicle volumes. In this example, the zebra crossing is being changed to a Puffin crossing.

---

**Wombat Crossings**

**Description**
A wombat crossing is a zebra crossing on a raised plateau at footpath level.
This type of treatment is suitable in a low speed environment, typically 40 km/h.

**Advantages**

![Hay Street, Subiaco](image)
Main Roads Western Australia  
Pedestrian Crossings – Warrants and Crossing Times

<table>
<thead>
<tr>
<th><strong>As for a zebra crossing plus:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• The raised platform improves the visibility of the crossing and forces motorists to slow down.</td>
</tr>
</tbody>
</table>

**Disadvantages**

As for a zebra crossing.

**Preferred Locations:**

- Two-lane roads with short crossing distances, low traffic speeds, low traffic volumes, consistent pedestrian usage throughout the day, street lighting and good visibility of the crossing.
- Residential roads not used as bus routes.

**Inappropriate Locations**

As for a zebra crossing plus:

- On bus routes and other routes used by heavy vehicles that could be adversely affected by the raised platform.

**Warrant**

As for a zebra crossing.

**Design Details**

- The desirable minimum width of the platform is 6 m.
- The maximum crossing width is two lanes.
- Kerb extensions should be considered for lane widths in excess of 4 m.

**Example**

Zebra and Wombat crossings are often used in shopping centres where non-conforming signing and pavement markings are common. However, they provide improved safety for pedestrians in a busy but slow vehicle environment.

![Thornlie Square Shopping Centre](image-url)
Main Roads Western Australia  
Pedestrian Crossings – Warrants and Crossing Times

**Example**

Raised plateaus without zebra markings can confuse both pedestrians and motorists over who has right of way.

![Image of a pedestrian crossing](image)

*Cantonment Street, Fremantle*

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**Warden Controlled Children’s Crossings**

**Description**

Children’s crossings are controlled by trained wardens who have the authority to stop traffic and allow school children and other pedestrians to safely cross the road. They are provided where there is a concentration of children crossing a busy road in the vicinity of a school. The crossing is only supervised for short periods before and after school hours and does not restrict motorists at other times of the day.

![Image of a warden controlled crossing](image)

*Spencer Road, Thornlie*

**Advantages**

- Pedestrians using the crossing are fully protected.
- The crossing warden has better control of the children than at an unmanned crossing and provides an adult assessment of when it is safe to cross.
- The crossing warden is able to balance the flow of traffic against the demand for pedestrians to cross the road.
- Unnecessary restrictions are not imposed on drivers outside the start and finish of normal school hours.

**Disadvantages**

- Expensive to provide a crossing warden.
- More than one warden may be required on a busy road.
## Main Roads Western Australia

### Pedestrian Crossings – Warrants and Crossing Times

<table>
<thead>
<tr>
<th>Preferred Locations:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• On pedestrian routes used by children moving to and from school.</td>
</tr>
<tr>
<td>• Mid-block locations clearly visible to approaching motorists.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inappropriate Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>• At locations other than near schools.</td>
</tr>
<tr>
<td>• Adjacent to intersections and roundabouts where turning vehicles may conflict with the crossing.</td>
</tr>
<tr>
<td>• Where an alternative pedestrian crossing has been provided such as a signalised intersection where pedestrians are fully protected by vehicle signals, a mid-block signalised crossing or a grade separated crossing.</td>
</tr>
</tbody>
</table>

### Warrant

A location may be approved as either a Type ‘A’ or a Type ‘B’ crossing. Both have similar legal significance but differ as follows:

- Type ‘A’ may be provided were a minimum of 20 student pedestrians and 200 vehicle movements occur in an hour with a minimum pedestrian/vehicle conflict of 15,000. This conflict warrant is only a guide and other factors may require consideration.

- Type ‘B’ may be provided where the warrant for a Type ‘A’ crossing is not satisfied.

Application for a children’s crossing can only be accepted from the school principal or recognised parent/teacher organisation. The application is made to the Police Traffic Branch’s School Crossing Section which is responsible for carrying out the investigation and presenting the results to the School Crossings Road Safety Committee for its consideration.

Following the approval of a children’s crossing, a trained crossing warden is appointed by the Police. The warden in control of a Type ‘A’ crossing is paid by the Police and a Type ‘B’ crossing by the school. Traffic signs, pavement markings, bollards and flags used by the warden are provided and maintained by Main Roads. The Local
Government or Main Roads (where the crossing is on a highway or main road) is responsible for any road modifications that may be required as part of the crossing installation.

