Great Western Highway – Katoomba to Mount Victoria Road safety upgrades Preferred treatments report

November 2014
Executive summary

Background
In July 2012 the Australian and New South Wales governments announced a $250 million revised package of road safety work to improve safety and travel conditions along the Great Western Highway between Katoomba and Lithgow.

As part of this package, road safety upgrades are being planned for the existing highway between Katoomba and Mount Victoria.

Roads and Maritime Services developed a range of potential treatments for the highway between Katoomba and Mount Victoria, and these were provided to the community to review as part of a community consultation process in April/May 2014.

After considering community feedback on the potential treatments an assessment against technical criteria was carried out by the project team. The preferred treatments have been selected and a prioritised package of work identified.

The Great Western Highway
The Great Western Highway links the Sydney metropolitan area to the Blue Mountains and provides a connection to the regional centres of Lithgow and Bathurst in Central NSW. The section of the highway between Katoomba and Mount Victoria is about 14 kilometres long and passes through the townships of Medlow Bath and Blackheath.

Upgrading of the Great Western Highway to four lanes between Emu Plains and Katoomba is due for completion in 2015. For the Great Western Highway between Katoomba and Mount Victoria, the focus in the short to medium term is on targeted road safety improvements.

It is important to ensure that these sections of road provide a safe driving environment for all road users. Preferred treatments that improve road safety and are sensitive to the surrounding built and natural environment have been identified for further design development and environmental assessment.

Crash statistics
The following crash statistics were recorded for the section of highway between Katoomba and Mount Victoria in the five years from 1 July 2008 to 30 June 2013. In that time there were:

- 154 crashes overall.
- Two fatal crashes and 72 injury crashes.
- 80 per cent of crashes were midblock (123 crashes).
- 47 per cent of crashes occurred on a wet surface (73 crashes).
- 51 per cent of crashes involved speed (78 crashes).
- 39 per cent of crashes involved vehicles leaving the road on a curve (60 crashes).

1 Crash statistics reported in the Potential Treatments Report (March 2014) were for the five year period from 1 July 2007 to 30 June 2012. Since then new crash data has been released and has been used for reporting in the Preferred Treatments Report.
Community consultation
In April/May 2014 consultation was carried out with two community information sessions held (one in Medlow Bath and one in Blackheath) allowing the community to provide feedback on potential treatments.

Community issues and concerns raised during the consultation process, that were considered as part of the road safety review and development of potential treatments, fall into the following categories:

- Speeding.
- Heavy vehicles.
- Pedestrian and cyclist safety.
- Highway design.
- Driver behaviour.
- Maintenance.
- Other, e.g. environment and heritage.

Road safety review
A road safety review is designed to investigate road safety issues in relation to the road environment and develop suitable road safety engineering treatments (or improvements) to address these issues.

In May 2013 a road safety review of this section of the highway was led by SMEC Australia Pty Ltd (SMEC). It was carried out by suitably qualified and experienced representatives from the project development, road safety, asset and design disciplines of Roads and Maritime. The review assessed the existing road environment and casualty crash locations, confirmed issues raised by the community and considered potential treatments to address the road safety issues that were identified.

The preferred treatments are targeted measures to address the identified road safety issues and crash patterns. They would provide a road environment that is safer and more forgiving of driver error, helping to reduce the incidence and severity of crashes.

Outcomes of the road safety review
The road safety review identified a range of issues and suggested potential treatments to improve road safety. Table i on the next page provides a summary of the road safety issues and the potential treatments.
### Observed road safety issue | Potential treatments
--- | ---
Road alignment | Provide a straighter road alignment by improving the curve radii in sections where there are tight low radius curves.
Road surface | Consider improving the surface of the road with high friction asphalt, particularly in locations with wet weather crash patterns.
Road shoulders | Increase the sealed width of road shoulders to improve safety around curves and increase consistency along the route.
Sight distance | Review sight distances from side road intersections to ensure they are adequate and develop suitable treatments to address any deficiencies.
Safety barriers | Install safety barriers to provide protection against hazards, such as drop-offs, drains, trees and utility poles in the clear zone.
 | Provide a suitable central median safety barrier to reduce the incidence of head-on crashes in sections of winding alignment.
Clear zones | Remove hazards in the clear zone or install a suitable safety barrier next to the hazard.
Intersection treatments | Provide protected right turn bays to provide greater protection for turning traffic. Where this cannot be provided, investigate alternative access arrangements such as left-in/left-out only.
Line marking | Install wide centre line marking to provide greater separation between opposing travel lanes. Use profile line marking in rural sections.
 | Review line marking to ensure that overtaking lanes do not end on curves, crests or across side road intersections.
 | Remove right turn access into side roads from overtaking lanes by adjusting the overtaking lane to provide a protected right turn bay.
Signage | Ensure consistent signage is provided along the route, especially for providing advance side road signage.
Delineation | Improve the delineation around curves with suitably placed curve alignment markers (CAMS) and ensure that this is consistent along the route.
Speed zones | Ensure speed zones are suitable for the road environment and that speed zone changes do not occur close to side road intersections or on curves or crests.
Pedestrian and cyclist facilities | Where possible provide off-road facilities in the form of shared paths or tracks, particularly in between townships.
 | Where possible widen road shoulders to at least two metres to provide safer access for cyclists.

Table i - Summary of identified road safety issues and potential treatments
Preliminary environmental investigation (PEI)
The PEI process integrates the environmental and social constraints into the decision making processes as part of design development.

In August 2013 GHD Group Pty Ltd prepared a PEI report to identify a range of constraints that may influence the design of the potential treatments and provide opportunities for design refinement within the study area. The key constraints in the study area are:

- Areas of high and medium biodiversity, including the Blue Mountains Shoalhaven Hanging Swamps, which have the potential to provide habitat for a range of threatened flora and fauna.
- Three Aboriginal heritage items and the Blue Mountains National Park and the Greater Blue Mountains World Heritage Area which are areas of high archaeological sensitivity.
- Heritage items including the Greater Blue Mountains World Heritage Area, Medlow Bath Railway Station Group, Blackheath Railway Station Group and railway shops, and 103 locally listed heritage items.
- Blue Mountains drinking water catchment.
- Noise management.
- Access along the highway.
- Visual appeal along the highway.
- The vulnerability of the local community due to changed traffic conditions and the potential impact on local businesses through changed traffic conditions and access arrangements, and loss of parking.

Next steps
Taking the community feedback into consideration, the project team measured potential treatments against technical criteria and the preferred treatments have been selected.

These preferred treatments will proceed to the design and environmental assessment phase of the project. The prioritisation of preferred treatments is based on a section-by-section approach so that treatments can be delivered as a package of works within available funding.

Figure i illustrates the process that was followed to select the preferred treatments.

Figure i - Process to select the preferred treatments and next steps
## Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AADT</td>
<td>Average annual daily traffic. The yearly two-way traffic volume divided by 365, expressed as vehicles per day</td>
</tr>
<tr>
<td>AHIMS</td>
<td>Aboriginal Heritage Information Management System</td>
</tr>
<tr>
<td>BAR</td>
<td>Basic auxiliary right turn which allows vehicles to go around vehicles turning right.</td>
</tr>
<tr>
<td>BCR</td>
<td>Benefit to cost ratio</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>The biological diversity of life is commonly regarded as being made up of the following three components:</td>
</tr>
<tr>
<td></td>
<td>• Genetic diversity – the variety of genes (or units of heredity) in any population</td>
</tr>
<tr>
<td></td>
<td>• Species diversity – the variety of species</td>
</tr>
<tr>
<td></td>
<td>• Ecosystem diversity – the variety of communities or ecosystems</td>
</tr>
<tr>
<td>CAMS</td>
<td>Curve alignment markers</td>
</tr>
<tr>
<td>Catchment</td>
<td>An area of land draining to the same low point</td>
</tr>
<tr>
<td>CHR</td>
<td>Protected right turn bay</td>
</tr>
<tr>
<td>Crash</td>
<td>Definitions in relation to the crash or casualty type are:</td>
</tr>
<tr>
<td></td>
<td>• Fatal crash – at least one person was killed</td>
</tr>
<tr>
<td></td>
<td>• Injury crash – at least one person was injured but no person was killed</td>
</tr>
<tr>
<td></td>
<td>• Casualty crash – at least one person was killed or injured</td>
</tr>
<tr>
<td></td>
<td>• Tow away crash – at least one vehicle was towed away but there were no casualties</td>
</tr>
<tr>
<td></td>
<td>• Fatality – a person who dies within 30 days of the crash and as a result of the injuries sustained from that crash</td>
</tr>
<tr>
<td></td>
<td>• Casualty – a person killed or injured as a result of a crash.</td>
</tr>
<tr>
<td>Crash statistics</td>
<td>Crash statistics recorded by Roads and Maritime are confined to those crashes that conform to National Guidelines for Reporting and Classifying Road Vehicle Crashes. The main criteria are that the crash was:</td>
</tr>
<tr>
<td></td>
<td>• Reported to the NSW Police Force</td>
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<tr>
<td></td>
<td>• Occurred on a public road that is open to the public</td>
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<tr>
<td></td>
<td>• Involved at least one moving vehicle</td>
</tr>
<tr>
<td></td>
<td>• Involved at least one person being killed or injured or at least one vehicle being towed away.</td>
</tr>
<tr>
<td>DBYD</td>
<td>Dial Before You Dig</td>
</tr>
<tr>
<td>DEWHA</td>
<td>Department of Environmental, Water, Heritage and the Arts</td>
</tr>
<tr>
<td>DSEWPaC</td>
<td>Department of Sustainability, Environment, Water, Population and Communities</td>
</tr>
<tr>
<td>EPBC Act</td>
<td><em>Environmental Protection and Biodiversity Conservation Act 1999</em></td>
</tr>
<tr>
<td>85th percentile speed</td>
<td>The speed at or below which 85 per cent of vehicles travel.</td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>HVCS</td>
<td>Heavy vehicle checking station. Operated by Roads and Maritime to manage and enforce heavy vehicle regulations and compliance to requirements in relation to licencing, mass, speed, roadworthiness, driving hours and driver fatigue, and load restraint.</td>
</tr>
<tr>
<td>Level of Service (LoS)</td>
<td>Level of service is a fundamental performance measure, used in the planning, design and operation of roads, providing the basis for determining the design capacity requirements of a road network, including the performance of intersections. The LoS of a road is classified between A and F (A reflecting excellent performance, F representing very poor performance)</td>
</tr>
<tr>
<td>LGA</td>
<td>Local government area</td>
</tr>
<tr>
<td>MCA</td>
<td>Multi criteria analysis</td>
</tr>
<tr>
<td>OEH</td>
<td>Office of Environment and Heritage</td>
</tr>
<tr>
<td>PEI</td>
<td>Preliminary environmental investigation</td>
</tr>
<tr>
<td>POEO Act</td>
<td><em>Protection of Environmental Operations Act 1997</em></td>
</tr>
<tr>
<td>RAMSAR</td>
<td>The RAMSAR Convention (formally, the Convention on Wetlands of International Importance, especially as Waterfowl Habitat) is an international treaty aimed at conserving natural resources. Australia is part of this treaty.</td>
</tr>
<tr>
<td>REF</td>
<td>Review of Environmental Factors</td>
</tr>
<tr>
<td>State Environmental Planning Policy Number 14 (SEPP 14)</td>
<td>Policy prepared under the <em>Environmental Planning and Assessment Act 1979</em> for the protection of identified coastal wetlands in NSW</td>
</tr>
<tr>
<td>SEPP 44</td>
<td>State Environmental Planning Policy 44</td>
</tr>
<tr>
<td>TfNSW</td>
<td>Transport for NSW</td>
</tr>
<tr>
<td>TIA</td>
<td>Traffic impact assessment</td>
</tr>
<tr>
<td>TSC Act</td>
<td><em>NSW Threatened Species Conservation Act 1995</em></td>
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</tbody>
</table>
# Table of contents

