Epping Road widening between Essex Street and Blaxland Road, Epping

Appendix C
Traffic and transport impact assessment Part D

November 2015

Appendix F – Proposed Upgraded Area

N:\AU\Sydney\Projects\21123388\GIS\Maps\Deliverables\21123388_009_Key_Features_of_the_proposal_RevA.mxd

Data Source: NSW Department of Lands: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; NSW Department of Primary Industry - Jan 2014; Imagery (Nearmap 07/11/2014). Created by:qjchung

Figure 1-2
Key features of the proposal

Appendix G – Pedestrian Access Study

Roads and Maritime Services

Epping Road Widening between Essex Street and Blaxland Road at Epping

Pedestrian Access Study

8th October 2015

This report: has been prepared by GHD for Roads and Maritime Services and *may only be used and relied on by Roads and Maritime Services for the purpose agreed between GHD and the Roads and Maritime Services as set out in section 1.4 of this report.*

GHD otherwise disclaims responsibility to any person other than Roads and Maritime Services arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 1.4. of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

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Glossary and abbreviations

Term	Description
EP& A Act	*Environment Planning and Assessment Act 1979*
LGA	Local government area
Mitigation	Reduction in severity
REF	Review of environmental factors
RMS	Roads and Maritime Services
RTA	Roads and Traffic Authority
TfNSW	Transport for NSW
TGSI's	Tactile ground surface indicators
DDA	Disabled Discrimination Act
vph	Vehicles per hour
vpd	Vehicles per day
vtph	Vehicle trips per hour
vtpd	Vehicle trips per day

1. Introduction

1.1 Background

Roads and Maritime Services (Roads and Maritime) is proposing to upgrade about 500 metres of Epping Road, between Blaxland Road and Essex Street in Epping (referred to as 'the proposal' for the purposes of this report). The proposal includes upgrading key intersections to improve active transport and traffic flows, as well as the construction of a median separating Epping Road. The proposal is likely to cause traffic diversions to other roads in the vicinity and the implications of the proposal on pedestrians will be examined in this study. Details of the proposed upgrades can be found in section 4.

The continued growth and development of the Epping town centre, as proposed by the *Epping Town Centre Study*, and the planning for the Epping Town Centre Urban Activation Precinct, will result in an increase in traffic demand on major regional road links to the town centre. The proposal is needed to improve traffic flows and access to the centre. It is needed to fulfil the commitments of the NSW Government, as confirmed by the 2012/13 budget, to improving the road network within and in the vicinity of the town centre.

A pedestrian access study is required to inform the Review of the Environmental Factors (REF), to assess the potential impacts of the proposal on pedestrians in the area.

1.2 Purpose of this report

This pedestrian access study has been prepared as an input to the REF.

This study has been prepared to assess pedestrian accessibility within the study area and impacts from the proposal and is structured as follows:

- Section 2 *Existing pedestrian and mobility review:* provides a list of the issues, constraints and opportunities for pedestrian access and movement
- Section 3 *Crash data review:* this section provides a review of crash data within the study area with a particular focus on any pedestrian crashes
- Section 4 *Proposed road network improvements*: provides details of the proposal
- Section 5 *Pedestrian impact assessment*: Reviews the impact to pedestrians that the proposal may have
- Section 6 *Planning for pedestrians*: provides an overview of best practice standards that apply to the treatment of pedestrian facilities
- Section 7 *Proposed pedestrian improvements*: a list of potential pedestrian improvements is given with the different types of infrastructure to improve safety, amenity and access for pedestrians
- Section 8 *Conclusions and recommendations*: provides the key findings in the study, with a list of recommendations.

1.3 Study area

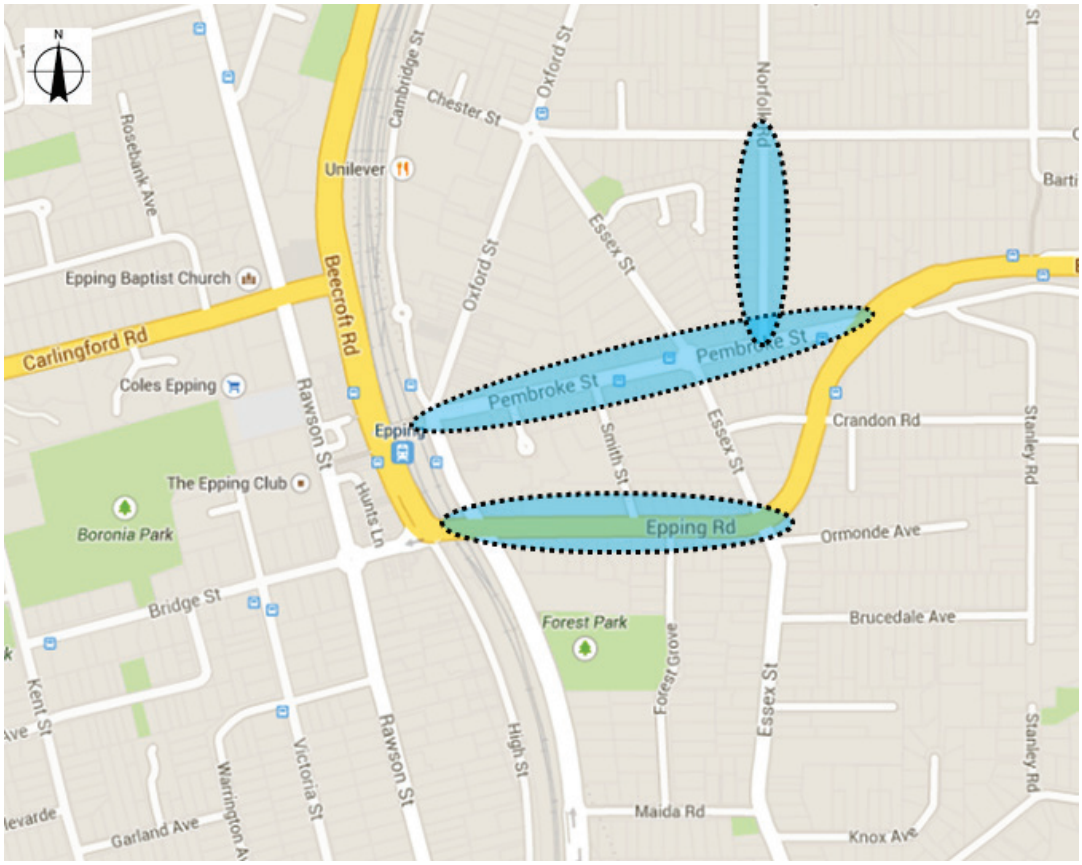
The proposal is located about 15 kilometres north-west of the Sydney central business district. The proposal also includes upgrading the intersection of Essex Street and Epping Road.

The study area for the pedestrian access study is:

- Pembroke Street between Langston Place and Epping Road
- Epping Road between Langston Place and Essex Street
- Norfolk Road between Pembroke street and Chester Street

The study area is located east of the Epping train station.

The study area is surrounded mostly by residential properties to the north and south and is shown in Figure 1.



Source: Google Maps 2014, modified by GHD

Figure 1 Study area

1.4 Study assumptions and limitations

The following assumptions have been used in conducting this study:

- No future growth of pedestrians and traffic volumes is considered in this study
- Traffic diversion assumptions are based on the shortest distance possible provided in the Traffic Impact Assessment report
- Pedestrian desire lines are based on traffic and pedestrian survey data collected by TTM and Skyhigh traffic survey companies.

2. Existing pedestrian and mobility review

This section provides an understanding of existing pedestrian infrastructure and identifies issues to be addressed through the improvements to pedestrian infrastructure. The outputs of this section constitute the development of pedestrian infrastructure improvement options.

A review of existing conditions in the study area was undertaken. The review focused on identifying existing facilities, land uses, any shortcomings in the pedestrian environment and potential safety issues. The review has been developed through:

- Traffic and pedestrian counts at relevant intersections on 13th and 16th August 2014
- Midblock pedestrian counts on 18th September 2014 and the 4th and 7th March 2015
- Three site inspections, which were conducted on 28th August, 29th August and 26th September 2014.

2.1 Traffic and pedestrian surveys

2.1.1 Traffic surveys

This study focuses on the impacts to pedestrians during the weekday morning, weekday evening and Saturday peak periods, when demand for traffic capacity in the surrounding network is perceived to be at its highest. This perceived value was calculated by adding consecutive 15 minute period vehicular flow rates from all approaches in the network and finding the maximum value for the hourly intervals. Analysis of the traffic survey data found the peak vehicular hours of the road network occur during the following:

- Weekday morning peak hour between 7.30–8.30 am
- Weekday evening peak hour between 5.30–6.30 pm
- Weekend peak hour between 12.30–1.30 pm.

2.1.2 Pedestrian surveys

Pedestrian crossing volumes at mid-block sections and intersections were assessed during the following peak hours:

- Weekday morning peak hour between 7.30–8.30 am
- Weekday evening peak hour between 5.00–6.00 pm
- Weekend peak hour between 12.30–1.30 pm.

Pedestrian volumes surrounding Epping Public School were also assessed during the following times:

- School morning peak hour between 8:00–9.00 am
- School afternoon peak hour between 3.00–4.00 pm.

Midblock surveys were carried out along Pembroke Street, from Langston Place to Epping Road, Epping Road from Langston Place to Essex Street as well as Norfolk Road

The surveyed intersections were:

- Langston Place and Pembroke Street (signalised intersection)
- Essex Street and Pembroke Street (priority controlled roundabout)

- Langston Place and Epping Road (signalised intersection)
- Essex Street and Epping Road (signalised intersection).

Pedestrian volumes surrounding Epping Public School were also assessed during the following times:

- School morning peak hour between 8:00–9.00 am
- School afternoon peak hour between 3.00–4.00 pm.

Diagrammatic representations of the pedestrian survey data is shown in Figure 2 with detailed reports found in Appendix B.

Source: Google Maps 2014, modified by GHD

Figure 2 Hourly pedestrian crossing volumes during peak vehicular hours

2.2 Pedestrian peak

The pedestrian peak correlates with the road network peak around the train station. However on Pembroke Street in the vicinity of Epping Public School and on Norfolk Road the pedestrian peak relates to the School start and finish times.

Figure 3 Peak pedestrian crossing volumes in the vicinity of Epping Public School

2.3 Pedestrian desire lines

Pedestrian desire lines are defined as the most favourable route perceived by a pedestrian when walking to a known destination. It takes into account factors such as safety, distance and convenience. Desire lines vary according to each individual.

As seen from the pedestrian survey data, a large portion of pedestrians are found to use designated facilities such as signalised crossing facilities.

Pembroke Street between Langston Place and Chambers Court

This segment has a significant number of pedestrians crossing Pembroke Street without the use of any facilities, even though facilities are located 100 metres away.

Pembroke Street and Essex Street roundabout

Epping Public School is located to the east of the Pembroke Street and Essex Street roundabout. Pedestrian surveys surrounding the School were undertaken in March 2015. It is believed that the pedestrian movements provide a good understanding of those associated with the school and the surrounding area.

A pedestrian refuge island with minimal dimensions can be found on the northern approach of the roundabout, providing access across Essex Street. Pedestrian fencing can also be found in the vicinity of the roundabout which prevents crossing through the roundabout as seen in Photo 1.

Photo 1 North approach pedestrian refuge island and fencing

.

The southern approach of the roundabout does not have any pedestrian crossing facilities, however does have pedestrian ramps shown in Photo 2. This encourages pedestrians to use the ramps and not cross the carriageway too close to the roundabout which could pose as a hazard. Pedestrian surveys show that 60 pedestrians per hour crossed Essex Street from the south approach during the PM peak.

Photo 2 South approach of Pembroke Street and Essex Street roundabout

Pembroke Street between Essex Street and Norfolk Road

Epping Public School is located on the corner of Pembroke Street and Norfolk Road. Pedestrian surveys were taken on a weekday on the 14th May 2015 on Pembroke Street and Norfolk Road in the vicinity of the School.

A pedestrian crossing is located on Pembroke Street east of the Essex Street roundabout, providing access across Pembroke Street (Photo 3). As seen from the pedestrian survey data, no pedestrians were recorded crossing the eastern approach at the roundabout. Pedestrians crossing Pembroke Street from the east approach are most likely using the pedestrian crossing.

A pedestrian crossing is also located on Norfolk Road adjacent to the School entrance. There are kerb ramps at the intersection of Pembroke Street and Norfolk Road.

This pedestrian crossing has a pedestrian refuge in the centre of the road; the refuge island should ideally have keep left signs on the ends in accordance with AS 1742.10 (2009).