**Innovations**

Flashing lights and red and white striped signal posts have been trialled to improve the visibility of the crossings. However, this facility is costly and should be used sparingly.

![Innovative crossing in Albany](image-url)
Main Roads Western Australia
Pedestrian Crossings – Warrants and Crossing Times

TRAFFIC SIGNAL CONTROLLED CROSSINGS

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<th>SIGNALISED INTERSECTIONS</th>
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<td>• Parallel Pedestrian Crossings - No Protection by Vehicle Signals</td>
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<tr>
<td>• Timings</td>
<td>• Parallel Pedestrian Crossings - Partial Protection by Vehicle Signals</td>
</tr>
<tr>
<td>• Staged Crossings</td>
<td>• Parallel Pedestrian Crossings - Full Protection by Vehicle Signals</td>
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<tr>
<td>• Left Turn Slip Lanes</td>
<td>• Exclusive Pedestrian Phase</td>
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<td></td>
<td><strong>MID-BLOCK SIGNALISED CROSSINGS</strong></td>
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<tr>
<td></td>
<td>• Pelican Crossings</td>
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<tr>
<td></td>
<td>• Puffin Crossings</td>
</tr>
</tbody>
</table>

GENERAL

**Signal Displays**

**Symbolic Pedestrian Signals**

Symbolic pedestrian signals and audible tactile facilities are now installed at all signalised intersections which adjoin a footpath or shared path on more than one side.

The signals consist of a red aspect displaying a standing figure above a green aspect displaying a green walking figure.

All parallel pedestrian crossings, crossings with an exclusive pedestrian phase and mid-block signalised pedestrian crossings use symbolic pedestrian signals.

**Circular Pedestrian Signals**

Many existing signalised intersections have circular pedestrian signals which are progressively being replaced with symbolic pedestrian signals.

Circular pedestrian signals allow pedestrians to cross the road at any time when the green signal is displayed but do not provide any indication when they are
Main Roads Western Australia  
Pedestrian Crossings – Warrants and Crossing Times

| about to change. |  |
| Intersections with circular pedestrian signals do not protect pedestrians by preventing vehicle turning movements and rely on turning vehicles to give way to pedestrians crossing the road. |  |

**Example**

Vehicles turning right out of Milligan Street often fail to give way to pedestrians crossing Wellington Street with a green circular pedestrian signal.

![Wellington Street/Milligan Street, Perth](image)

**Example**

Pedestrian signals must be clearly visible to pedestrians crossing the road. In this example, the circular signals on the other side of the road are shielded by a visor and cannot be seen by pedestrians.

![Wellington Street/King Street, Perth](image)
**Main Roads Western Australia**

**Pedestrian Crossings – Warrants and Crossing Times**

**Timings**

The timings for symbolic pedestrian signals generally comprise:

- **Walk period** (green figure) - minimum 6 seconds; and
- **A clearance period** (red flashing figure) - based on a walking speed of 1.2 m/sec.

At crossings with circular pedestrian signals, push buttons are generally provided which extend the normal green time to give pedestrians sufficient time to cross the road.

The cycle times at coordinated intersections are generally very long and pedestrians may have to wait over 2 minutes to cross the road. Long delays tend to frustrate pedestrians and often results in failure to observe the pedestrian signals, as shown in this example.

**Staged Crossings**

Staged pedestrian crossings may be considered where a single crossing is impractical, such as at wide roads and complex intersections.

Staged crossings are usually offset so that it is clear that the crossings are separately controlled. Visors or louvres may be used to screen pedestrian signals that operate separately.

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Wellington Street/William Street, Perth

Karrinyup Road, Karrinyup
Main Roads Western Australia
Pedestrian Crossings – Warrants and Crossing Times

Left Turn Slip Lanes

Left turn slip lanes under Give Way control at signalised intersections may require crossing markings to ensure the safety of pedestrians.

If more than one slip lane exists at an intersection and one of the slip lanes meets requirements for crossing markings to be installed, then all slip lanes should be provided with similar markings.

The treatment of free flowing slip lanes is similar to slip lanes under Give Way control.

Crosswalk Markings

Pedestrian guide lines should be installed across slip lanes where in the same hour:

- pedestrian volumes exceed 10 per hour; and
- vehicular traffic exceeds 100 per hour.