## Executive summary
- Background
- The Great Western Highway
- Crash statistics
- Community consultation
- Road safety review
- Outcomes of the road safety review
- Preliminary environmental investigation (PEI)
- Next steps

## Glossary

### 1. Introduction
- 1.1 Project overview
- 1.2 Purpose of this report
- 1.3 Project justification
- 1.4 Great Western Highway in context
- 1.5 Study area
- 1.5.1 General description of the highway sections under review

### 2. Project objectives
- 2.1 Project objectives
- 2.2 Road safety
- 2.3 Design objectives

### 3. Development process
- 3.1 Project announcement
- 3.2 Study area investigations
- 3.3 Development process of preferred treatments
- 3.4 Selection of preferred treatments
# 4. Community and stakeholder consultation

- 4.1 Consultation objectives and strategy  
- 4.2 Community consultation  
- 4.3 Community feedback from 2014 consultation  
  - 4.3.1 Summary of issues raised  
- 4.4 Consideration of issues from community consultation

## 5. Road safety review

- 5.1 Road safety crash statistics  
  - 5.1.1 Katoomba to Medlow Bath  
  - 5.1.2 Medlow Bath township  
  - 5.1.3 Medlow Bath to Blackheath  
  - 5.1.4 Blackheath township  
  - 5.1.5 Blackheath to Mount Victoria  
- 5.2 Road safety review  
- 5.3 Road safety issues and potential treatments  
  - 5.3.1 Mass action treatments  
  - 5.3.2 Targeted treatments

## 6. Description of preferred treatments

- 6.1 Section A: Katoomba (Albion Street) to Medlow Bath (Foy Avenue)  
- 6.2 Section B: Medlow Bath township (Foy Avenue to 150 metres west of Cox Avenue)  
- 6.3 Section C: Medlow Bath (150 metres west of Cox Avenue) to Blackheath (Evans Lookout Road)  
- 6.4 Section D: Blackheath township (Evans Lookout Road to Radiance Avenue)  
- 6.5 Section E: Blackheath (Radiance Avenue) to Mount Victoria (Browntown Oval entrance)
7. Environmental and technical considerations 47
   7.1 Overview 47
   7.2 Preliminary environmental investigation (PEI) 47
      7.2.1 Key constraints 47
   7.3 Other technical considerations 48
      7.3.1 Traffic impact assessment 48
      7.3.2 Speed cameras 49
      7.3.3 Red light speed cameras 49
      7.3.4 Traffic signals at Govetts Leap Road 49

8. Cost estimate and Benefit to Cost Ratio (BCR) of preferred treatments 50
   8.1 Cost estimate 50
   8.2 Benefit to Cost Ratio (BCR) 50

9. Prioritisation and selection of preferred treatments 51
   9.1 Multi criteria analysis (MCA) assessment 51
   9.2 Technical assessment 53
   9.3 Comparison of the sections as part of the MCA assessment 54

10. Program of works based on the prioritisation of sections and approved funding 55

11. What happens next? 55
    11.1 Next steps 55
    11.2 Concept design and environmental assessment and approval 56
List of Figures

Figure i - Process to select the preferred treatments and next steps vi
Figure 1 - Highway west of Medlow Bath (looking east) 1
Figure 2 - Great Western Highway, Katoomba to Mount Victoria (source SMEC 2013) 2
Figure 3 - Four-lane highway west of Albion Street (looking east) 4
Figure 4 - Alignment west of Rowans Lane (looking west) 5
Figure 5 - Alignment west of Explorers Road (looking west) 5
Figure 6 - Highway through Medlow Bath (looking east) 6
Figure 7 - Highway through Medlow Bath at rail station (looking west) 6
Figure 8 - Highway east of Evans Lookout Road (looking west) 7
Figure 9 - Highway west of Cox Avenue (looking east) 7
Figure 10 - Highway west of Gardiner Crescent (looking east) 8
Figure 11 - Highway at Govetts Leap Road intersection (looking east) 9
Figure 12 - Highway west of Sturt Street (looking east) 9
Figure 13 - Highway west of the Mount Boyce HVCS entrance (looking east) 10
Figure 14 - Highway east of Browntown Oval (looking east) 10
Figure 15 - Inputs into the development of preferred treatments 13
Figure 16 - Development process of preferred treatments 14
Figure 17 - Process to confirm the preferred treatments 15
Figure 18 - Future stages of consultation 21
Figure 19 - Plot of casualty crashes (2008-2013) between Katoomba and Mount Victoria (source – Roads and Maritime 2014) 23
Figure 20 - Preferred treatments for Section A. 37
Figure 21 - Preferred treatments for Section B. 39
Figure 22 - Preferred treatments for Section C 41
Figure 23 - Preferred treatments for Section D 44
Figure 24 - Preferred treatments for Section E 46
Figure 25 - Results of the pair wise comparison assessment 52
Figure 26 - Process to select the preferred treatments 56
List of Tables

Table i - Summary of identified road safety issues and potential treatments  v
Table 1 - Summary of key road safety issues from the community (April/May 2014)  17
Table 2 - Summary of casualty crashes for Section A (source – Roads and Maritime 2014)  24
Table 3 - Summary of casualty crashes for Section B (source – Roads and Maritime 2014)  24
Table 4 - Summary of casualty crashes for Section C (source – Roads and Maritime 2014)  25
Table 5 - Summary of casualty crashes for Section D (source – Roads and Maritime 2014)  25
Table 6 - Summary of casualty crashes for Section E (source – Roads and Maritime 2014)  26
Table 7 - Summary of mass action treatments  28
Table 8 - Road safety issues and potential treatments (Katoomba to Medlow Bath)  29
Table 9 - Road safety issues and potential treatments (Medlow Bath township)  31
Table 10 - Road safety issues and potential treatments (Medlow Bath to Blackheath)  32
Table 11 - Road safety issues and potential treatments (Blackheath township)  33
Table 12 - Road safety issues and potential treatments (Blackheath to Mount Victoria)  35
Table 13 - Speed survey results through Blackheath town centre  48
Table 14 - Strategic cost estimate for Sections A-E  50
Table 15 - Safety BCRs for Sections A-E  50
Table 16 - MCA assessment of the sections against the criteria  53
Table 17 - Overall weighted score and section priority  53
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1. Introduction

1.1 Project overview
In July 2012 the Australian and New South Wales governments announced a $250 million revised package of upgrades to improve safety and travel conditions along the Great Western Highway between Katoomba and Lithgow. The road safety work includes:

1. Upgrading the Great Western Highway at Forty Bends.
2. A package of enhanced safety work between Mount Victoria and Lithgow.
3. Finalisation of the concept design and road boundaries for the future upgrade of the highway between Mount Victoria and Lithgow. Councils will be requested to adopt these designs in their future planning.
4. Safety upgrades between Katoomba and Mount Victoria.

Road safety upgrades to the existing highway between Katoomba and Mount Victoria are proposed, as opposed to large scale highway upgrades which have taken place along other sections of the highway, east of Katoomba.

Roads and Maritime has developed a range of preferred treatments between Katoomba and Mount Victoria, taking into consideration input from the community and an assessment of the road safety issues with the existing highway road environment.

**Figure 1** below illustrates the winding nature of the highway west of Medlow Bath.

The location of the highway is illustrated in **Figure 2** on the next page.

![Highway west of Medlow Bath](image-url)

**Figure 1 - Highway west of Medlow Bath (looking east)**
Figure 2 - Great Western Highway, Katoomba to Mount Victoria (source SMEC 2013)
1.2 Purpose of this report

This report documents the process of identifying the road safety issues along the highway between Katoomba and Mount Victoria, the development of potential treatments and the identification and selection of preferred treatments to address these issues.