Photo 3 Pedestrian crossing, east of Pembroke Street and Essex Street roundabout

Pembroke Street and Norfolk Street intersection

There is currently no pedestrian refuge island on the Norfolk Street approach to Pembroke Street. It is obvious from site inspections that children associated with the School would not cross at this location but be encouraged to walk along Norfolk Street around 60 metres to a pedestrian crossing providing direct access to the school.

Kerb ramps are located on both sides of Pembroke Street on the west side of Norfolk Street which encourage pedestrians to cross at this location.

Norfolk Street between Pembroke Street and Chester Street

There is a pedestrian crossing currently located on Norfolk Road around 60 metres north of Pembroke Street adjacent to Epping Public School.

Photo 4 Norfolk Road – pedestrian crossing adjacent to Epping Public School

Pembroke Street between Norfolk Street and Epping Road

The designated shared path facilities provided at the intersection of Pembroke Street and Epping Road are inadequate in terms of width and visibility.

Photo 5 Pembroke Street, approach to Epping Road

Epping Road between Smith Street and Forest Grove

During the AM peak, 23 pedestrians were recorded to be crossing the four lanes of traffic on Epping Road between Smith Street and Forest Grove. This area can be seen in Photo 6. The nearest signalised pedestrian crossing facilities are located to the east and west of the segment at around 150 metres away.

Photo 6 Epping Road, east of Forest Grove

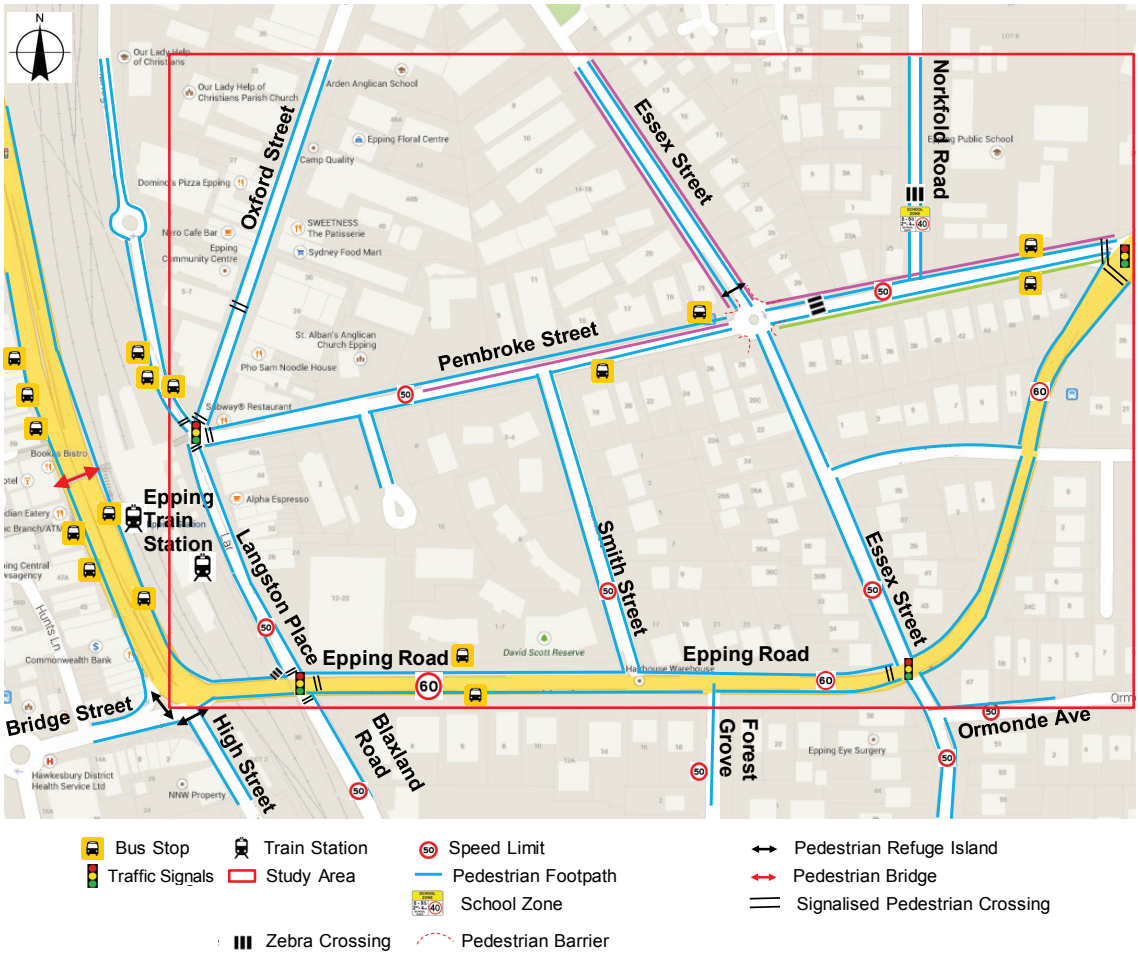
Epping Road between Pembroke Street and Essex Street

There is a significant amount of overhanging vegetation obstructing the existing footpaths on the section of Epping Road between Pembroke Street and Essex Street. There are locations where the footpath is totally blocked through vegetation and power poles located within the footpath and also other areas where overhanging vegetation forces pedestrians to walk right on the kerb edge adjacent to the traffic lane as shown in Photo 7.

Photo 7 Epping Road, south of Pembroke Street

2.4 Existing Pedestrian Infrastructure Map

Existing traffic calming and pedestrian facilities in the study area is shown at Figure 4.

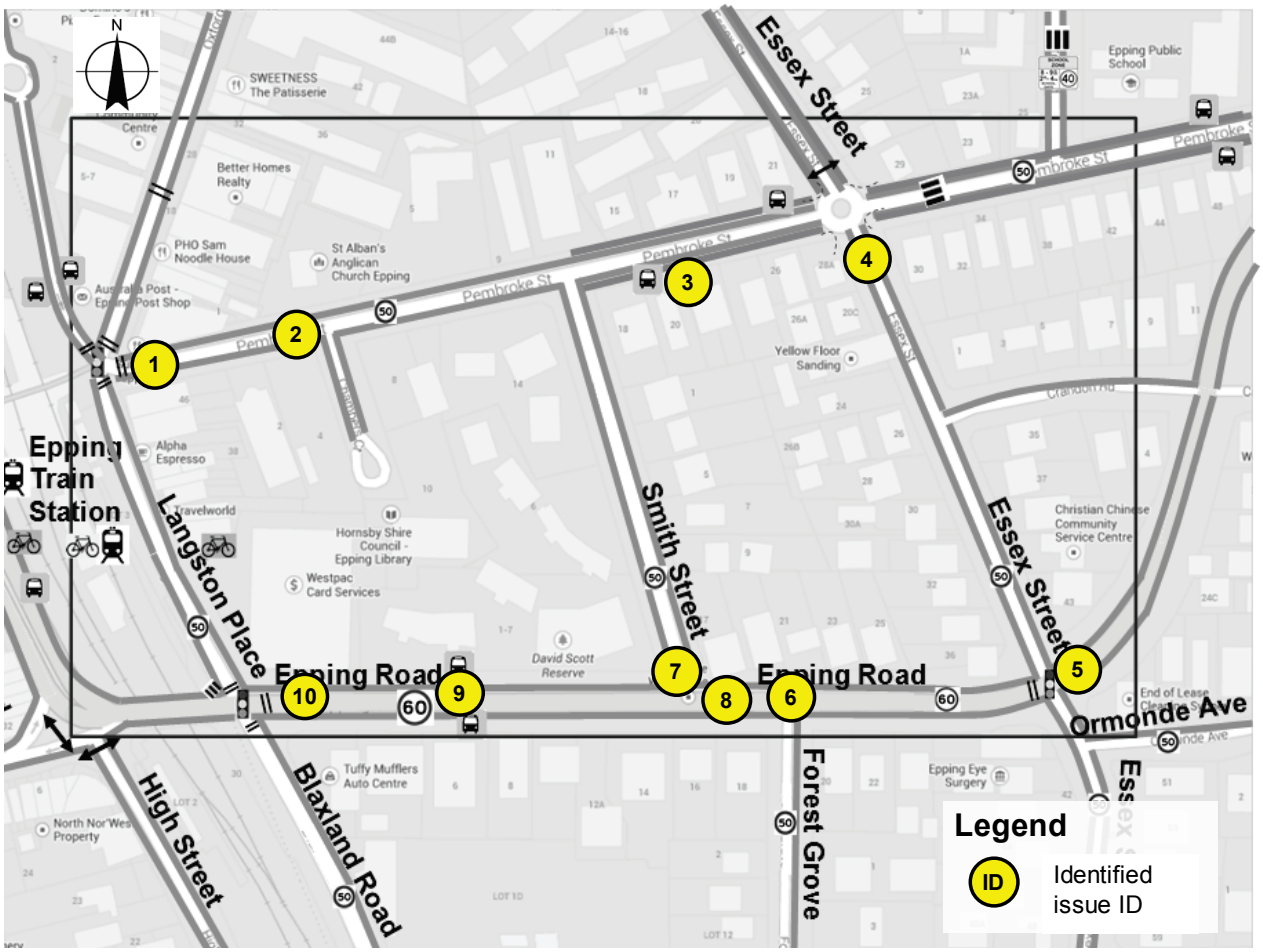


Source: Google Maps 2014, modified by GHD

Figure 4 Existing pedestrian infrastructure map

2.5 Existing issues and constraints review

The issues and constraints for pedestrian access and mobility were determined in a field survey. A summary of the constraint locations are shown in Figure 5 and a description and photos of the corresponding identified issue ID in the tables below.



Source: Google Maps 2014, modified by GHD

Figure 5 Locations of existing issues and constraints for pedestrians

1	Langston Place and Pembroke Street intersection –tactile surfacing not consistent

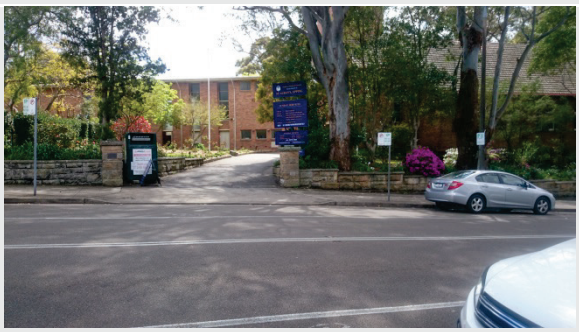
Tactile surfacing is provided on the western side of the intersection from the train station but not on the eastern side of the intersection for those heading to the station from the east.

Southern approach, facing train station with tactile surfacing shown

Southern approach, facing train station from the eastern side, no tactile surfacing

2	Pembroke Street, Bus stop east of Smith Street – High number of pedestrians crossing

A high number of pedestrians cross between Langston Place and Chambers Court. This may be an issue with the expected increase in traffic from the proposal, due to traffic diversions.



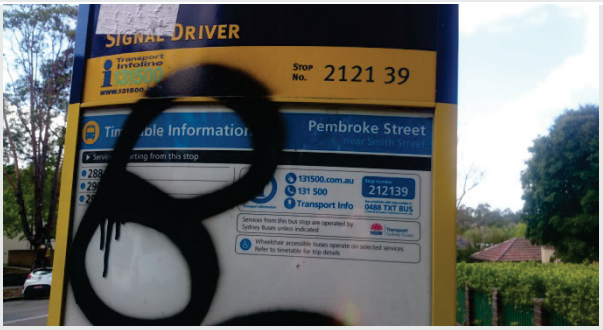
Pembroke Street east of Chambers Court, facing north

Pembroke Street, facing east

3	Pembroke Street, Bus stop east of Smith Street – Poor footpath quality

Passengers alight from bus onto unsurfaced area. Non DDA compliant bus stop

Bus stop number 212139



4	Pembroke Street and Essex Street intersection – No pedestrian crossing facilities

Pedestrian ramps on footpaths across southern leg, however no pedestrian crossing facilities are present such as refuge island or splitter islands.

Essex Street southern approach, facing west

5	Essex Street and Epping Road intersection – Poor pedestrian facilities

Overall, pedestrian mobility is poor at this intersection. No pedestrian crossing facilities currently exist on the eastern, northern and southern approach. Footpaths and ramps are not aligned and are damaged in certain areas.

Damaged footpath on northern approach, east of Essex Street

Southern approach – footpath leads to carriageway and ramps do not align

Southern approach – footpath leads to carriageway and ramps do not align

Southern approach, facing north

6	Epping Road east of Forest Grove – Poor footpath quality

The pedestrian ramp on the eastern side directs pedestrians out into Epping Road. Ramps should be aligned in the direction the pedestrian is to walk. No pedestrian refuge island is provided at this location.

No pedestrian refuge island provided

Pedestrian ramps not aligned correctly

7	Epping Road east of Smith Street

No pedestrian refuge island is provided at this location for crossing Smith Street.