Zebra Crossings

Zebra crossing markings should be installed across slip lanes where in the same hour:

- pedestrian volumes exceed 20 per hour; and
- vehicular traffic exceeds 200 per hour.
**Main Roads Western Australia**  
**Pedestrian Crossings – Warrants and Crossing Times**

## SIGNALISED INTERSECTIONS

### Parallel Pedestrian Crossings - No Protection by Vehicle Signals

<table>
<thead>
<tr>
<th><strong>Description</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrian and vehicle signals turn green simultaneously allowing pedestrians to cross a signalised intersection in parallel with the traffic flow and at the same time. Turning vehicles are legally required to give way to pedestrians. There are no intersections in Perth currently with this type of pedestrian crossing. All parallel pedestrian crossings with symbolic pedestrian signals are either partially or fully protected by vehicle signals.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Advantages</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Only delays to motorists are when turning vehicles give way to pedestrians.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Disadvantages</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Some turning motorists may not give way to pedestrians.</td>
<td></td>
</tr>
<tr>
<td>Some pedestrians may hesitate, thereby encouraging vehicles to turn in front of them.</td>
<td></td>
</tr>
<tr>
<td>Some pedestrians assume that turning vehicles will give way and may not take adequate care.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Preferred Locations</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Where turning traffic has clear sight lines to pedestrians.</td>
<td></td>
</tr>
<tr>
<td>Where turning volumes are low.</td>
<td></td>
</tr>
<tr>
<td>Where turning speeds are low.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Inappropriate Locations</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intersections meeting the conditions for full protection by vehicle signals.</td>
<td></td>
</tr>
</tbody>
</table>
Parallel Pedestrian Crossings - Partial Protection by Vehicle Signals

**Description**
Parallel pedestrian crossings partially protected by vehicle signals allow pedestrians to cross a signalised intersection in parallel with the traffic flow after being given a head start.

Protection is provided at the start of the pedestrian phase by preventing vehicles turning with a red signal. At the end of the start period, the red signal is removed and turning vehicles are required to give way to pedestrians. The start period is generally 3-5 seconds.

Motorists are prevented from turning using:
- red circular displays that delay the start of the green vehicle display; or
- red left and right turn arrows.

**Advantages**
- Minor delays to motorists.

**Disadvantages**
- Some turning motorists may not give way to pedestrians after the red signal is removed.
- Pedestrians assume that turning vehicles will give way after the start period and may not take adequate care.

**Preferred Locations**
- Intersections where some protection for pedestrians is required but traffic conditions do not require the crossing to be fully protected by vehicle signals.

**Inappropriate Locations**
- Intersections where full protection by vehicle signals is preferred.
Parallel Pedestrian Crossings - Full Protection by Vehicle Signals

**Description**
Fully protected parallel crossings allow pedestrians to cross a signalised intersection in parallel with the traffic flow under full protection by vehicle signals. All vehicles are prohibited from turning during the full pedestrian phase using red left and right turn arrows.

![Barrack Street/Roe Street, Perth](image)

**Advantages**
- Pedestrians using the crossing do not have to watch for turning vehicles (except where the turn movement is under Give Way control).
- Suitable for use by children, the elderly or people with disabilities.

**Disadvantages**
- Delays to through traffic and also turning traffic where turn lanes are not provided.

**Preferred Locations**
Intersections where one or more of the following conditions are met:
- The sight distance between motorists and pedestrians is less than the stopping distance for typical vehicle speeds near the intersection.
- The volume of heavy vehicles turning across the pedestrian footway exceeds 50 vehicles per hour for each of the same 4 hours of a normal weekday.
- There has been more than one recorded vehicle versus pedestrian fatality in the previous twelve months.
- More than one lane of turning traffic is permitted with pedestrian movements.
- Left and right turn lanes are provided.
- There is significant use by children, the elderly or people with disabilities.

**Inappropriate Locations**
Main Roads Western Australia
Pedestrian Crossings – Warrants and Crossing Times

- Intersections that do not meet any of the conditions for preferred locations.

Exclusive Pedestrian Phase

Description
An exclusive pedestrian phase allows pedestrians to cross in all directions simultaneously in one movement with full protection from all traffic movements under signal control.

Crossings with an exclusive pedestrian phase may also incorporate supplementary parallel crossing sequences where the intersection geometry permits i.e. intersections of one-way roads.

Wellington Street/William Street, Perth

Advantages
- Pedestrians using the crossing are fully protected.
- Suitable for use by children, the elderly and people with disabilities.