A planning and investigation study was carried out to identify and examine potential treatments, develop strategic concept designs and to consider feedback from the community and inputs from other technical investigations. The following studies and investigations which were conducted for the Great Western Highway road safety upgrades (Katoomba to Mount Victoria), are documented in this report:

- Road safety review and crash analysis.
- Benefit to Cost Ratio (BCR) analysis.
- Preliminary environmental investigation (PEI).
- Urban design.
- Drainage and hydrology.
- Traffic management and access (via traffic impact assessment).
- Geometric road design.
- Cost estimation.
- Community consultation.

This report presents the project development process, the findings of the studies and investigations and the issues and concerns raised by the community for consideration by the project team. Following further input received from the April/May 2014 consultation and an assessment of the potential treatments against technical criteria by the project team, the preferred treatments have been selected and this process is outlined in this report.

1.3 Project justification

In July 2012 the Australian and New South Wales governments announced a revised package of upgrades to improve safety and travel conditions between Katoomba and Lithgow. This package includes road safety upgrades along the section of the highway between Katoomba and Mount Victoria.

Upgrading of the Great Western Highway to four lanes between Emu Plains and Katoomba is due for completion in 2015. For the Great Western Highway between Katoomba and Mount Victoria, the focus in the short to medium term is on targeted road safety improvements. In order to ensure these sections provide a safe road environment for all road users, it is important that road safety issues are investigated and suitable treatments are developed to address these issues.

1.4 Great Western Highway in context

The Great Western Highway links the Sydney metropolitan area to the Blue Mountains and connects through to the regional centres of Lithgow and Bathurst in Central NSW. It provides the major route through the Blue Mountains.

The highway starts near the Sydney CBD and travels through the western suburbs to the Blue Mountains. Past Mount Victoria it travels down Victoria Pass into the valley through Hartley, Lithgow and further west across to Bathurst. The highway ends in Bathurst where it connects to the Mid Western and Mitchell highways which provide further connections to the south-west and north-west of the state respectively.

For many sections of the highway through the Blue Mountains east of Katoomba, upgrades have either been completed or are under construction, resulting in a four-lane highway. For the Great Western Highway between Katoomba and Mount Victoria, the focus in the short to medium term is on targeted road safety improvement works. There is a need to ensure that this section of the highway provides a safe road environment for all road users. Preferred treatments that not only provide a safer road environment but are sensitive to the surrounding built and natural environment have been selected for further design development and environmental assessment approval.
1.5 Study area

The section of the highway from Katoomba to Mount Victoria is about 14 kilometres in length, travelling through the townships of Medlow Bath and Blackheath. The northern section of the study area is near the Blue Mountains National Park and the Greater Blue Mountains World Heritage Area. The Blue Mountains rail line runs parallel to the highway and the railway line and the highway intersect at Medlow Bath.

The study area has been divided into the following five sections:

- **Section A**: Katoomba (Albion Street) to Medlow Bath (Foy Avenue).
- **Section B**: Medlow Bath township (Foy Avenue to 150 metres west of Cox Avenue).
- **Section C**: Medlow Bath (150 metres west of Cox Avenue) to Blackheath (Evans Lookout Road).
- **Section D**: Blackheath township (Evans Lookout Road to Radiance Avenue).
- **Section E**: Blackheath (Radiance Avenue) to Mount Victoria (Browntown Oval entrance).

1.5.1 General description of the highway sections under review

*Section A: Katoomba to Medlow Bath*

In this section the highway passes through a semi-urban environment with street lighting installed through Katoomba. At Katoomba the highway is a divided road with two lanes in each direction and left and right turn bays. Travelling west from Rowans Lane the highway enters a more rural environment and the road narrows to one lane in each direction, with a winding horizontal alignment through more hilly terrain toward Medlow Bath.

There is limited disturbance through this area, with dense native vegetation occurring. The Cascade Creek Dams are located 250 metres from the study area and the Explorers Tree, a local landmark, is located close to Nellies Glen Road. **Figures 3-5** illustrate the highway characteristics for this section.

![Figure 3 - Four-lane highway west of Albion Street (looking east)](image-url)
Figure 4 - Alignment west of Rowans Lane (looking west)

Figure 5 - Alignment west of Explorers Road (looking west)
Section B: Medlow Bath township

In this section the study area is semi-urban and contains sections with native vegetation, the railway line and residential, commercial and recreational infrastructure, with a variety of roads and other tracks on either side of the highway. Through Medlow Bath the only commercial land is the United Petrol Station and the Hydro Majestic Hotel.

At the beginning of this section the highway consists of one lane in each direction. It then crosses the railway line via an overpass and converts to two lanes in each direction with the provision of left and right turn bays at Railway Street. There is a bus stop with a line marked indented bay to the east of the overpass at Medlow Bath railway station and a pedestrian refuge across the highway. A 60km/h speed zone starts just west of Bellevue Crescent and continues through the town centre to 150 metres west of Cox Avenue where an 80km/h speed zone starts heading west toward Blackheath.

Adams Creek is located east of the highway, just outside the study area and Lake Medlow is located further out, about 1.5 kilometres from the highway. Figures 6 and 7 illustrate the highway characteristics for this section.

Figure 6 - Highway through Medlow Bath (looking east)

Figure 7 - Highway through Medlow Bath at rail station (looking west)
Section C: Medlow Bath to Blackheath

In this section the highway alignment returns to a rural environment with several back to back horizontal curves. The shoulders are generally narrower and there is an eastbound overtaking lane starting at Evans Lookout Road. East of the highway the terrain drops away into near by bushland, with several unprotected drop-offs, drains and utility poles close to the road edge and limited existing safety barriers.

Roads and Maritime recently carried out maintenance and general upgrade work, providing higher friction pavement, wider centre line marking, curve alignment markers (CAMS) and safety barriers. The speed limit on the highway is generally 80km/h.

The surrounding area includes extensive areas of retained vegetation on either side of the highway, including a portion of the Blue Mountains National Park to the east, the railway line to the west and several roads and tracks. There is an easement of cleared land 10 metres and 40 metres on either side of the highway and 15 metres and 35 metres either side of the railway line. Figures 8 and 9 illustrate the highway characteristics for this section.

Figure 8 - Highway east of Evans Lookout Road (looking west)

Figure 9 - Highway west of Cox Avenue (looking east)
Section D: Blackheath township

This section of the highway alignment is within an urban environment. Most of this section consists of one lane in each direction with narrow sealed shoulders. Within the town centre there is generally kerb and gutter with provision for on-street parking. There is a short westbound overtaking lane starting just east of Hargraves Street and ending at Prince George Street. There are traffic signals, with signalised pedestrian facilities, at the intersection of Govetts Leap Road and mid-block signalised pedestrian crossings just west of Leichhardt Street and outside the Blackheath railway station.

This section of the highway passes through a mix of residential, educational and commercial mixed land uses on both sides, including the Blackheath Cemetery, Blackheath Railway Station, and Memorial Park at Hat Hill Road. Victoria Creek and Hat Hill Creek are also located near the highway.

Beyond Ridgewell Road the horizontal alignment becomes more winding then straightens on approach to Radiance Avenue. Speed limits range from 60km/h to 80km/h, with a 40km/h school speed zone associated with Blackheath Primary School located between Leichhardt Street and Prince George Street. Figures 10-12 illustrate the highway characteristics for this section.

Figure 10 - Highway west of Gardiner Crescent (looking east)
Figure 11 - Highway at Govetts Leap Road intersection (looking east)

Figure 12 - Highway west of Sturt Street (looking east)
Section E: Blackheath to Mount Victoria (Browntown Oval entrance)

This section of the highway passes predominantly through a rural environment. The beginning of the section includes features of the Blackheath township infrastructure, including the railway. Most of the section consists of retained native vegetation, with the Blue Mountains National Park and the Greater Blue Mountains World Heritage Area to the east of the highway.

Roads and Maritime’s Mount Boyce heavy vehicle checking station (HVCS) is located in this section. All heavy vehicles over 8 tonne gross vehicle mass (GVM) are required to enter for screening. Heavy vehicles must enter from both directions, via single lanes with turning lanes and entry/exit points to facilitate this. To the west of the Mount Boyce HVCS the highway enters an upgraded section at Soldiers Pinch.

Through this section there is an eastbound overtaking lane between Browntown Oval and the HVCS, with sealed road shoulders, kerb and safety barriers. Browntown Oval is located on the western side of the highway and is accessed from the highway. The speed limit through this section of the highway is 80km/h, except for 60km/h at the Mount Boyce HVCS. Figures 13 and 14 illustrate the highway characteristics for this section.

Figure 13 - Highway west of the Mount Boyce HVCS entrance (looking east)

Figure 14 - Highway east of Browntown Oval (looking east)
2. Project objectives

2.1 Project objectives
The road safety upgrade project for the Great Western Highway between Katoomba and Mount Victoria is designed to:

• Improve road safety.
• Cater for a mix of through, local and tourist traffic, pedestrians and cyclists.
• Be sensitive to the area’s natural environment, heritage and local communities.
• Provide best value for money.

2.2 Road safety
Updated five year crash statistics for the period from 1 July 2008 to 30 June 2013 have been used to assess and confirm the preferred treatments. These crash statistics identify that there were 154 crashes overall of which two were fatal and 72 were injury crashes.

In May 2013 a road safety review was conducted to identify road safety issues with the existing road environment and to determine a range of suitable potential treatments to address them.

The treatments identified as a result of road safety reviews are intended to provide improvements to address road safety issues and crash patterns. The treatments are designed to provide a road environment that is safer and more forgiving of driver error, thereby reducing the incidence and severity of crashes.