Epping Road east of Smith Street, facing west

8	Epping Road east of Smith Street

A high number of pedestrians cross Epping Road between Smith Street and Forest Grove. This may be an issue with the additional westbound lane with the Epping Road widening proposal.

Epping Road east of Forest Grove, facing west

Epping Road east of Smith Street, facing west

9	Epping Road west of Smith Street – Poor footpath quality

Passengers alight from bus onto unsurfaced area for bus stop numbers 2121214 and 2121216. Non DDA compliant bus stop

Bus stop number 2121214

Unsurfaced area

10	Langston Place and Epping Road intersection – Poor footpath quality

South eastern corner pedestrian ramps do not align with the north eastern pedestrian crossing, making it difficult for pedestrians to manoeuvre. No tactile surfacing can be found on all approaches of the pedestrian crossings.

Facing south from Epping Road

No tactile surfacing

11	Pembroke Street and Epping Road intersection – Poor footpath quality

South eastern corner pedestrian ramps non-standard with signal pole blocking access to pedestrian ramp, making it difficult for pedestrians to manoeuvre. No tactile surfacing can be found on all approaches of the pedestrian crossings.

Source: Google street view

Facing south from Epping Road/ Pembroke Street

12	Pembroke Street and Epping Road intersection – Shared Path Facilities

The shared path facilities provided at the crossing location on the eastern side of Epping Road crossing to the southern side of Pembroke Street are too narrow to be a shared facility. When cyclists reach the southern side of Pembroke Street a cycle symbol is located on the narrow footpath with another cycle symbol located on the road 50 metres east – there is no kerb cut down or connection to link the two.

Facing east on Epping Road opposite Pembroke Street

South-west end of Pembroke Street

13	Norfolk Street Pedestrian Crossing

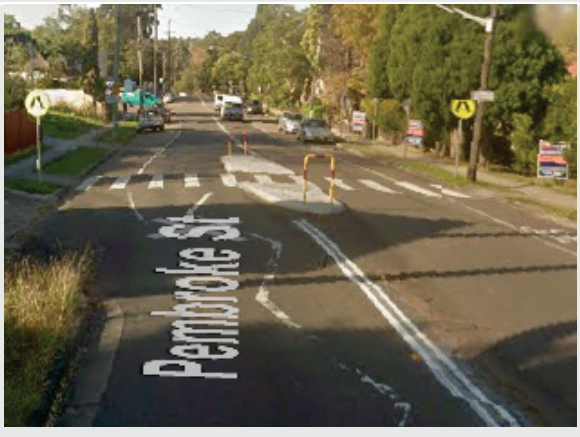
The School pedestrian crossing on Norfolk Street has a refuge island in the middle. The refuge island does not have any 'keep left' signage on the refuge island. In accordance with AS 1742.10 – 2009 refuge islands should ideally have a 'Keep Left' sign (R2-3 (L)) installed on both approaches.

Source: Google street view

Norfolk Street Pedestrian Crossing

14	Pembroke Street Pedestrian Crossing

The pedestrian crossing on Pembroke Street has a refuge island in the middle. The refuge island does not have any 'keep left' signage on the refuge island. In accordance with AS 1742.10 – 2009 refuge islands should ideally have a 'Keep Left' sign (R2-3 (L)) installed on both approaches.



Source: Google street view

Pembroke Street Pedestrian Crossing

15	Pembroke Street – West of Epping Road

Passengers alight from bus onto unsurfaced area for bus stop numbers 2121223 and 2121218. Non DDA compliant bus stop

Bus stop number 2121223

Bus stop number 2121218

16	Pembroke Street – on approach to Epping Road

The shared path reduces to around 1.2 metres on approach to Epping Road. The path is too narrow to be a designated shared path and there is no visibility on oncoming pedestrians or cyclists due to the horizontal alignment and vegetation growth.

Shared path too narrow

Shared path too narrow and lack of visibility

17	Epping Road – south of Pembroke Street, west side

The footpath is obstructed by poles and overgrowing vegetation that needs to be cut back and maintained.

Over hanging vegetation

Footpath totally blocked through poles and overhanging vegetation

18	Pembroke Street – Essex Street to Epping Road

This road is directly adjacent to a School. Even though the Schools main entrance is on Norfolk Street this section of road is highly pedestrianised with school children and a pedestrian crossing. This section of road should be a school zone with reduced speed limit in school start and finish times. Especially given the traffic in this section will be increased as a result of the improvements to Epping Road.

This section of Pembroke Street should be a designated school zone.

3. Crash data review

3.1 Crash statistics

Roads and Maritime supplied crash statistics for roads within the study area used for the Epping Road widening project over a five year period between (July 2009 and June 2014). This crash data was used to determine the main factors contributing to crashes within the study area covered by this pedestrian access study. The extended study area for the crash data is shown in Figure 6, with a detailed report of the data supplied in Appendix A.

A total of 125 crashes were recorded within the study area. These crashes involved 134 light vehicles and five heavy vehicles. Five pedestrian crashes were recorded, of these all involved pedestrians crossing the carriageway.

Figure 6 Crash statistic study area

Source: Google Maps 2014, modified by GHD

3.1.1 Langston Place

One pedestrian related incident occurred at the intersection of Langston Place and Cambridge Street Intersection. This involved a vehicle going through Langston Place to Cambridge Street, colliding with the pedestrian crossing Langston Place at the intersection. A near side collision (RUM code 0) was recorded. The intersection is fully signalised with pedestrian crossing facilities on all approaches.

In total, there were eight crashes recorded along Langston Place within the study area. Of these:

- Two (25%) incidents resulted in injuries
- Six (75%) incidents occurred at an intersection
- One (13%) incident involved a pedestrian
- three (38%) incidents involved through and opposite right turn movements.

3.1.2 Pembroke Street

One pedestrian related incident occurred along Pembroke Street, 10 metres east of Chambers Court. This involved a vehicle travelling west on Pembroke Street, colliding with the pedestrian crossing Pembroke Street. An emerging type collision was recorded (RUM code 1)

In total, there were eight crashes recorded along Pembroke Street within the study area. Of these:

- Two (25%) incidents resulted in injuries
- Five (63%) incidents occurred at intersections, two at Chamber Court T-junction and 3 at Norfolk Road T-junction
- One (13%) incident occurred at the Essex Street roundabout
- One (13%) incident involved a pedestrian.

3.1.3 Essex Street

One pedestrian related incident occurred along Essex Street, 50 metres north of Maida Road. This involved a vehicle travelling north on Essex Street, colliding with a pedestrian crossing Essex Street. A far side collision was recorded (RUM code 2)

In total, there were six crashes recorded along Essex Street within the study area. Of these:

- Three (50%) incidents resulted in injuries
- Two (33%) incidents occurred at the Pembroke Roundabout
- One (17%) incident occurred at the Ormonde Avenue and Essex Street intersection, where a right turning vehicle collided with a vehicle heading north in Essex Street.
- Two (33%) incidents involved cross traffic collisions at the Pembroke Street and Essex Street Roundabout.
- One (17%) incident involved a pedestrian.

3.1.4 Forest Grove

One pedestrian related incident occurred near the intersection of Forest Grove and Epping Road intersection. This involved a vehicle turning from Epping Road to Forest Grove, colliding with the pedestrian crossing Forest Grove at the intersection. A near side collision (RUM code 0) was recorded.

In total, there were two crashes recorded along Forest Grove within the study area. Of these:

- Both incidents resulted in injuries
- In addition to the pedestrian incident another incident occurred in Forest Grove, 20 metres south of Epping Road which involved a vehicle parking manoeuvre.

3.1.5 Blaxland Road

One pedestrian related incident occurred at the intersection of Epping Road and Blaxland Road. This involved a vehicle turning right from Epping Road to Blaxland Road, colliding with the pedestrian crossing Blaxland Road at the intersection. A near side collision (RUM code 0) was recorded. Signalised pedestrian crossing facilities are provided on Blaxland Road.

In total, there were 22 crashes recorded on Blaxland Road within the study area. Of these:

- Eight (32%) incidents resulted in injuries
- Seventeen (77%) incidents occurred at intersections
- Five (31%) incidents involved cross traffic collisions
- Five (31%) incidents involved through and opposite right turn movements
- Three (19%) incidents involved rear end collision with vehicles in the same lane direction
- One (5%) incident involved a pedestrian.

3.1.6 Epping Road

In total, there were 55 crashes recorded along Epping Road within the Epping Road widening project study area. Of these:

- 20 (36%) incidents resulted in injuries
- Thirty Five (64%) incidents occurred at an intersection
- Eight (15%) incidents occurred at the intersection of Pembroke Street and Epping Road
- Seven (13%) incidents occurred at the intersection of Blaxland Road and Epping Road
- Seven (13%) incidents occurred at the intersection of Smith Street and Epping Road
- Six (11%) incidents occurred at the intersection of Crandon Road and Epping Road
- Five (9%) incidents occurred at the intersection of Essex Street and Epping Road
- 2 (4%) incidents occurred at the intersection of Forest Grove and Epping Road
- Twenty Five (45%) incidents involved rear end collisions
- No pedestrian incidents were recorded.

3.1.7 Oxford Street

In total, there were 10 crashes recorded along Oxford Street within the Epping Road widening project study area (i.e. between Pembroke Street and Surrey Street). Of these:

- 3 (30%) incidents resulted in injuries
- 3 (30%) incidents occurred at Pembroke Street and Oxford Street intersection
- 4 (40%) incidents occurred at roundabouts, which two of these were located at Chester Street roundabout and other two located at Surrey Street roundabout
- 2 (20%) incidents involved rear end collision with vehicles in the same lane direction
- 2 (20%) incidents involved adjacent cross traffic collisions
- 2 (20%) incidents involved adjacent cross traffic collisions
- No pedestrian incidents were recorded.

3.1.8 Chester Street

In total, there were five crashes recorded along Chester Street within the Epping Road widening project study area (i.e. between Cambridge Street and Norfolk Road). Of these:

- 2 (40%) incidents resulted in injuries
- All (100%) incidents occurred at Norfolk Road and Chester Street intersection
- 4 (80%) incidents involved cross traffic collisions
- No pedestrian incidents were recorded.

3.1.9 Norfolk Road

In total, there were two crashes recorded along Norfolk Road within the Epping Road widening project study area. Of these:

- One incident resulted in injuries
- All (100%) incidents were recorded at Norfolk Road and Surrey Street intersection
- All (100%) incidents involved cross traffic collisions
- No pedestrian incidents were recorded.

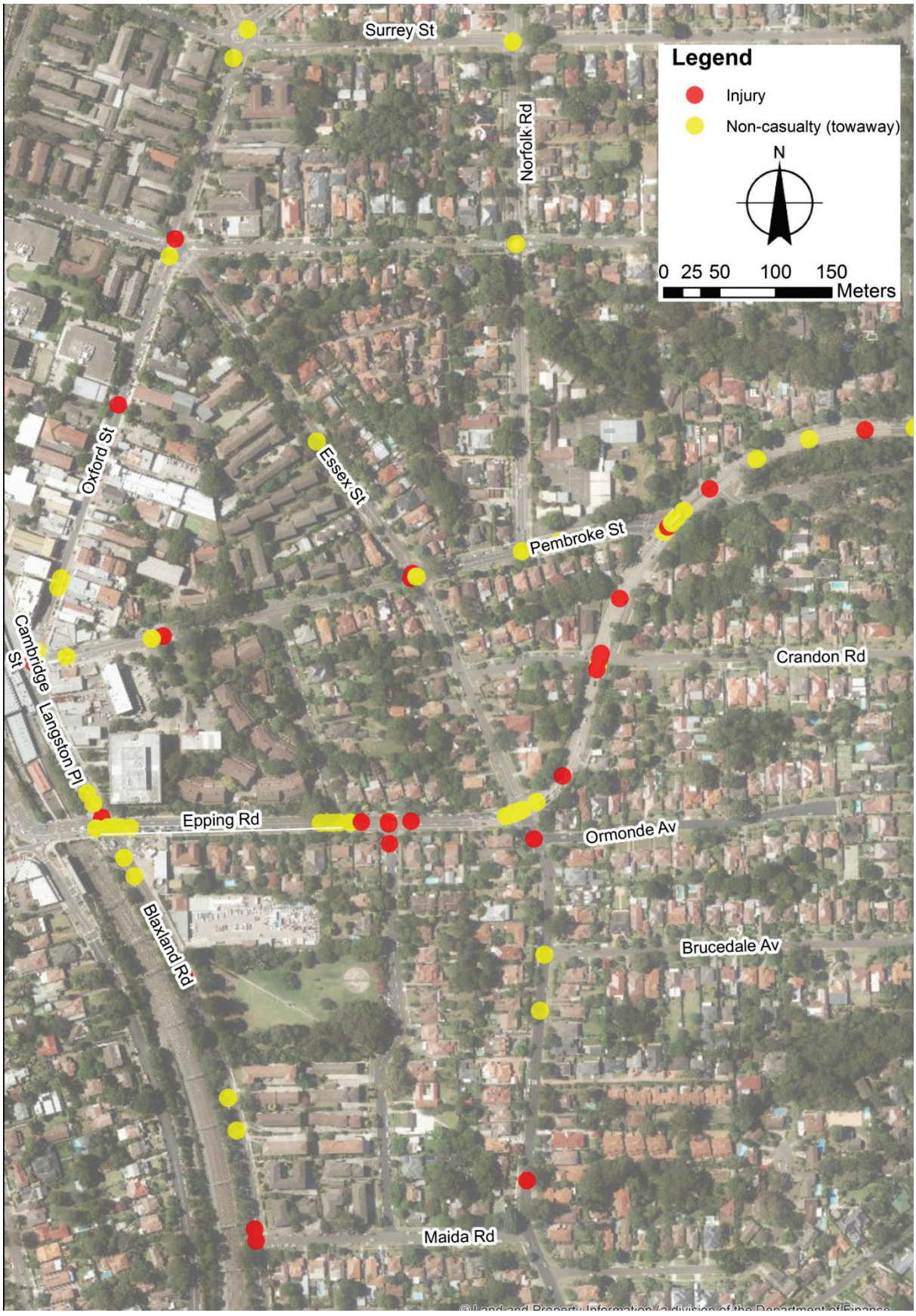
3.1.10 Vehicle crash data review

A high level assessment was undertaken of vehicle crash data for the study area for the years 2009 to 2014, based on the Roads and Maritime crash data. Within the five-year period, 125 crashes were recorded in the study area, which is illustrated in Figure 6. The following key points were noted from the assessment of this data:

- 26 crashes (44%) occurred along Epping Road
- 89 crashes (71%) occurred at Intersections
- 45 crashes (36%) involved injuries
- No fatalities were recorded
- Five crashes (4%) involved pedestrians, all of which resulted in injuries.

It should be noted that the crash data presented is based on NSW Police reports, which generally under-represent the incidence of pedestrian and cyclist related crashes due to some of these incidents not being reported. This is due to the fact that many minor pedestrian incidents do not result in tow-away crashes where police are called and the incident therefore goes unrecorded.

Figure 7 Crash locations map



4. Proposed road network improvements

4.1 Proposal overview

Roads and Maritime proposed to upgrade about 500 metres of Epping Road, between Blaxland Road and Essex Street, and around 80 metres east of Essex Street, in Epping. The key features of the proposal are summarised below and are illustrated on Figure 8:

- Providing an additional westbound lane by widening the southern side of Epping Road by about 3.7 metres between Essex Street and Blaxland Road, this becomes a dedicated left turn lane into Blaxland Road.
- Upgrading the intersection of Epping Road and Essex Street:
  - Widening on the north-eastern side of the intersection to provide an additional right turn lane into Epping Road (westbound). This will provide two marked right turn lanes, and an unmarked left/through lane;
  - Widening on the south-western side of the intersection to provide a left turn lane from Essex Street onto Epping Road (westbound);
  - Removing the right turn movement from Epping Road to Essex Street in both directions;
  - Providing three new traffic light controlled pedestrian crossings.
- Removing the right turn movement from Langston Place into Epping Road in the westbound direction for all traffic.
- To widen 80 metres of the northern side of Epping Road east of Essex Street.
- Construction of a raised median (about 340 metres long) along Epping Road, between Langston Place/Blaxland Road and just west of Essex Street. This would restrict access from Epping Road to Forest Grove and Smith Street, and to residential properties along this section of Epping Road, to left-in and left-out only.
- Constructing a raised median about 20 metres long on Essex Street north of the Epping Road intersection.
- Constructing a 1.2 metre wide pedestrian pathway on Epping Road.

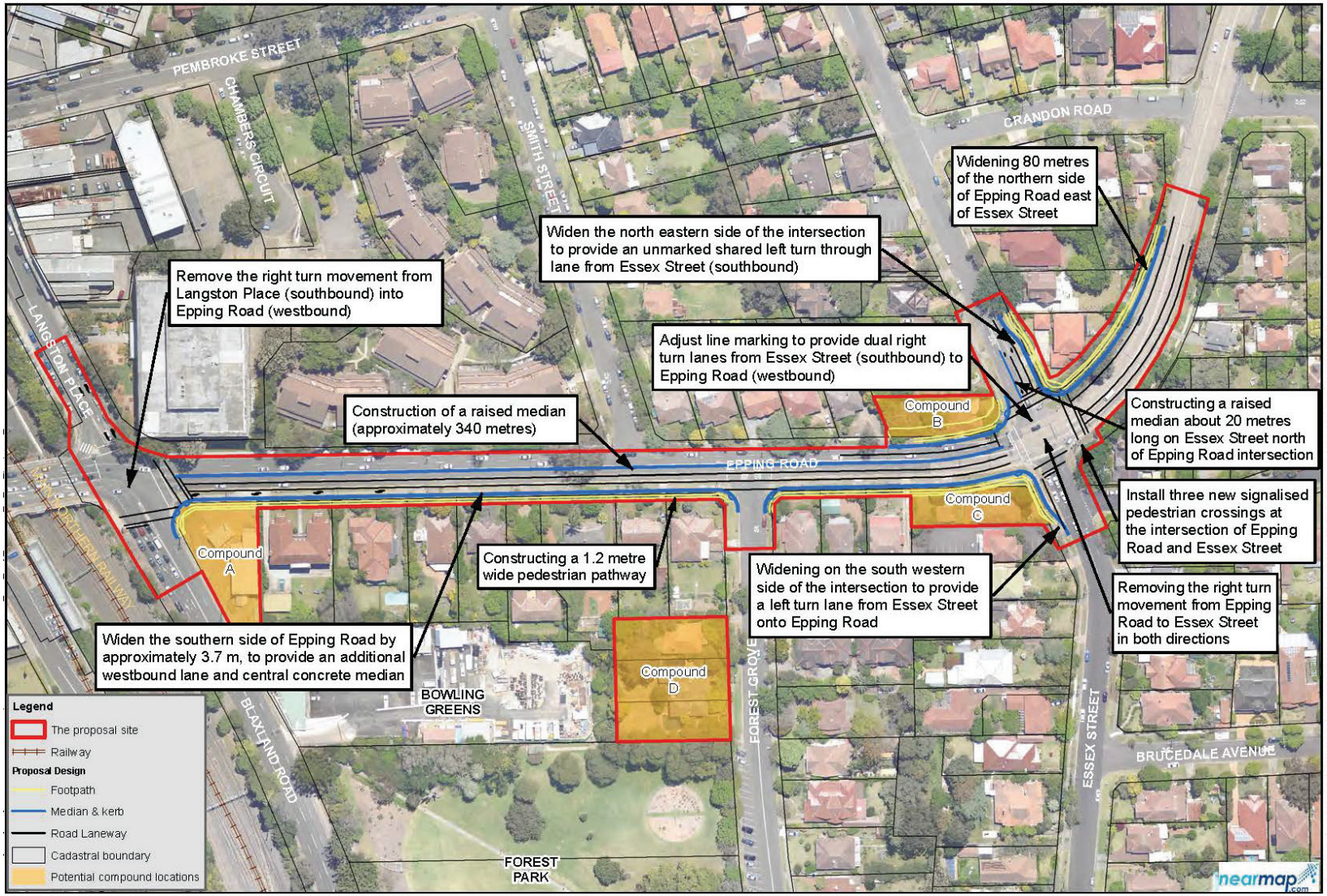


Figure 8 The proposal

4.1.1 Intersection upgrades

Langston Place/Blaxland Road intersection

Part of the proposed upgrades involves banning the right turn from Langston Place (southbound) into Epping Road (westbound). These works would only be carried out along the carriageway, and would not affect adjacent properties.

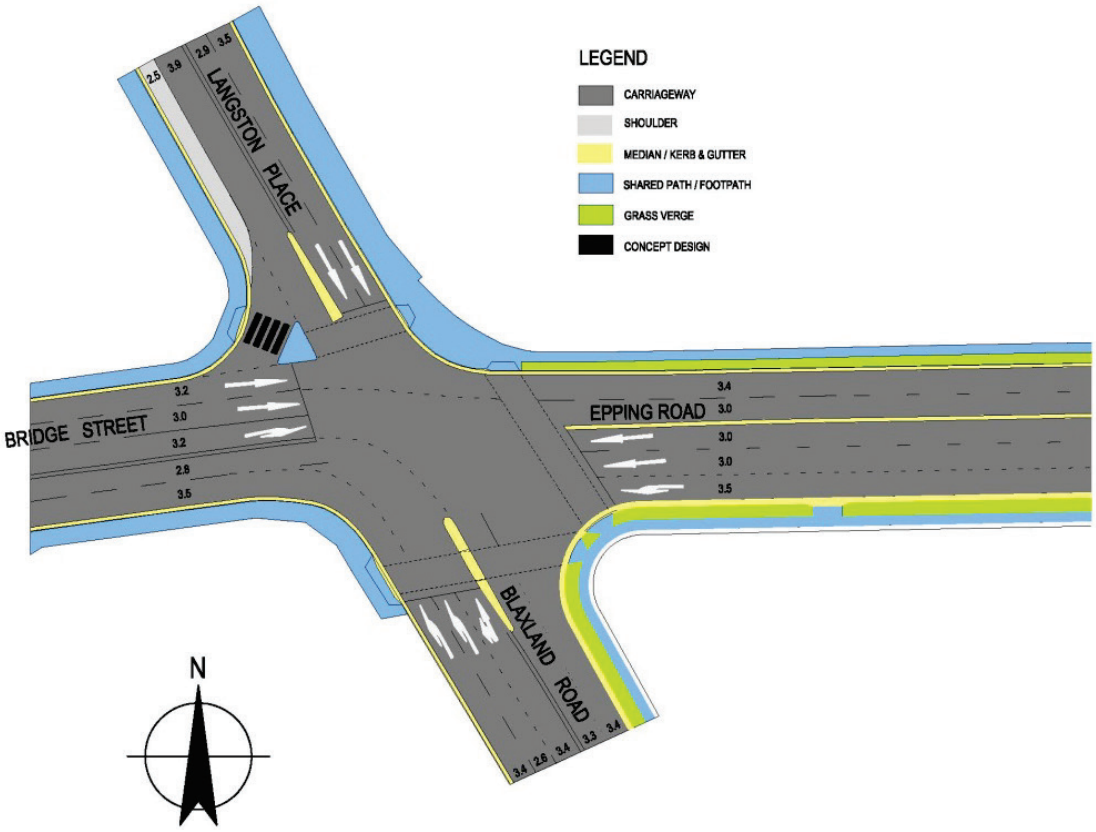


Figure 9 Langston Place/Blaxland Road Intersection

Smith Street and Forest Grove intersections

The existing T-intersections would be restricted to a left-in and left-out only intersection by introducing a 0.5 metre wide concrete median along Epping Road to separate the east and westbound traffic.

The proposed intersection arrangement is illustrated in Figure 10.