Disadvantages
- Significant delays to traffic movements.

Preferred Locations
Intersections where all of the following conditions are met:
- None of the roads is a declared highway or main road.
- The intersection is located in a central business area or major shopping area.
- An equivalent or better alternative route is available for through traffic to avoid the intersection.
- The signal installation will operate with no more than two vehicle phases per cycle.
- The pedestrian movements in all directions are significant and continuous. This condition can be assumed to be met where for each of any four hours of a normal weekday, all pedestrian movements in all directions exceed 200 persons per hour.
- Vehicular turning movements at the intersection are sufficiently high to
impede reasonable pedestrian movement. This condition can be assumed to be met where for each of the same four hours of a normal week day, all vehicular turning movements in all directions exceed 400 vehicles per hour.

**Inappropriate Locations**

- Intersections that do not meet all the conditions for preferred locations.
### Pelican Crossings

**Description**

Pelican crossings (Pedestrian Light Control Crossing) are pedestrian activated traffic signals located at mid-block locations. They are used where pedestrian crossing activity is concentrated along short sections of road carrying high traffic volumes.

The signal sequence is similar to signals at signalised intersections except that a flashing yellow period is included for motorists soon after the display of the flashing red figure commences for pedestrians. Drivers may then proceed through the crossing with caution during the flashing yellow phase but must give way to pedestrians still on the crossing.

**Advantages**

- Pedestrians using the crossing are protected.
- Suitable for pedestrians with a visibility or mobility impairment.
- Delays to motorists are minimised due to the inclusion of a flashing yellow phase.

**Disadvantages**

- Expensive to install and maintain.
- Slow pedestrians may still be on the road when vehicles are released.
- Vehicles are unnecessarily held when the crossing is clear.

**Preferred Locations**

- Locations with high pedestrian crossing volumes and high traffic volumes.

**Inappropriate Locations**

- Where pedestrians cross over a long section of road.
- Where pedestrian crossing volumes and traffic volumes are low.
- Close to a signalised intersection.

**Warrant**

<table>
<thead>
<tr>
<th>Wellington Street, Perth</th>
<th>Wellington Street, Perth</th>
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</thead>
<tbody>
<tr>
<td>Wellington Street, Perth</td>
<td>Wellington Street, Perth</td>
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</tbody>
</table>

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**MID-BLOCK SIGNALISED CROSSINGS**

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**City of Kalamunda**

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**Attachment 10.4.10.1**

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**Ordinary Council Meeting - 30 April 2019 Attachments**
A pelican crossing may be provided if any of the following conditions exist:

(a) For each of 3 hours on an average day:
   • the pedestrian volume exceeds 350 persons per hour; and
   • the traffic volume of the road exceeds 600 veh/hr (total both directions) or 1000 veh/hr (total both directions) where there is a central pedestrian refuge.

(b) For each of 8 hours on an average day:
   • the pedestrian volume exceeds 175 persons per hour; and
   • the traffic volume of the road exceeds 600 veh/hr (total both directions) or 1000 veh/hr (total both directions) where there is a central pedestrian refuge; and
   • there is no zebra crossing, footbridge or underpass within a reasonable distance.

(c) At a school where, in two separate one hour periods of a typical school day, there are no fewer than 50 persons crossing the roadway and at least 600 vehicles pass the site subject to the product of the number of pedestrians per hour and vehicles in the same hour exceeding 40,000.

(d) The pedestrian and traffic volume is sufficient to justify a zebra crossing but pedestrians would be in danger on an ‘unprotected’ pedestrian crossing. This could be due to the width of carriageway, traffic speed or traffic volume.

(e) A zebra crossing exists and two or more pedestrian accidents of the type susceptible to the correction by signals have occurred on or near the crossing within the past three years.

(f) A zebra crossing is justified and pedestrian volumes are very heavy and coincide with high traffic volumes to the extent that excessive delays to road traffic are likely.
**Main Roads Western Australia**

**Pedestrian Crossings – Warrants and Crossing Times**

| (g) | The site is in an area where the 85<sup>th</sup> percentile speeds are less than 80 km/h. |

**Puffin Crossings**

- **Preferred Locations:**
  - Across freeways and other high standard roads.
  - Across major non-freeway roads where alternative pedestrian crossing facilities are not feasible.
  - Across railway lines.

- **Inappropriate Locations:**
  - Where alternative pedestrian crossing treatments are suitable.