2.3 Design objectives
The design objectives for the road safety upgrades include the following preferred treatments at suitable locations along the highway:

• Wider sealed road shoulders (a minimum of one to two metres where possible), especially in non-urban areas.
• Road upgrades only in isolated locations, not along the full section of highway.
• Road pavement improvements (high friction asphalt).
• Suitable safety barriers (central median or next to road shoulder).
• Wide centre line marking/painted median (a minimum of 0.9 metres, with 1.2 to 1.6 metres where possible).
• Pedestrian and cyclist facilities (where possible and appropriate).
• Bus stop relocations or adjustments.
• Sight distance improvements at side roads.
• Improved guide signage.
• Intersection treatments (right turn bays, e.g. protected right turn bays, or left in/left out only and basic auxiliary right turn (BAR) bays).
• Overtaking lane adjustments.
• Delineation improvements (particularly around curves).
• Profile linemarking (rural sections only).
• Speed zone adjustments (where appropriate).
• Traffic signal adjustments (where appropriate).
• Relocation of utility poles (partially on rural sections close to curves).
3. Development process

3.1 Project announcement
In May 2010 the Australian and New South Wales governments announced a $250 million investment to fund upgrades to the Great Western Highway between Mount Victoria and Lithgow. Of this, $30 million was committed to fund road safety upgrades for this section of the highway.

In July 2012 the Australian and New South Wales governments announced a revised package of upgrades to improve safety and travel conditions between Katoomba and Lithgow. This package of work includes the work at Forty Bends, safety work between Mount Victoria and Lithgow and the concept design and road boundary work for the ultimate highway upgrade between Mount Victoria and Lithgow.

The package also includes improvements to the highway between Katoomba and Mount Victoria to improve road safety. This is to be done in consultation with the community and taking into consideration the findings of an assessment of the road safety issues in relation to the existing road environment of the highway.

3.2 Study area investigations
A number of investigations have been carried out as part of the development of the preferred treatments. Investigations conducted include:

- Road safety review and crash analysis.
- Benefit to Cost Ratio (BCR) analysis.
- Preliminary environmental investigation (PEI).
- Urban design.
- Drainage and hydrology.
- Traffic management and access (via traffic impact assessment).
- Geometric road design.
- Cost estimation.
- Community consultation.

The road safety upgrade development process adopts a holistic approach, considering inputs from various studies and investigations and incorporating the objectives and constraints of the project while considering the value for money and quality outcomes. Refer to Section 3.3 for further details of the process.

The road safety upgrade development process is illustrated in Figure 15 on the next page.
Figure 15 - Inputs into the development of preferred treatments
3.3 Development process of preferred treatments

The development process of preferred treatments is illustrated below in Figure 16.

**Phase 1**
Initial scope, investigations and inputs
- Define high level scope and objectives of project
- Define high level design requirements
- Carry out 5 year crash analysis
- Identify safety issues on the highway
- Identify potential treatments to address road safety issues
- Hold community consultation
- Engage PEI, traffic survey, road boundary survey
- Prepare high level outline designs (pre-strategic concept)

**Phase 2**
Further investigations and identification of potential treatments
- Finalise PEI
- Identify issues from previous community consultation that may impact the design
- Identify constraints from the PEI that may impact the design
- Carry out a road safety review
- Prepare strategic concept designs
- Engage road survey
- Carry out a traffic impact assessment (Blackheath)
- Carry out an urban design assessment of potential treatments through village areas
- Identify issues/constraints and document how these will be addressed (or not if out of scope or are not feasible)
- Develop and agree technical assessment criteria to assess potential treatments
- Prepare the Potential Treatments Report

**Phase 3**
Development of potential treatments and reporting
- Finalise the strategic concept designs
- Prepare and publish the Potential Treatments Report
- Hold community consultation
- Identify issues from previous community consultation that may impact the design

**Phase 4**
Preferred treatment selection
- Identify changes to the strategic design from comments collected at community consultation
- Identify the preferred treatments
- Carry out a technical assessment of potential treatments and select preferred treatments
- Prepare and publish the Preferred Treatments Report
- Community update

**Future stages**
- Development of concept designs based on road boundary survey and consideration of community comment
- Environmental field investigations and mapping of constraints
- Carry out road survey
- Refinement of designs to address any identified constraints
- Preparation of a Review of Environmental Factors (REF)
- Community consultation at key stages of design and REF development and determination
3.4 Selection of preferred treatments

Consultation in April/May 2014 allowed the community to review the potential treatments and provide feedback. Taking the community feedback into consideration, the project team assessed potential treatments against technical criteria and the preferred treatments have been selected.

The process used to select the preferred treatments is illustrated in Figure 17 below.

![Figure 17 - Process to confirm the preferred treatments]
4. Community and stakeholder consultation

4.1 Consultation objectives and strategy
RMS has carried out a range of community consultation activities in relation to the upgrade of the highway between Katoomba and Mount Victoria, with specific reference to road safety.

Community consultation for the project has been carried out in three distinct stages:

1. Community consultation was carried out throughout January to March 2013. It identified the community’s issues in relation to road safety along the highway. More information about the 2013 consultation is provided in the Potential Treatments Report (March 2014).

2. Community consultation was carried out in April/May 2014 to present the potential treatments and the Potential Treatments Report for community feedback.

3. Community consultation will be carried out in November 2014 to inform the community of the preferred treatments and present the next stages of concept design development and environmental assessment approval. This phase of consultation will not involve information sessions and will consist of a community update providing feedback to the community.

4.2 Community consultation
In April/May 2014, the following consultation opportunities for stakeholders and the community were provided:

- **Community information sessions** - Two community information sessions were held, one at Medlow Bath and one at Blackheath, to discuss road safety issues and concerns and to allow the community to view the potential treatments and provide feedback.

- **Written correspondence** - During the consultation phase, community members were able to provide feedback to RMS’s project team in writing, via email or post.

- **Stakeholder meetings** – A series of three face-to-face stakeholder meetings were held in April/May 2014 to brief the key stakeholders about the potential treatments to ensure community input into the development process of the project.

- **Community update** – 5000 community updates were provided, advertisements were placed in the local newspaper and the Roads and Maritime Services project website was updated.
4.3 Community feedback from 2014 consultation

Community consultation was held in April/May 2014 and community members and other stakeholders were able to provide feedback on the potential treatments and the Potential Treatments Report. The submissions received during the consultation period have been summarised and are detailed in a Community Feedback Report which is on the project website.

4.3.1 Summary of issues raised

A high level summary of the key issues raised by the community during the consultation process in April/May 2014 is presented in Table 1 below.

Table 1 - Summary of key road safety issues from the community (April/May 2014)

<table>
<thead>
<tr>
<th>Category</th>
<th>Road safety issue/concern/comment on potential treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>• 70km/h speed limit in Section A should be 80km/h.</td>
</tr>
<tr>
<td></td>
<td>• 70km/h outside Bellevue Crescent (Medlow Bath) should be reduced to 60km/h.</td>
</tr>
<tr>
<td></td>
<td>• 80km/h speed limit in Section C should be reduced to 70km/h.</td>
</tr>
<tr>
<td></td>
<td>• Support for a lower speed limit in Blackheath.</td>
</tr>
<tr>
<td></td>
<td>• Support for speed cameras on the approach to Blackheath town centre.</td>
</tr>
<tr>
<td></td>
<td>• Concern that there is still vehicles going through the red light at the Govetts Leap Road intersection.</td>
</tr>
<tr>
<td>Heavy vehicles</td>
<td>• Increased number of trucks (and noise) and impact on residents and local businesses like guesthouses.</td>
</tr>
<tr>
<td></td>
<td>• Heavy vehicle speeding.</td>
</tr>
<tr>
<td></td>
<td>• Noise from compression braking and the need for signage to remind drivers not to do this.</td>
</tr>
<tr>
<td></td>
<td>• Point to Point speed cameras for heavy vehicle enforcement.</td>
</tr>
<tr>
<td></td>
<td>• Increased enforcement and monitoring of heavy vehicles at the Mount Boyce HVCS.</td>
</tr>
<tr>
<td>Pedestrian and cyclist safety</td>
<td>• Time to cross at signalised pedestrian crossings is too short.</td>
</tr>
<tr>
<td></td>
<td>• Keeping the bus stop and pedestrian refuge in the current location in Medlow Bath.</td>
</tr>
<tr>
<td></td>
<td>• A need for greater cyclist facilities along the highway or through town centres like Blackheath.</td>
</tr>
<tr>
<td></td>
<td>• Lack of pedestrian facilities from the residential areas on the approaches to Blackheath village.</td>
</tr>
<tr>
<td>Driver behaviour</td>
<td>• Speeding through village areas.</td>
</tr>
<tr>
<td></td>
<td>• Need to review heavy vehicle speed and driver behaviour through village areas.</td>
</tr>
<tr>
<td>Maintenance</td>
<td>• The traffic signal lanterns at the Govetts Leap Road intersection are angled and it is difficult to see the lanterns.</td>
</tr>
<tr>
<td></td>
<td>• Need for improvements to the traffic signal phasing in Blackheath.</td>
</tr>
<tr>
<td></td>
<td>• Need for increased maintenance to reduce flooding along the highway due to leaf litter blocking drains and culverts.</td>
</tr>
<tr>
<td>Category</td>
<td>Road safety issue/concern/comment on potential treatment</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Highway design   | • A need for safety barriers to protect pedestrians on the footpath.  
• Additional right turn bays along the highway (where none are proposed e.g. Foy Avenue).  
• Do not support the reduction in overtaking lanes but support the improvement to the merging of overtaking lanes in safe locations.  
• Support the road realignment of the winding section between Medlow Bath and Blackheath.  
• Support improvements to the merging lane exiting from Evans Lookout Road and to the current right turn lane.  
• Additional closures of some street accesses in Blackheath to support a range of different needs.  
• Support (or do not support) the various intersection treatments proposed through Blackheath with a range of comments to improve upon these.  
• Increasing the scope of the intersection treatments at some locations in Blackheath so that traffic signals could be installed in the future.  
• Concerns over access with the proposed intersection treatments and left in/left out changes proposed at some locations.  
• Concern that intersection treatments in some locations will widen the road and move it closer to properties which would increase noise and also impact on trees and parking.  
• A need for right turn arrows at the Govetts Leap Road intersection.  
• Concern that there would be restriction to access private residences or businesses from the highway, especially where there is a wide painted median.  
• Providing central median safety barrier with the wide painted median. |
| Other issues     | • Recent loss of avenue of pine trees along the highway in Medlow Bath.  
• Concerns over noise during the construction of the works and impact on businesses like guesthouses.  
• Support for the reduction in parking along the highway to allow for the intersection improvements but alternative parking needs to be provided in its place.  
• Improvements to the tourist signage to the Rhododendron gardens in Blackheath.  
• Concern to the possible impact to trees from some potential treatments in Blackheath and the need to minimise the impacts as much as possible.  
• Various other comments out of the project scope such as: moving road freight to rail, improvements to bus stop facilities, bypasses of Blackheath, provision of two lanes in each direction. |
4.4 Consideration of issues from community consultation