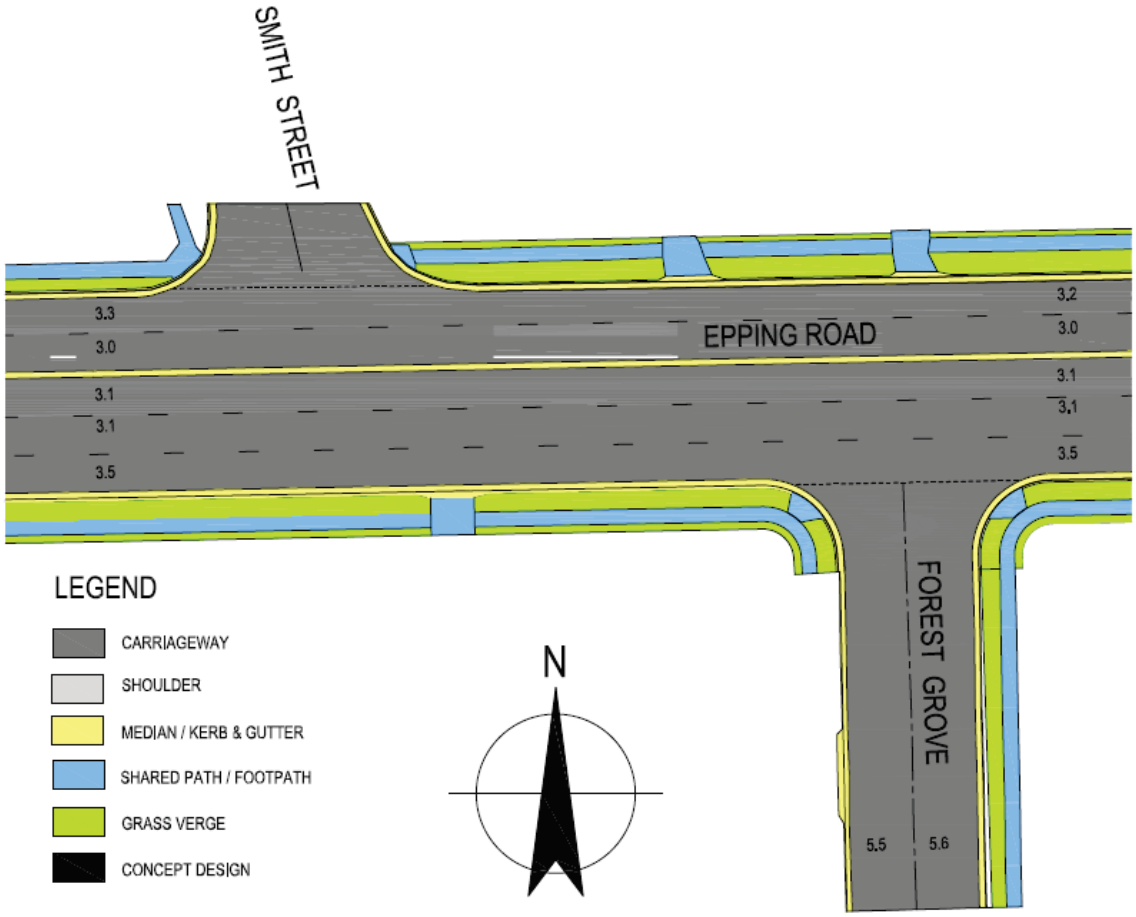


Figure 10 Smith Street and Forest Grove intersections

Essex Street intersection

The existing Epping Road/Essex Street intersection would be modified to include:

- Banning of the right turn movements from the Epping Road eastern and western approaches;
- Dual right turn from Essex Street (north) to Epping Road in the westbound direction;
- Widening on the south-western side of the intersection to provide an additional left turn lane from Essex Street onto Epping Road (westbound).
- Constructing a raised median about 20 metres long on Essex Street north of Epping Road intersection
- New signal controlled pedestrian crossings at both the Essex Street northern and southern approaches;
- Additional Epping Road westbound through lane; and

The proposed intersection arrangement is illustrated in Figure 11.

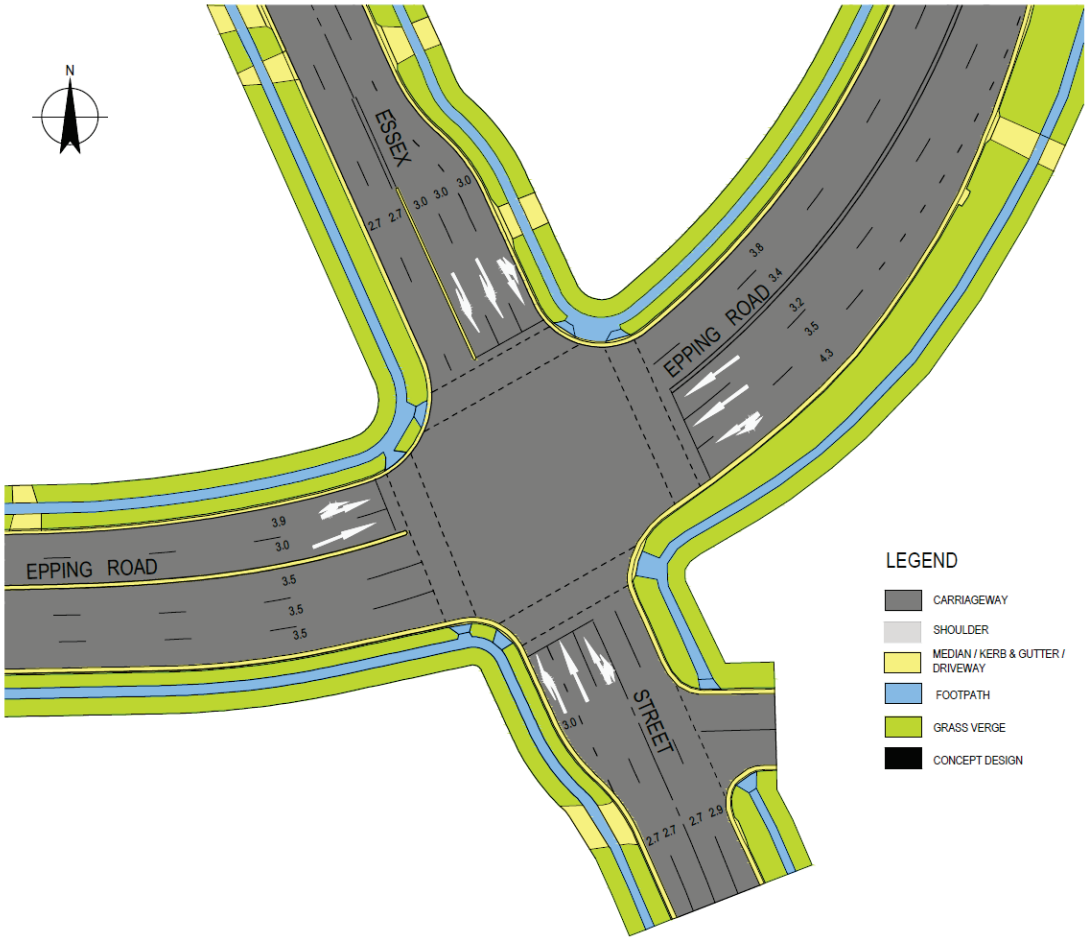


Figure 11 Essex Street intersection

5. Pedestrian impact assessment

This section will investigate the impacts the proposal will have on pedestrian access, mobility and safety.

5.1 Improvements to the network

The proposed upgrades to the Essex Street and Epping Road intersection will address the current issues stated in 2.5, ID number 4.

5.2 Impacts on local roads and access

This section discusses the traffic impacts in terms of diverted traffic from the proposed upgrades.

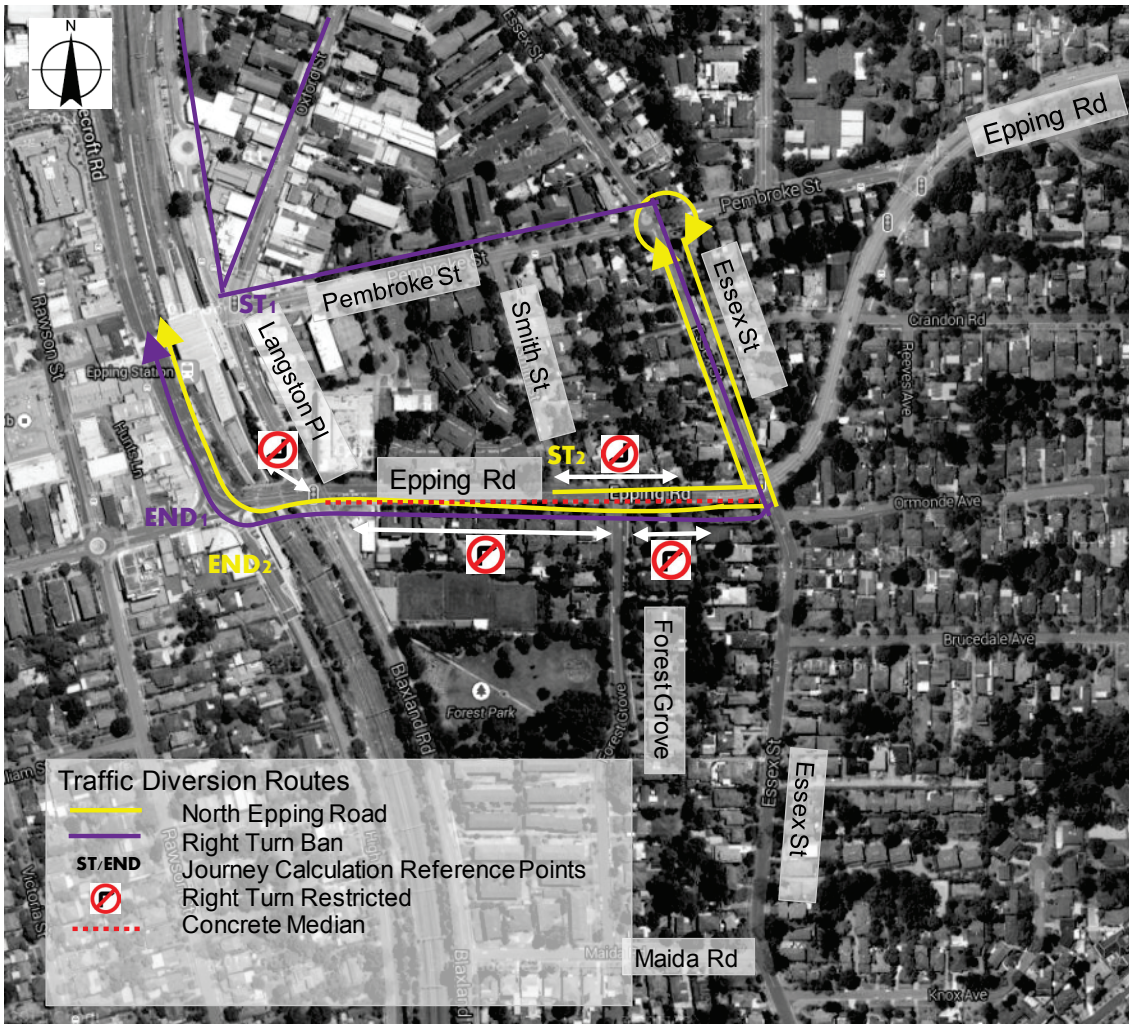
5.2.1 Proposed alternative routes

Alternate routes for motorists travelling from the north to Beecroft Road with the proposed right turn ban installed from Langston Place into Epping Road

Removing the right turn from Langston Place into Epping Road would result in motorists taking the alternative routes as indicated by the purple lines in or the green lines in Figure 13. This would however generate a substantial number of vehicles during the peak hours to Essex Street/Pembroke Street and Epping Road/Essex Street intersections, with additional vehicles also expected at the intersection of Norfolk Road/Pembroke Street.

Alternate routes for motorists travelling in the westbound direction from the northern side of Epping Road

With the installation of the proposed 0.5 metre wide concrete median, indicated by the dotted red line Figure 12, house owners along the northern side of Epping Road would no longer be able to make a right turn onto Epping Road to access the western end of Epping Road. This is a similar situation for vehicles exiting Smith Street.



Source: Google Maps 2014, modified by GHD

Figure 12 Alternative route A to west of Epping Road

Source: Google Maps 2014, modified by GHD

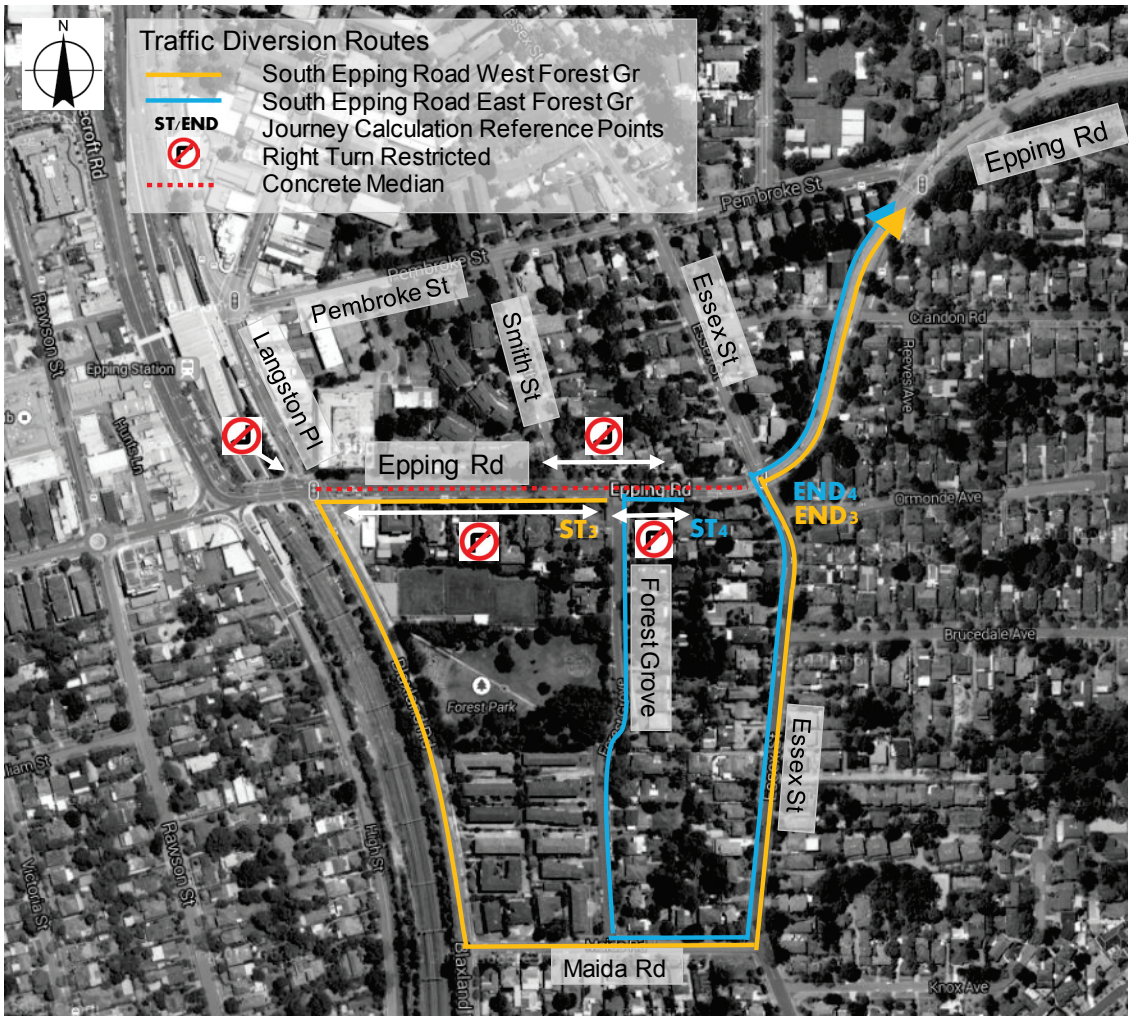
Figure 13 Alternate route B to the west of Epping Road

Alternate routes for motorists travelling in the eastbound direction from the southern side of Epping Road

This section discusses the effects the proposal would have on vehicles accessing the east of Epping Road.