Community issues have been categorised to illustrate how the project team has considered these and where these may be carried through for further consideration and development in the future stages of the project. These categories are described as:

1. **Out of project scope**

The scope of the project is to provide suitable road safety engineering treatments to improve safety along the highway and this is based on the following design objectives:

- Wider sealed road shoulders.
- Isolated sections of realignment to improve tight curves (not upgrades along the whole highway).
- Road pavement improvements.
- Suitable safety barriers.
- Wide centre linemarking treatments.
- Pedestrian and cyclist facilities (where possible and appropriate).
- Bus stop relocations or adjustments.
- Sight distance improvements at side roads.
- Improved guide signage.
- Intersection treatments e.g. left in/left out only or protected right turn bays.
- Overtaking lane adjustments.
- Delineation improvements (particularly around curves).
- Profile linemarking (rural sections only).
- Speed zone adjustments (where appropriate).
- Traffic signal adjustments (where appropriate).
- Relocation of utility poles (particularly on rural sections close to curves).

Issues raised in relation to bypasses, diversion of road-based freight to rail, or shared path networks through village areas are considered to be outside the scope of this project.

2. **Reviewed by the project team but not considered a feasible or warranted solution and therefore not considered further (and the proposed treatment is retained).**

There were several suggestions raised by the community for consideration as alternative treatments or as new treatments at locations where there were none proposed by Roads and Maritime had not proposed treatments. These suggestions were reviewed by Roads and Maritime but were considered to be:

- Out of scope or not in line with the objectives of the project.
- Not feasible as they would not meet the necessary engineering and safety standards.
- Not warranted as the suggested treatment would not suitably address the issue or that the proposed treatment by Roads and Maritime was considered to be the most appropriate.
3. Proposed as part of the proposed treatments and no further change is required.
   This category was for suggestions that were made by the community that agreed with the proposed treatments or that suggested treatments that aligned with those proposed by Road and Maritime.

4. Requires further investigation and reporting in the Preferred Treatments Report.
   Several issues were raised by the community that Roads and Maritime committed to reviewing after the April/May 2014 consultation and to report back to the community on the findings of any investigations and the proposed actions to these issues. These were for the following specific issues:
   - Red light running at the Govetts Leap Road traffic signals in Blackheath.
   - Provision of a right turn arrow at the Govetts Leap Road traffic signals in Blackheath.
   - Angle of the signal lanterns at Govetts Leap Road traffic signals in Blackheath.
   - Review of the 70km/h speed limit that was along the highway across the entry to Bellevue Crescent in Medlow Bath.

5. Requires further investigation during the next stage of the project (concept design and environmental assessment)
   There were many suggestions or issues raised by the community that could not be adequately considered by Roads and Maritime as there is not sufficient information available, or that would be suitably considered when more detailed design and environmental assessment work is carried out. Roads and Maritime will review these issues as part of the commencement of the next stage of the project to make sure that these issues are considered wherever possible.

6. Requires a future design change during the next stage of the project (concept design and environmental assessment)
   Separate to the above category, this category was for issues or suggestions that had a definitive change to the treatment proposed by Roads and Maritime. There was one location that was identified in this category and it was for the selection of the preferred treatment option at the intersection of the highway and Gardiners Crescent in Blackheath. Community views on the proposed treatments – a protected right turn bay (Option A) or a left in/left out (Option B) – were almost equal. However, Roads and Maritime reviewed this location in more detail and determined that Option B is the most suitable option when assessed against safety and traffic management requirements.

7. Requires ongoing monitoring, police enforcement, or community education
   There were several issues raised by the community that although a typically out of the general scope of the project, they do present a key safety concern to the community and Roads and Maritime consider these to require ongoing monitoring, enforcement, or education with possible measures to address these issues considered through other programs if deemed necessary. These types of issues related to speeding, heavy vehicle speeding, speed zone changes and pedestrian timing at signalised intersections.

The Community Feedback Report provides a more detailed summary of the feedback and issues received during the April/May 2014 consultation and how these have been reviewed against the above seven categories.
4.6 Future consultation

The consultation process held in April/May 2014 provided the opportunity for the community and stakeholders to review the potential treatments and provide feedback.

Consultation in November 2014 will provide an update to the community to provide feedback on the preferred treatments that will proceed to the next stage of concept design and environmental assessment approval.

As part of the concept design development, a Review of Environmental Factors (REF) will be prepared. The community will be invited to provide comment on the concept design as part of the REF consultation process at an appropriate time in 2015.

Figure 18 illustrates the consultation and future design development process.
5. Road safety review

5.1 Road safety crash statistics

Definitions
Roads and Maritime crash statistics record crashes that conform to the National Guidelines for Reporting and Classifying Road Vehicle Crashes\(^2\). The main criteria for inclusion are that the crash was:

- Reported to the NSW Police Force.
- Occurred on a public road that is open to the public.
- Involved at least one moving vehicle.
- Involved at least one person being killed or injured or at least one vehicle being towed away.

Definitions relating to the crash or casualty type are:

- Fatal crash – at least one person was killed.
- Injury crash – at least one person was injured but no person was killed.
- Casualty crash – at least one person was killed or injured.
- Tow away crash – at least one vehicle was towed away but there were no casualties.
- Fatality – a person who dies within 30 days of the crash and as a result of the injuries sustained from that crash.
- Casualty – a person killed or injured as a result of a crash.

Crash analysis
The following crash statistics were recorded for the section of highway between Katoomba and Mount Victoria in the five years from 1 July 2008 to 30 June 2013\(^3\). In that time there were:

- 154 crashes overall.
- Two fatal crashes and 72 injury crashes.
- 80 per cent of crashes were midblock (123 crashes).
- 47 per cent of crashes occurred on a wet surface (73 crashes).
- 51 per cent of crashes involved speed (78 crashes).
- 39 per cent of crashes involved vehicles leaving the road on a curve (60 crashes).

Figure 19 on the next page illustrates the locality of casualty crashes along the highway between Katoomba and Mount Victoria.

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\(^2\) Great Western Highway (Mount Victoria to Lithgow) Safety Review October 2012 (Roads and Maritime/Pub. 10.320)

\(^3\) Crash statistics reported in the Potential Treatments Report (March 2014) were for the five year period from 1 July 2007 to 30 June 2012. Since then new crash data has been released and has been used for reporting in the Preferred Treatments Report.
Figure 19 - Plot of casualty crashes (2008-2013) between Katoomba and Mount Victoria (source – Roads and Maritime 2014)
### 5.1.1 Katoomba to Medlow Bath

**Table 2** below provides a summary of the casualty crashes for Section A, Katoomba to Medlow Bath.

**Table 2 - Summary of casualty crashes for Section A (source – Roads and Maritime 2014)**

<table>
<thead>
<tr>
<th></th>
<th>Crashes</th>
<th>Casualties</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24</td>
<td>15</td>
</tr>
<tr>
<td>Fatal</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Injury</td>
<td>13</td>
<td>54%</td>
</tr>
<tr>
<td>Non-casualty</td>
<td>11</td>
<td>46%</td>
</tr>
</tbody>
</table>

**Contributing factors**

<table>
<thead>
<tr>
<th></th>
<th>Speed</th>
<th>Fatigue</th>
<th>Alcohol</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>11</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>46%</td>
<td>21%</td>
<td>13%</td>
</tr>
</tbody>
</table>

**Conditions**

<table>
<thead>
<tr>
<th></th>
<th>Wet surface</th>
<th>Darkness</th>
<th>Intersection</th>
<th>Non-intersection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
<td>9</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>21%</td>
<td>38%</td>
<td>33%</td>
<td>67%</td>
</tr>
</tbody>
</table>

### 5.1.2 Medlow Bath township

**Table 3** below provides a summary of the casualty crashes for Section B, Medlow Bath township.

**Table 3 - Summary of casualty crashes for Section B (source – Roads and Maritime 2014)**

<table>
<thead>
<tr>
<th></th>
<th>Crashes</th>
<th>Casualties</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>18</td>
<td>23</td>
</tr>
<tr>
<td>Fatal</td>
<td>1</td>
<td>6%</td>
</tr>
<tr>
<td>Injury</td>
<td>8</td>
<td>44%</td>
</tr>
<tr>
<td>Non-casualty</td>
<td>9</td>
<td>50%</td>
</tr>
</tbody>
</table>

**Contributing factors**

<table>
<thead>
<tr>
<th></th>
<th>Speed</th>
<th>Fatigue</th>
<th>Alcohol</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>11</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>61%</td>
<td>6%</td>
<td>6%</td>
</tr>
</tbody>
</table>

**Conditions**

<table>
<thead>
<tr>
<th></th>
<th>Wet surface</th>
<th>Darkness</th>
<th>Intersection</th>
<th>Non-intersection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>11</td>
<td>5</td>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>61%</td>
<td>28%</td>
<td>6%</td>
<td>94%</td>
</tr>
</tbody>
</table>
5.1.3 Medlow Bath to Blackheath

Table 4 below provides a summary of the casualty crashes for Section C, Medlow Bath to Blackheath.

Table 4 - Summary of casualty crashes for Section C (source – Roads and Maritime 2014)

<table>
<thead>
<tr>
<th>Crashes</th>
<th>55</th>
<th>Casualties</th>
<th>42</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatal</td>
<td>0</td>
<td>Killed</td>
<td>0</td>
</tr>
<tr>
<td>Injury</td>
<td>30</td>
<td>Injured</td>
<td>42</td>
</tr>
<tr>
<td>Non-casualty</td>
<td>25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contributing factors</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>48</td>
<td>87%</td>
<td></td>
</tr>
<tr>
<td>Fatigue</td>
<td>3</td>
<td>6%</td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td>2</td>
<td>4%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conditions</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet surface</td>
<td>42</td>
<td>76%</td>
<td></td>
</tr>
<tr>
<td>Darkness</td>
<td>13</td>
<td>24%</td>
<td></td>
</tr>
<tr>
<td>Intersection</td>
<td>1</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td>Non-intersection</td>
<td>54</td>
<td>98%</td>
<td></td>
</tr>
</tbody>
</table>

5.1.4 Blackheath township

Table 5 below provides a summary of the casualty crashes for Section D, Blackheath township.

Table 5 - Summary of casualty crashes for Section D (source – Roads and Maritime 2014)

<table>
<thead>
<tr>
<th>Crashes</th>
<th>48</th>
<th>Casualties</th>
<th>23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatal</td>
<td>1</td>
<td>Killed</td>
<td>1</td>
</tr>
<tr>
<td>Injury</td>
<td>19</td>
<td>Injured</td>
<td>22</td>
</tr>
<tr>
<td>Non-casualty</td>
<td>28</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contributing factors</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>4</td>
<td>8%</td>
<td></td>
</tr>
<tr>
<td>Fatigue</td>
<td>2</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td>0</td>
<td>0%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conditions</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet surface</td>
<td>11</td>
<td>23%</td>
<td></td>
</tr>
<tr>
<td>Darkness</td>
<td>5</td>
<td>10%</td>
<td></td>
</tr>
<tr>
<td>Intersection</td>
<td>22</td>
<td>46%</td>
<td></td>
</tr>
<tr>
<td>Non-intersection</td>
<td>26</td>
<td>54%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Collision type</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Single vehicle</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>Multi vehicle</td>
<td>14</td>
<td></td>
</tr>
</tbody>
</table>
## 5.1.5 Blackheath to Mount Victoria

Table 6 below provides a summary of the casualty crashes for Section E, Blackheath to Mount Victoria.

### Table 6 - Summary of casualty crashes for Section E (source – Roads and Maritime 2014)

<table>
<thead>
<tr>
<th>Crashes</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatal</td>
<td>0</td>
</tr>
<tr>
<td>Injury</td>
<td>2</td>
</tr>
<tr>
<td>Non-casualty</td>
<td>8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Casualties</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Killed</td>
<td>0</td>
</tr>
<tr>
<td>Injured</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Crashes by year</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>0</td>
</tr>
<tr>
<td>2012</td>
<td>2</td>
</tr>
<tr>
<td>2011</td>
<td>3</td>
</tr>
<tr>
<td>2010</td>
<td>3</td>
</tr>
<tr>
<td>2009</td>
<td>2</td>
</tr>
<tr>
<td>2008</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conditions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet surface</td>
<td>4</td>
</tr>
<tr>
<td>Darkness</td>
<td>3</td>
</tr>
<tr>
<td>Intersection</td>
<td>0</td>
</tr>
<tr>
<td>Non-intersection</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Collision type</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Single vehicle</td>
<td>3</td>
</tr>
<tr>
<td>Multi vehicle</td>
<td>7</td>
</tr>
</tbody>
</table>
5.2 Road safety review

The process
Over the last few years the road safety review process has been adopted by Roads and Maritime and the Transport for New South Wales (TfNSW) Centre for Road Safety. Road safety reviews have been conducted on a number of major highways across the state e.g. Pacific, New England, Great Western, Mitchell and Mid Western Highways.

The key focus of the road safety review process is to investigate, to a sufficient level of detail (though not to road safety audit detail), the following key road safety engineering issues of the highway road environment:

- Road alignment.
- Road surface.
- Road shoulders.
- Safety barriers.
- Intersection treatments.
- Sight distance.
- Signage.
- Line marking.
- Delineation.
- Clear zones.
- Speed zones.
- Pedestrian and cyclist facilities.

The aim of the road safety review process is to develop suitable road safety engineering treatments to address the identified road safety issues. Generally the treatments developed as a result of road safety reviews are intended to address road safety issues and crash patterns.

The intention of the road safety engineering treatments is to provide a safer road environment and one that is more forgiving of driver error, thereby reducing the occurrence and severity of crashes.

The review
A road safety review led by SMEC, with representatives from Roads and Maritime, was carried out on 29 May 2013. Representatives from Roads and Maritime included suitably qualified and experienced people from the project development, road safety, asset, and road design disciplines.

The purpose of the road safety review was to assess the road environment along the section of the highway, identify road safety issues, confirm the issues raised during community consultation and consider possible road safety engineering treatments.

The highway was reviewed in both the eastbound and westbound directions using a series of drive throughs and inspections from safe locations from the side of the road.

Casualty crash locations recorded over the five year period from 1 July 2007 to 30 June 2012 and feedback gathered from the community consultation process in February 2013 were also considered as part of the review process.
5.3 Road safety issues and potential treatments

The aim of the road safety review was to develop potential treatments to address the identified road safety issues. These treatments can take two forms:

1. Mass action: general treatments along the whole route to provide a level of consistency, e.g. advance side street signage, CAMS, wide centre line marking, side road sight distance reviews.

2. Targeted: treatments at specific locations or discrete sections of the highway to address a range of issues, e.g. intersection treatments, road re-alignment, safety barriers at hazards in the clear zone, shoulder widening.

5.3.1 Mass action treatments

Table 7 below provides details of the whole of route road safety issues and the potential mass action treatments to address them.

Table 7 - Summary of mass action treatments

<table>
<thead>
<tr>
<th>Road safety issues</th>
<th>Mass action treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of suitable advance side road signage.</td>
<td>• Install suitable advance side road signage before all side road intersections.</td>
</tr>
<tr>
<td>Overtaking lanes end on curves, crests or across right turn accesses and overtaking</td>
<td>• Review the overtaking lanes and other overtaking opportunities to ensure that they are in safe locations. Make necessary adjustments where required to make sure that overtaking is not permitted in unsafe locations.</td>
</tr>
<tr>
<td>right turn accesses and overtaking is permitted in short sections where no overtaking</td>
<td></td>
</tr>
<tr>
<td>lanes are provided.</td>
<td></td>
</tr>
<tr>
<td>Inconsistent use of profile line marking in rural sections.</td>
<td>• Install profile line marking (edge and centre) along all rural sections of the highway where it does not presently exist. It will not be installed in close proximity to or through urban areas.</td>
</tr>
<tr>
<td>Curve alignment marker signage (CAMS) has been installed on most curves although there</td>
<td>• Review the curves along the route and identify those that require CAMS and advisory speed limit signage.</td>
</tr>
<tr>
<td>are locations where it could be improved for consistency. This also applies to advisory</td>
<td>• Install CAMS and advisory speed limit signage as required.</td>
</tr>
<tr>
<td>speed limit signage.</td>
<td></td>
</tr>
<tr>
<td>Lack of suitable delineation on safety barriers.</td>
<td>• Install suitable delineation along the safety barriers where required.</td>
</tr>
<tr>
<td>There are locations where guideposts are not consistently placed or are missing.</td>
<td>• Upgrade guide posts along the route where necessary.</td>
</tr>
<tr>
<td>Restricted sight distance from side road intersections due to vegetation and other</td>
<td>• Review the sight distance of all side road accesses and develop a program of work to improve sight distance where required.</td>
</tr>
<tr>
<td>obstructions.</td>
<td></td>
</tr>
<tr>
<td>Some utility poles are located close to the road shoulder or on the outside of curves.</td>
<td>• Review the location of utility poles and identify those that require relocation or the installation of safety barriers to improve safety.</td>
</tr>
<tr>
<td>Unprotected drop-offs and other hazards in the clear zone.</td>
<td>• Review and identify locations where work is required to reduce the risk of hazards in the clear zone, e.g. removal of the hazard or the installation of a suitable safety barrier.</td>
</tr>
</tbody>
</table>
### 5.3.2 Targeted treatments

A summary of the key road safety issues and potential treatments is provided in **Tables 8 to 12** on the next pages.