With the installation of the proposed concrete median, house owners on the southern side of Epping Road would no longer be able to turn right onto Epping Road to travel eastbound. Residents on the east of Forest Grove are likely to use the route shown in Figure 14, indicated by the blue arrows.

Residents on the west of Forest Grove are likely to use the route indicated by the orange arrows.

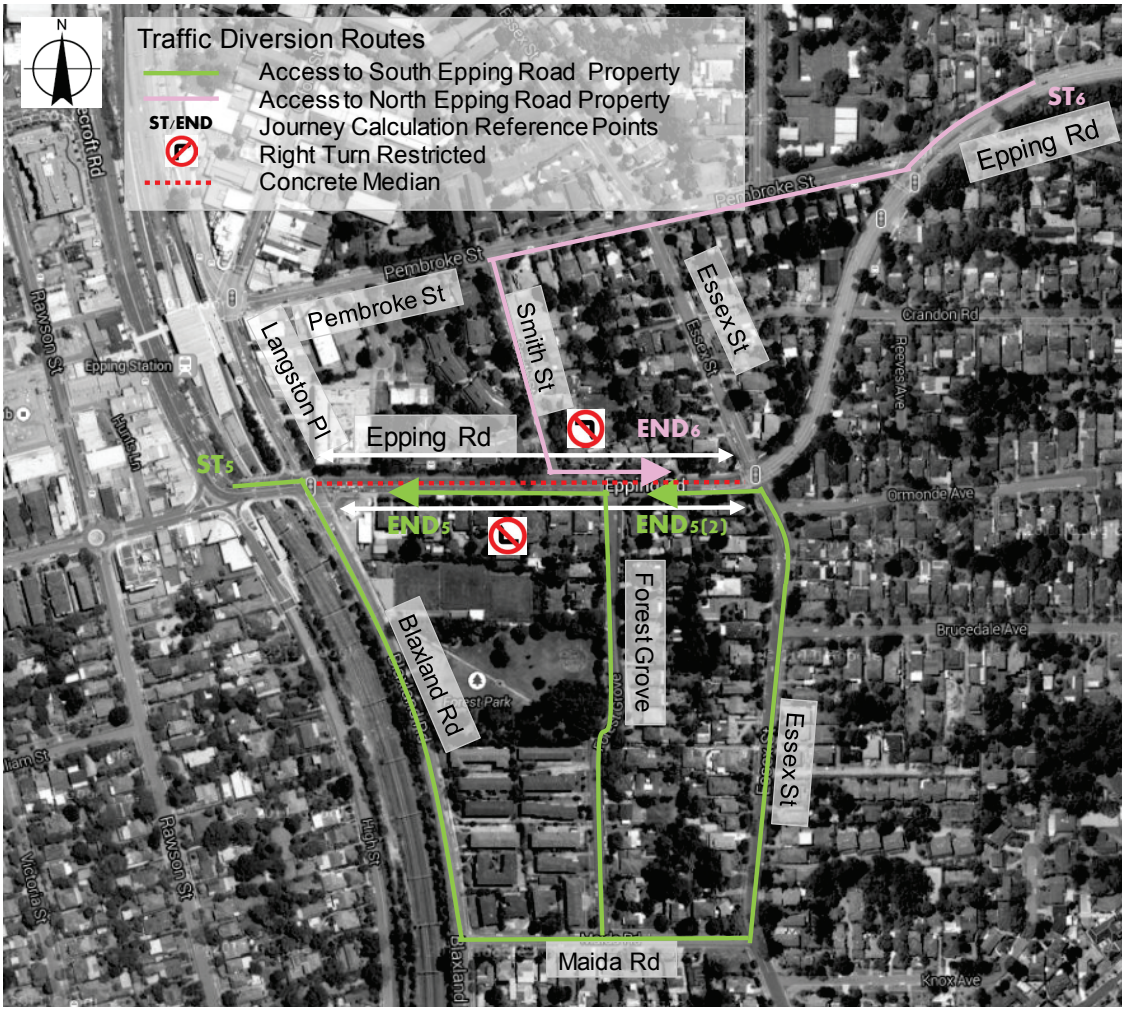


Source: Google Maps 2014, modified by GHD

Figure 14 Alternate routes to east of Epping Road – Orange and Blue Route

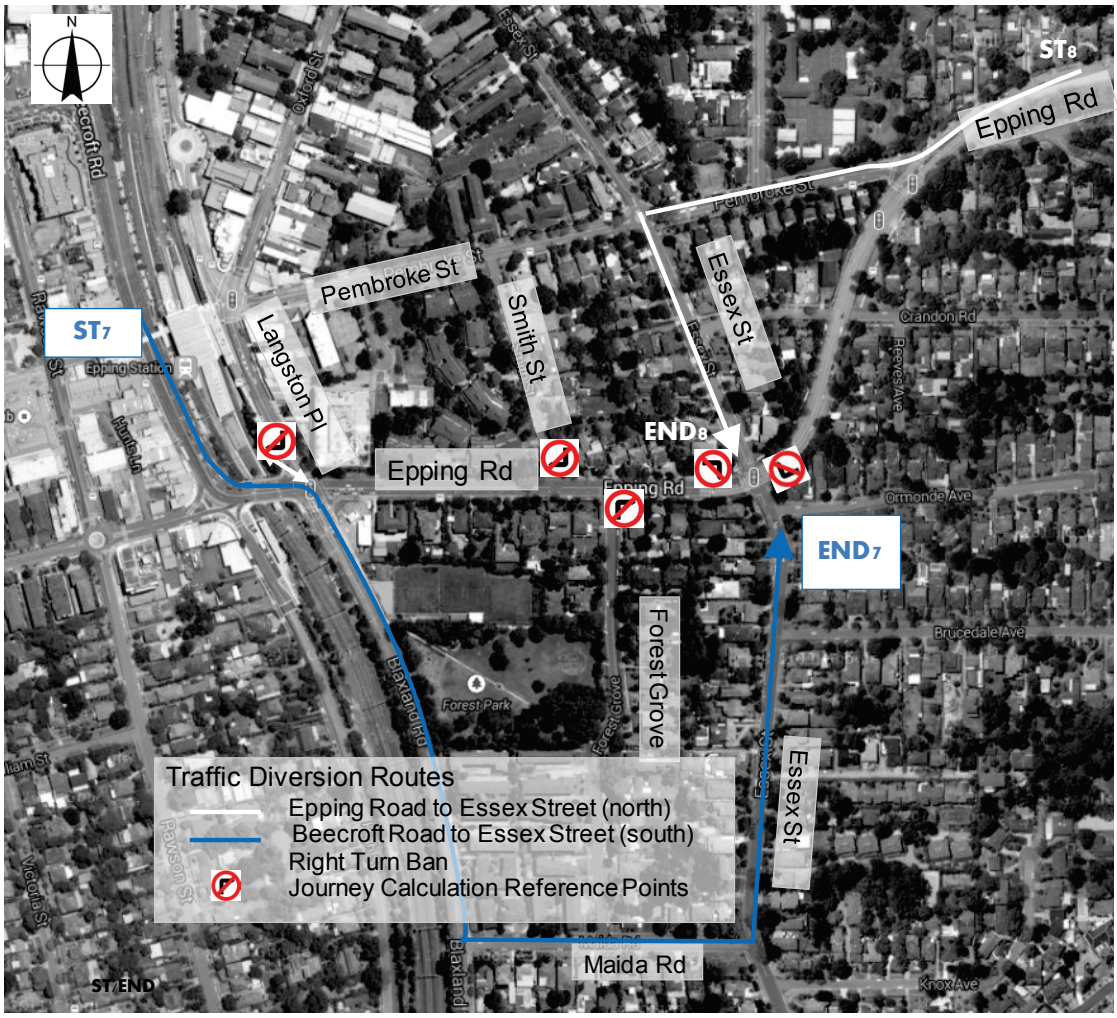
Properties fronting Epping Road

Vehicles would no longer be able to access properties by making a right turn on Epping Road with the proposed concrete median upgrade. Alternative routes are shown in Figure 15.



Source: Google Maps 2014, modified by GHD

Figure 15 Alternative routes to properties along Epping Road – Green and Pink Route



Source: Google Maps 2014, modified by GHD

Figure 16 Alternative routes to properties along Epping Road – Navy blue and White Route

5.2.2 Proposed traffic changes

A summary of the increase in traffic volumes obtained from the Epping Road Widening Traffic and Transport Assessment report is provided in Table 1.

Table 1 Traffic changes due to traffic diversions – 2016

Road Link	Do Nothing Traffic (vph)		With Development Traffic (vph)		% Increase	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Epping Road, east of Langston Place	3356	2986	3682	3138	10%	5%
Epping Road, east of Smith Street	3330	2986	3640	3144	9%	5%
Epping Road, east of Forest Grove	3316	2756	3650	3034	10%	10%
Epping Road, east of Essex Road	3184	2604	3288	2710	3%	4%
Epping Road, north of Crandon Road	3152	2612	3194	2688	1%	3%
Pembroke Street, east of Smith Street	424	348	336	396	-21%	14%
Pembroke Street, east of Essex Street	720	528	754	592	5%	12%

Road Link	Do Nothing Traffic (vph)		With Development Traffic (vph)		% Increase	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Pembroke Street, east of Norfolk Road*	490	556	476	552	-3%	-1%
Norfolk Road, north of Pembroke Street	704	584	770	716	9%	23%
Norfolk Road, north of Chester Street*	514	448	606	538	18%	20%
Blaxland Road, south of Epping Road	1284	1008	1308	1092	2%	8%
Langston Place, south of Cambridge St	890	586	554	400	-38%	-32%
Essex Street, south of Pembroke Street	370	448	658	712	78%	59%
Essex Street, north of Pembroke Street	196	182	266	276	36%	52%

Note: vph – vehicles per hour

5.3 Impacts to pedestrians

5.3.1 Epping Road

Epping Road between Essex Street and Langston Road will experience an increase in traffic, of up to 10% with an additional 334 vehicles per hour during the AM peak hour expected east of Forest Grove as shown in Table 1.

Concrete median along Epping Road

Installation of the median could attract more pedestrians crossing Epping Road at midblock locations, as they now have the option to stand on the median and wait for traffic to clear.

The proposed median would be 0.5 m wide and this width does not meet Austroads standards of 2 m for a pedestrian refuge. This makes it unsafe to cross given the insufficient space to stand (however might be perceived safe to pedestrians). Including the widening of an additional westbound lane, pedestrians would have to cross five lanes in total. The volume of pedestrians crossing at midblock locations does not warrant the installation of a pedestrian crossing.

Pedestrian surveys undertaken in September 2014, show that during the AM peak hour there were 23 pedestrians crossing Epping Road at midblock locations between Smith Street and Forest Grove. These movements comprised of:

- 15 pedestrians crossing northbound
- Eight pedestrians crossing southbound

Based on these directional splits, it is likely that these pedestrian crossing movements are associated with school children walking towards Epping Public School located at Pembroke Street. It is recommended that this be monitored post construction and consideration given to the installation of pedestrian fencing in the median if required.