#### Table 8 - Road safety issues and potential treatments (Katoomba to Medlow Bath)

**Section A: Katoomba to Medlow Bath**

<table>
<thead>
<tr>
<th>Observed road safety issues</th>
<th>Potential treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete median does not have sufficient delineation (where there is no street lighting).</td>
<td>• Paint the edge of the concrete median.</td>
</tr>
<tr>
<td>Painted median is not filled in.</td>
<td>• Install painted chevrons within the painted median.</td>
</tr>
<tr>
<td>Westbound lane merge (from two lanes to one lane) occurs at the Rowan Lane egress.</td>
<td>• Relocate the merge and terminate it before Rowan Lane.</td>
</tr>
</tbody>
</table>

**Rowan Lane to Explorers Tree (Pulpit Hill Road)**

<table>
<thead>
<tr>
<th>Observed road safety issues</th>
<th>Potential treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep uncovered and unprotected dish drain next to the road shoulder and on the outside of a curve west of Pulpit Hill Road (next to the Explorers Tree memorial).</td>
<td>• Pipe the open dish drain (possibly with an open grate system) and bring to the same level as the road shoulder.</td>
</tr>
<tr>
<td>There is no safety barrier on the approach to and departure from the Explorers Tree memorial (west of Pulpit Hill Road).</td>
<td>• Install a suitable safety barrier or redirective kerb.</td>
</tr>
<tr>
<td>Curve alignment marker signage (CAMS) is old and not consistently placed.</td>
<td>• Upgrade the CAMS around the curves on the approach to Pulpit Hill Road in both directions.</td>
</tr>
<tr>
<td>Narrow road shoulders with no provision for cyclists.</td>
<td>• Widen the road shoulders (potentially with some minor curve realignment) at the curves on approach to Pulpit Hill Road and at the crest further west of Pulpit Hill Road.</td>
</tr>
<tr>
<td>‘No Right Turn’ signage (for turn onto highway) opposite Pulpit Hill Road is old and faded.</td>
<td>• Install new ‘No Right Turn’ signage.</td>
</tr>
</tbody>
</table>
## Explorers Tree (Pulpit Hill Road) to Foy Avenue (Medlow Bath sign)

<table>
<thead>
<tr>
<th>Observed road safety issues</th>
<th>Potential treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>The alignment about 150-400 metres west of Explorers Road has narrow road shoulders and is on a curve with no central median safety barrier separation.</td>
<td>• Provide wider road shoulders, install central median wire rope safety barrier and improve the capacity of the mountain drain on the eastern side.</td>
</tr>
<tr>
<td>W-beam safety barrier at the informal truck stop (old stockpile site) terminates too early and is on a curve.</td>
<td>• Extend the W-beam safety barrier further east to provide greater protection around the approach to the curve.</td>
</tr>
<tr>
<td>The truck stop location (with truck stop sign) is not ideal as it is on the outside of a curve in the clear zone (old stock pile site).</td>
<td>• Remove the truck stop sign.</td>
</tr>
<tr>
<td>The overtaking lane east of Foy Avenue (westbound) ends on a crest and on a curve.</td>
<td>• Relocate the merge and terminate it before the curve and crest, east of Foy Avenue.</td>
</tr>
<tr>
<td>The shoulders are generally narrow and inconsistent in width, with some locations not fully sealed and with no provision for cyclists.</td>
<td>• Widen and seal the road shoulders, to at least two metres where possible.</td>
</tr>
<tr>
<td>There are locations with unprotected drop-offs and drains next to the highway on the westbound side.</td>
<td>• Install suitable safety barrier next to the drop-offs and drains.</td>
</tr>
</tbody>
</table>
### Table 9 - Road safety issues and potential treatments (Medlow Bath township)

#### Section B: Medlow Bath township

<table>
<thead>
<tr>
<th>Foy Avenue to the Hydro Majestic Hotel</th>
<th>Potential treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sealed road shoulders are narrow in sections and there is no provision for cyclists.</td>
<td>- Widen and seal the road shoulders, to at least two metres where possible.</td>
</tr>
<tr>
<td>There is no wide centreline through the township to the east of Foy Avenue. The pavement between the United petrol station and the Medlow Bath railway station is very wide. Outside the Hydro Majestic there are no formal parking arrangements on the westbound side.</td>
<td>- Install a wide painted centre line through the Medlow Bath township to provide better lane delineation especially through the wide section of road.</td>
</tr>
<tr>
<td>The 70km/h speed zone starts just before the Bellevue Crescent intersection.</td>
<td>- Review the speed zone with the intention to relocate the 70km/h speed zone to a suitable location east of Bellevue Crescent.</td>
</tr>
<tr>
<td>There is no right turn facility into Bellevue Crescent.</td>
<td>- Provide a protected right turn bay at Bellevue Crescent.</td>
</tr>
<tr>
<td>There is a deep uncovered and unprotected dish drain next to the road shoulder on the westbound side outside the United petrol station.</td>
<td>- Replace the dish drain with a pipe (possibly with an open grate system) and bring it to the same level as the road shoulder, or install a suitable safety barrier next to the drain.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hydro Majestic Hotel to about 150 metres west of Cox Avenue</th>
<th>Potential treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>The bus stop (eastbound) outside Medlow Bath railway station is before the pedestrian refuge and buses block the sight line of those crossing from the station.</td>
<td>- Relocate the bus stop further east to just past the entrance to the Medlow Bath railway station.</td>
</tr>
<tr>
<td>The eastbound lane merge from the over bridge occurs on a curve and close to the bus stop.</td>
<td>- Extend the merge further east as part of the relocation of the bus stop.</td>
</tr>
<tr>
<td>Pedestrian refuge does not have any kerbside blisters.</td>
<td>- Install kerbside blisters on either side of the pedestrian refuge (ensure that they allow for safe cycle access).</td>
</tr>
<tr>
<td>The concrete median and concrete safety barrier across the rail over-bridge does not have sufficient delineation.</td>
<td>- Install suitable reflectors on the concrete safety barrier and paint the edge of the concrete median.</td>
</tr>
<tr>
<td>There is evidence of errant vehicles (perhaps travelling too fast) possibly hitting the central concrete median.</td>
<td>- Investigate this further (perhaps via a speed survey). If there is a speeding problem consider installing re-directive kerb.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Station Street/Belgravia Street, Medlow Bath to rail level crossing at Blackheath</th>
<th>Potential treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>There are no suitable facilities for cyclists or pedestrians along the highway.</td>
<td>- Seal the existing off-road gravel track that runs to the south of and next to the rail line and install suitable shared use signage. (Note: this is partially in Section B and D and along the full length of Section C).</td>
</tr>
</tbody>
</table>
Table 10 - Road safety issues and potential treatments (Medlow Bath to Blackheath)

**Section C: Medlow Bath to Blackheath**

<table>
<thead>
<tr>
<th>Observed road safety issues</th>
<th>Potential treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>The eastbound lane merge occurs at the beginning of the rail overbridge on a curve.</td>
<td>• End the merge to the west, before the curve.</td>
</tr>
<tr>
<td>This section generally has a winding alignment (with several low radius curves with 55km/h advisory speed limits), narrow road, narrow road shoulders and minimal separation of opposing travel lanes.</td>
<td>• Realign the curves to provide a straighter alignment. Widen and seal the road shoulders to at least two metres where possible. Install a wide centre line with profile line marking and a suitable safety barrier and CAMS, where required.</td>
</tr>
<tr>
<td>There are unprotected drop-offs and drains next to the road.</td>
<td>• Install suitable safety barriers next to the drop-offs and drains.</td>
</tr>
<tr>
<td>Utility poles are close to the road and often on the outside of curves.</td>
<td>• Relocate the utility poles that are close to the road and where necessary to facilitate the curve realignment and shoulder widening. Where they cannot be relocated install suitable safety barrier.</td>
</tr>
</tbody>
</table>
Table 11 - Road safety issues and potential treatments (Blackheath township)

**Section D: Blackheath township**

<table>
<thead>
<tr>
<th>Evans Lookout Road to Govetts Leap Road</th>
<th>Potential treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Observed road safety issues</strong></td>
<td></td>
</tr>
<tr>
<td>The rock basket retaining wall near the road shoulder on the westbound side at Evans Lookout Road is not protected.</td>
<td>• Investigate suitable measures to improve safety at this location such as safety barrier or redirecive kerb.</td>
</tr>
<tr>
<td>The westbound overtaking lane terminates on a crest and a curve just past Jellicoe Street and before Prince George Street.</td>
<td>• Adjust the overtaking lane so that it terminates at a suitable location.</td>
</tr>
<tr>
<td>The right turn into Hargraves Street is from within the fast lane of the overtaking lane.</td>
<td>• Provide a protected right turn bay at Hargraves Street by making adjustments to the overtaking lane</td>
</tr>
<tr>
<td>There is a short section of broken barrier line between Hargraves Street and Evans Lookout Road and between Abbott Street and Govetts Leap Road, that allows mid-block overtaking (in one direction) where no overtaking lanes are provided.</td>
<td>• Remove these sections of mid-block overtaking and install a double unbroken barrier line to prevent overtaking on this urban section of the highway.</td>
</tr>
<tr>
<td>There is no dedicated right turn bay into Prince George Street.</td>
<td>• Provide a protected right turn bay at Prince George Street.</td>
</tr>
<tr>
<td>There are sight distance issues at Jellicoe Street due to a crest and near by rock cutting embankment.</td>
<td>• Change the arrangements at Jellicoe Street to left in/left out only or a closure at the highway.</td>
</tr>
<tr>
<td>There is no dedicated right turn bay into Abbott Street.</td>
<td>• Provide a protected right turn bay at Abbott Street to allow indirect access to Jellicoe Street and to address the proposed banned right turn at Jellicoe Street.</td>
</tr>
<tr>
<td>There is no dedicated right turn bay into Leichhardt Street.</td>
<td>• Change the arrangements at Leichhardt Street to provide left in/left out only with indirect access provided by the right turn at Prince George Street.</td>
</tr>
</tbody>
</table>
## Govetts Leap Road to Radiance Avenue