5.3.2 Pembroke Street

Table 1 outlines the potential traffic changes as a result of the traffic diversions. These are summarised as follows:

- Pembroke Street east of Smith Street will experience an increase in traffic of around 14%, with an additional 48 vehicles per hour during the PM peak hour.
- Pembroke Street between Essex Street and Norfolk Road will experience an increase in traffic of around 12%, with an additional 34 vehicles per hour during the PM peak hour.

Due to the proximity to Epping Public School consideration should be given to extending the school zone on Norfolk Road to include Pembroke Street between Essex Street and Epping Road. Also consideration should be given to having an RMS School Crossing Supervisor at the pedestrian crossing located on Pembroke Street near Essex Street during school start and finish times.

5.3.3 Essex Street

Table 1 outlines the potential traffic changes as a result of the traffic diversions. These are summarised as follows:

- Essex Street south of Pembroke Street will experience a significant increase of around 78% with an additional 288 vehicles per hour during the AM peak hour.
- Essex Street north of Pembroke Street will experience a significant increase of around 52% with an additional 94 vehicles per hour during the AM peak hour.

The majority of diverted traffic on Pembroke Street whether from Langston Place or from Norfolk Road will turn onto Essex Street, additional measures should be taken to increase the safety of pedestrians crossing Essex Street on the south approach to Pembroke Street.

5.3.4 Norfolk Road

Norfolk Road, to the north of Pembroke Street, will experience an increase in traffic of around 23%, with an additional 132 vehicles per hour during the PM peak hour, as shown in Table 1.

Epping Public School is located on the corner of Pembroke Street and Norfolk Road. As outlined in Section 2.3 pedestrian crossings are located on Pembroke Street east of Essex Street and Norfolk Road around 60 metres north of Pembroke Street.

6. Planning for pedestrians

This section provides an outline of how to plan for pedestrians in the future and provides input into the recommendations as part of this study.

6.1 Creating a safe and attractive environment for walking

Walking is the simplest form of transportation. It is available to most people, including those who use mobility aids, is free and has insignificant environmental cost. Furthermore, all trips involve some walking component, if only from the car park to the shop. Therefore, planning for safe and convenient pedestrian access is very important in transportation planning.

Pedestrians use every part of the public domain, including roads, footpaths, nature strips, shopping centres and other public spaces. Some planners and engineers incorrectly assume that planning for pedestrians will follow the same logic as traffic planning:

- Car → 'trips' → 'routes' → 'traffic network'

The planning scale for pedestrians is detailed to accommodate the local nature of the trips. Pedestrian movement can be better conceptualised in terms of:

- Pedestrian → 'activity' → 'areas of activity' → 'pedestrian environment'

Rather than conforming to traditional traffic engineering concepts like turning radii and design speeds, pedestrians are far more attuned to the environment in which they are moving. Therefore, planners need to consider the needs of pedestrians with regards to design, amenity, and personal security. Pedestrians are particularly vulnerable to cars and other motorised traffic.

Pedestrian needs

The provision of pedestrian infrastructure should not only aim to fulfil the requirements of existing users or to comply with relevant standards, but should also promote walking for transport, recreation and health and increase the number of trips taken by foot. Such an outcome would result in fewer car trips, healthier residents and a more active (and safe) public domain. A number of elements are required in order to provide a high quality pedestrian environment:

Safety

Perceived and actual safety is very important to pedestrians. Road crossings present the greatest danger to pedestrians. Therefore, safe crossing locations must be provided at regular intervals along major streets or at the location where key desire lines cross major streets. Pedestrians will rarely walk along an indirect route to access safe crossing points, so frequent, direct crossing points must be provided.

Lighting and open space is important for security. Pedestrians of all ages need to feel that it is safe to walk whenever they choose to do so.

Directness

Pedestrians do not like to walk out of their way to reach a destination. This is a natural response to avoid the extra effort involved in walking extra distance. Pedestrian facilities serving desire lines between major centres of activity need to be direct and legible in order to provide for and encourage walking trips.

Wherever possible, barriers should be overcome with additional crossing points such as grade separated or signalised crossings, although grade separation does not always provide the most direct access.

Engineering solutions to direct pedestrians for safety reasons (such as fencing) should only be used when no other solution is possible.

Amenity

Pedestrians are particularly sensitive to the quality of the urban environment. Areas with high volumes of traffic, excessive noise, and poor pavements will discourage walking. Additionally, urban areas should be maintained at a human scale that provides an attractive walking environment.

While it would be extremely costly to improve the amenity of all pedestrian areas, targeted works can achieve a great improvement in areas of high pedestrian activity (such as shopping streets, areas around commercial, employment and public buildings, and recreation areas). Spot improvement programs can also target localised areas of high need.

Suitable for all users

Quality pedestrian environments must be available to all who choose to use them. This requires compliance with Austroads Part 13 – Pedestrians and AS1428.1-2001 - Design for access and mobility. Paths must be of a suitable width to accommodate the number of pedestrians (and other users, such as mobility scooters) expected and be of an appropriate gradient, including ramps. The path should be continuous and free of obstructions such as signage and street furniture. The needs of hearing and vision-impaired users must be considered and provided for, especially where user safety is an issue.

Pedestrian strategies

Council should support and encourage walking in Epping through the following actions:

- Provide an environment where the personal, social and environmental benefits of walking are recognised as paramount and that the needs of pedestrians are considered as a primary element in any projects affecting the urban landscape;
- Ensure that all planning and redevelopment includes walking as a safe, healthy and accessible form of transport; and
- Incorporate the needs of people with a disability into all levels of planning and implementation of the transportation network and public domain improvements.

6.2 Best practice standards

This sub-section provides a brief overview of best practice standards that apply to the treatment of pedestrian facilities.

Minimum footpath widths

The Austroads Guide to Road Design Part 6A 2009 – Pedestrians and Cyclist Paths states that:

"As a guide, the desirable minimum width of a footpath that has a very low demand is 1.2 m with an absolute minimum of 1.0 m. These widths should be increased at locations where:

- *high pedestrian volumes are anticipated*
- *a footpath is adjacent to a traffic or parking lane*
- *a footpath is combined with bicycle facilities*
- *the footpath is to cater for people with disabilities"*.

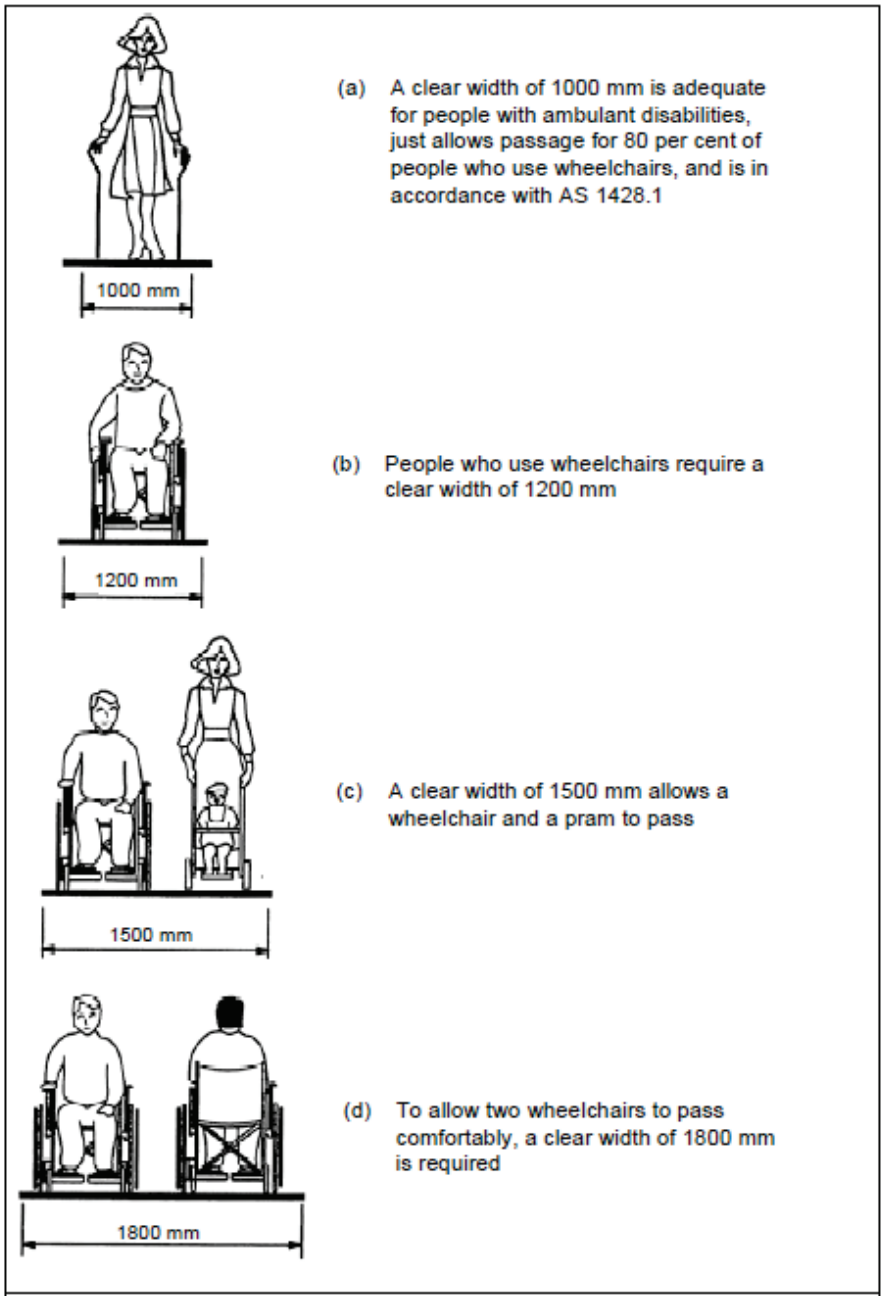
Figure 17 and Table 2 show the minimum widths for various types of footpath users.

Table 2 Minimum Footpath Widths

Situation	Desired width (m)	Comments
General low demand	1.2 to 1.0 (absolute minimum)	General minimum is 1.2 m for most roads and streets. Clear width required for one wheelchair. Not adequate for commercial or shopping environments.
High pedestrian volumes	2.4 m (or higher based on demand)	Generally commercial and shopping areas.
For wheelchairs to pass	1.8 to 1.5 (desired minimum)	Allow for two wheelchairs to pass (1.8 m comfortable, 1.5 m minimum) Narrower width (1.2 m) can be tolerated for short distances.
For people with other disabilities	1.8 to 1.0	

Source: *Austroads Guide to Road Design Part 6A 2009 – Pedestrians*

Figure 17 Path Width Requirements for Various Users



Source: *Austroads Guide to Road Design Part 6A 2009 – Pedestrians*

Minimum grades

Grades of footpaths and drop kerbs are important as they affect the usability and safety of pedestrian facilities. Long sections of high grade footpath can be extremely difficult for mobility impaired users to negotiate.

High grade kerb ramps can also cause safety issues for mobility impaired users. Users can become venerable to general traffic as they attempt leave the carriageway and proceed up steep ramps.

It is noted that AS 1428.1 – 1993, specifies that any footpath should not exceed a gradient of 1:8 as wheelchairs may tip backwards. This is considered as an absolute maximum ramp gradient and should only be used in extenuating circumstances.

Table 3 shows the maximum grades for footpaths and kerb ramp treatments.

Table 3 Maximum Grades

Footpaths	Grade
Recommended maximum grade (footpaths)	1:10 (2.5% cross fall)
Absolute maximum grade (kerb ramps)	1:8

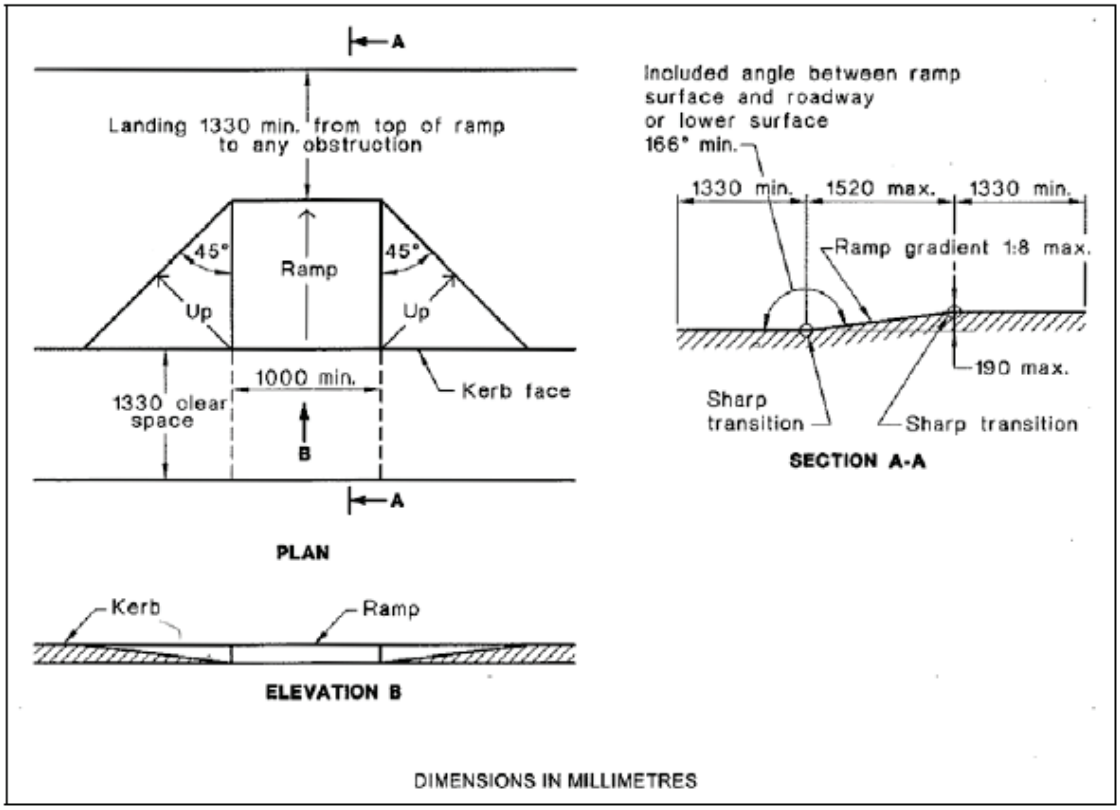
Source: *Austroads Guide to Road Design Part 6A 2009 – Pedestrians.*

Kerb ramps

The difference in the level between the footpath and the roadway is a common situation that poses difficulties for pedestrians, particularly with mobility and vision impairments. A drop kerb or kerb ramp provides a smooth change in the level between the footpath and the roadway (maximum grade of 1:8).

The general dimensions of a drop kerb are illustrated in Figure 18. The Austroads Guide to Road Design Part 4 – Intersections and Crossings states that: “A minimum footway width of 1330 mm should be provided beyond the top of the ramp, to ensure that users of the footway along the street are not inconvenienced by the ramp.”

Figure 18 Kerb ramp design



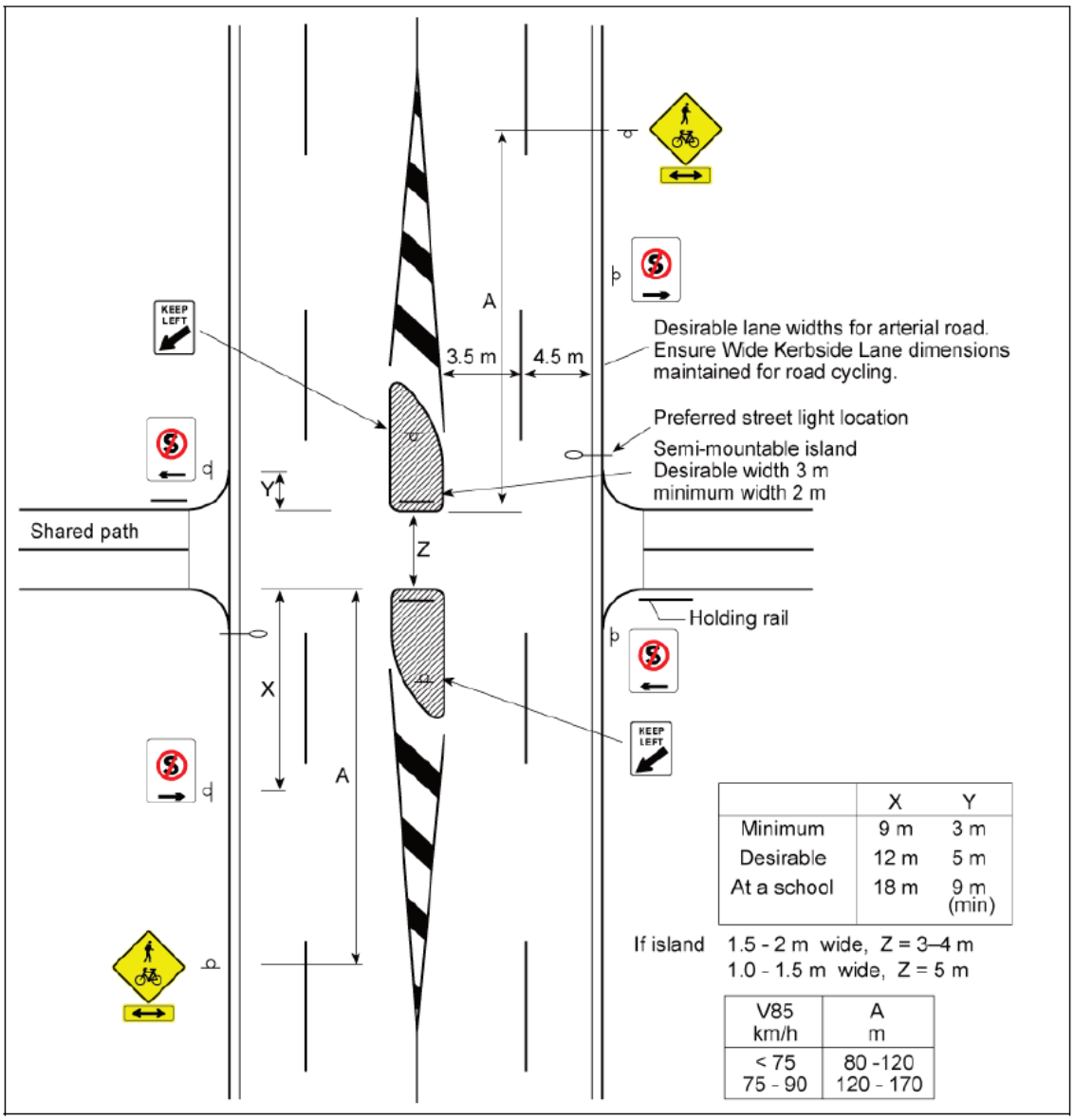
Source: *Austroads Guide to Road Design Part 4 – Intersections and Crossings.*

Pedestrian refuges

Pedestrian refuges allow a safe point for pedestrian store safe across wide or busy roads. It is noted that many people to not feel safe when using refuges and should the funds be available kerb extensions should be considered to reduce the width of the road at the crossing points rather than using refuges.

The general dimensions of a kerb ramps are illustrated in Figure 19. Pedestrian refuges should in all cases be adequately illuminated in accordance with AS/NZS 1158 – 2007 and careful positioning of street lights should be considered in accordance with AS 1158.4: 2007. Austroads Guide to Road Design Part 4 – Intersections and Crossings also recommends a refuge width of at least 2 m to allow storage for a person with a pram or bicycle needs.

Figure 19 Pedestrian refuge design



	X	Y
Minimum	9 m	3 m
Desirable	12 m	5 m
At a school	18 m	9 m (min)

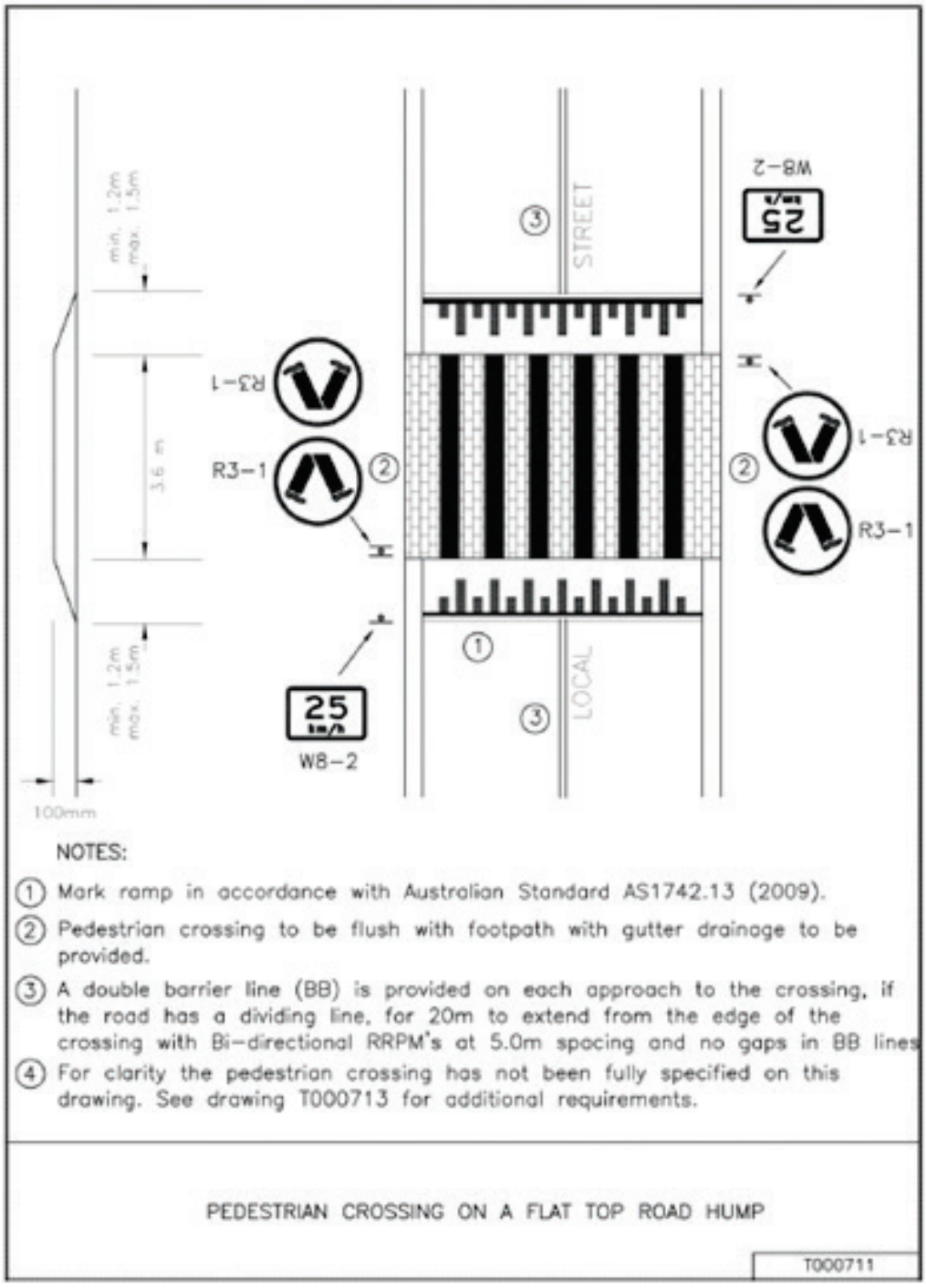
V85 km/h	A m
< 75	80 -120
75 - 90	120 - 170

Source: *Austroads Guide to Road Design Part 4 – Intersections and Crossings.*

Wombat crossings

Wombat crossings are generally the same dimensions as flat top road humps (with pedestrian priority provided with the use of 'zebra' style line markings) as shown in Figure 20. It provides priority to pedestrians as well as acting as a traffic calming measure. The minimum length of the device including ramps is six metres and the desirable minimum height of the platform is 100 mm. Wombat crossings generally have ramp gradients of 1:15 to 1:20 to be bicycle and/or bus friendly. Wombat crossings can be used when the warrant for such a traffic control is met as required in AS 1742.10

Figure 20 Typical details of a wombat crossing



Source: Roads and Maritime Australian Standards Supplement AS1742 Manual of Uniform Traffic Control Devices Parts 1-16 (Roads and Maritime Services, July, 2013)

Tactile Ground Surface Indicators (TGSI's)

TGSI's should also be provided to indicate the edge of the roadway to sight impaired pedestrians.

Roads and Maritime Services requirements for pedestrian (Zebra) crossings

The *Roads and Maritime Services Australian Standard Supplements 2013, section 6.3*, provides practice for numerical warrants for a pedestrian (zebra) crossing. It is warranted where in each of three separate one hour periods in a typical day where:

- The pedestrian flow per hour (P) crossing the road is greater than or equal to 30 and;
- The vehicular flow per hour (V) through the site is greater than or equal to 500 and;
- The product PV is greater than or equal to 60,000.

Special Warrants may also be considered where consideration can be given to a potential pedestrian crossing site. In such circumstances, council should justify why this location is in need of special consideration. The special warrant conditions state that:

- PV ≥ 45,000 and;
- P ≥ 30 and;
- V ≥ 500.