### Observed road safety issues

<table>
<thead>
<tr>
<th>Observed road safety issues</th>
<th>Potential treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is no right turn bay or right turn signal at the Govetts Leap Road intersection (westbound).</td>
<td>• Investigate traffic signal adjustments to provide a right turn filter (shared with the through lane movement).</td>
</tr>
<tr>
<td>The central traffic signal lantern at Govetts Leap Road (eastbound) is angled down making it difficult to see the green lantern due to the louvre over the signal.</td>
<td>• Review the traffic signal lanterns for visibility.</td>
</tr>
<tr>
<td>Speeding through town, especially by heavy vehicles, is a concern.</td>
<td>• Conduct a speed survey. If the results indicate that there is a speeding problem then other measures need to be considered, e.g. a road side enforcement bay for mobile speed enforcement.</td>
</tr>
<tr>
<td>Red light running at the Govetts Leap Road intersection, especially by heavy vehicles, is a concern.</td>
<td>• Conduct a counter survey to gather more evidence and establish how prevalent this behaviour is.</td>
</tr>
<tr>
<td>The uncontrolled crossing of the highway by pedestrians creates a safety issue due to the parking on the westbound side of the highway (particularly just west of Govetts Leap Road).</td>
<td>• Install corner fencing at the ‘No Stopping’ zone on the north east corner of the intersection to encourage pedestrians to use the signalised pedestrian crossing at the intersection with Govetts Leap Road.</td>
</tr>
<tr>
<td>There is no right turn bay at the Hat Hill Road intersection.</td>
<td>• Install a protected right turn bay into Hat Hill Road.</td>
</tr>
<tr>
<td>There is no right turn bay at the Gardiners Crescent intersection</td>
<td>• Install a protected right turn bay or left in/left out only.</td>
</tr>
<tr>
<td>There are narrow road shoulders in sections with no provision for cyclists</td>
<td>• Widen and seal road shoulders to at least two metres where possible.</td>
</tr>
<tr>
<td>There is no wide centreline through the township and its approaches.</td>
<td>• Install a wide painted centre line where appropriate and particularly on approaches to the township, for consistency along the route. • This treatment is more suitable on the westbound approach up to Prince George Street and the eastbound approach up to Ridgewell Road.</td>
</tr>
<tr>
<td>There are short sections of broken barrier line between Hat Hill Road and Radiance Avenue that allow mid-block overtaking (in one direction), where no overtaking lanes are provided.</td>
<td>• Remove these sections of mid-block overtaking and install a double unbroken barrier line to prevent overtaking on this urban section of the highway.</td>
</tr>
<tr>
<td>The bus stop between Radiance Avenue and Sunbeam Avenue (eastbound) is between the highway and the near by parallel side road, creating sight line issues.</td>
<td>• Investigate the possibility of relocating the bus stop to the near by parallel side road.</td>
</tr>
<tr>
<td>The side road access to Radiance Avenue allows right turn access (westbound) from the highway with no turning bay.</td>
<td>• Ban the right turn access in this location. Access is provided further to the east, via Radiance Avenue.</td>
</tr>
</tbody>
</table>
Table 12 - Road safety issues and potential treatments (Blackheath to Mount Victoria)

Section E: Blackheath to Mount Victoria

<table>
<thead>
<tr>
<th>Radiance Avenue to Browntown Oval entrance</th>
<th>Potential treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed road safety issues</td>
<td>Potential treatment</td>
</tr>
<tr>
<td>The line marking for the eastbound exit out of the Mount Boyce HVCS is misleading.</td>
<td>Review the line marking at this location and upgrade to a suitable arrangement delineating the acceleration lane (eastbound) and the entry/exit at the Mount Boyce HVCS.</td>
</tr>
<tr>
<td>The painted chevrons in the painted median (east side) are faded.</td>
<td>Install painted chevrons within the painted median.</td>
</tr>
<tr>
<td>The concrete safety barrier through the back to back curves needs better delineation.</td>
<td>Install suitable reflectors or mini CAMS on the concrete safety barrier.</td>
</tr>
<tr>
<td>The sealed shoulder on approach to Browntown Oval (westbound) is near by to a chevron and also the left turn bay into the oval.</td>
<td>The line marking of the road shoulder area needs to be more formal near by to the chevron.</td>
</tr>
<tr>
<td>The eastbound lane merge takes place just before the left turn (eastbound) access into the Mount Boyce HVCS.</td>
<td>Review the access and merging arrangements with a view to starting the lane merge further west and allowing sufficient distance before the access to the Mount Boyce HVCS.</td>
</tr>
</tbody>
</table>
6. Description of preferred treatments

Consultation carried out in April/May 2014 allowed the community to review the potential treatments and provide feedback. Taking the community feedback into consideration, the project team assessed potential treatments against technical criteria and the preferred treatments have been selected. More detail regarding the feedback and issues gathered from the April/May 2014 consultation process is provided in the Community Feedback Report.

6.1 Section A: Katoomba (Albion Street) to Medlow Bath (Foy Avenue)

Identified road safety issues:

- Insufficient delineation on concrete median (along divided road).
- Insufficient curve alignment marker signage (CAMS).
- Overtaking lanes merge at inappropriate locations.
- Uncovered and unprotected open drainage channel (next to the Explorers Tree memorial).
- Insufficient protection against roadside hazards from safety barriers.
- Narrow and inconsistent sealed road shoulders with no provision for cyclists.
- Existing wide painted median could be extended in length and width.
- Lack of profile line marking through the winding/undulating (rural) section.

Whole of section

Preferred treatments:

- Upgrade of directional signage and delineation.
- Relocation of overtaking lane merges to safer locations.
- Piping of the open drainage channel near by to the Explorers Tree memorial.
- Installation of suitable safety barriers next to roadside hazards.
- Two metre wide sealed road shoulders.
- Painted central median up to 1.2 metres wide.
- Installation of profile line marking (rural sections only).

Potential impacts:

- There are no identified potential impacts from the proposed road safety upgrades along this section at this stage of design development.
- Future stages of design development (which will include survey) may identify potential impacts and these will be considered at that time.

Figure 20 on the next page illustrates the preferred treatments for Section A.
NOTE
Refer to section 6 of this report for more detail about the proposed road safety upgrade work for this section of the highway.

Figure 20 - Preferred treatments for Section A.
6.2 Section B: Medlow Bath township (Foy Avenue to 150 metres west of Cox Avenue)

Identified road safety issues:

- Narrow road shoulders and no provision for cyclists.
- Very wide road pavement with insufficient lane delineation between United petrol station and Medlow Bath railway station and no formalisation of parking near by to the Hydro Majestic hotel.
- 70km/h speed zone starts just before the Bellevue Crescent intersection.
- No right turn bay for access into Bellevue Crescent.
- Deep uncovered and unprotected dish drain next to the road shoulder at the United petrol station.
- Bus stop blocks sight distance for those crossing from the rail station.
- Location of overtaking lane merge is on a curve and close to the bus stop.
- Pedestrian refuge at the rail station does not have any kerb side blisters.
- Concrete median and safety barrier across the rail over bridge does not have sufficient delineation.
- There is an off-road track on the western side of the rail line that provides access to Blackheath.

Whole of section

Preferred treatments:

- Two metre wide sealed road shoulders.
- Painted central median up to 1.2 metres wide and painted edgeline to improve delineation of traffic lanes and the near by parking.
- Relocation of the 70km/h after the Bellevue Crescent intersection (extending the 60km/h speed limit across the entry/exit to Bellevue Cresent).
- Provision of a protected right turn bay at Bellevue Crescent.
- Piping of the open drainage channel next to the United petrol station.
- Improve access arrangements at the United petrol station.
- Relocation of the bus stop and pedestrian refuge at the rail station further east (with kerb blisters for the pedestrian refuge).
- Relocation of overtaking lane merge to a safer location.
- Redirective kerb along the central median to improve vehicle direction over the rail bridge.
- Wire rope safety barrier (eastbound approach) to the rail bridge.
- Off-road sealed shared path between Station Street/Belgravia Street, Medlow Bath and Blackheath (using existing track).

Potential impacts:

Access

- The relocation of the bus stop further east will require pedestrians to walk a further 90-130 metres.
- The recent redevelopment of the Hydro Majestic Hotel has created new access arrangements from the highway. As a result of this the proposed changes to the bus stop and pedestrian refuge outside the Medlow Bath railway station will require review during concept design stage.
- Future stages of design development (which will include survey) may identify other impacts and these will be considered at that time.

Figure 21 on the next page illustrates the preferred treatments for Section B.
NOTE
Refer to section 6 of this report for more detail about the proposed road safety upgrade work for this section of the highway.

LEGEND

- **Widened sealed road shoulders (both directions)**
- **Wide painted central median**
- **Off road sealed shared path**
- **Intersection treatment**
- **Relocation of lane merge**
- **Piping of open drainage channel**
- **Bus stop and pedestrian refuge relocation**
- **Rail**

**Figure 21 - Preferred treatments for Section B.**
6.3 Section C: Medlow Bath (150 metres west of Cox Avenue) to Blackheath (Evans Lookout Road)

Identified road safety issues:
- Overtaking lanes merge at inappropriate locations.
- Narrow carriageway with winding alignment and minimal separation of opposing travel lanes.
- Unprotected drop-offs and drains next to the road.
- Utility poles are often on the outside of curves and close to the road.
- Narrow road shoulders and no provision for cyclists or pedestrians.
- There is an off-road track on the western side of the rail line that provides access to Blackheath.

Whole of section

Preferred treatments:
- Relocation of overtaking lane merges to a safer location.
- Three metre wide sealed road shoulders.
- Painted central median up to 1.5 metres wide.
- Upgrade of directional signage and delineation.
- Installation of profile line marking (rural sections only).
- Realignment of sections of carriageway to straighten some curves.
- Installation of safety barrier near by to roadside hazards.
- Utility pole relocations.
- Off-road sealed shared path between Station Street/Belgravia Street, Medlow Bath and Blackheath (using existing track).

Potential impacts:
- There are no identified potential impacts from the proposed road safety upgrades along this section at this stage of design development.
- Future stages of design development (which will include survey) may identify potential impacts and these will be considered at that time.

Figure 22 on the next page illustrates the preferred treatments for Section C.
LEGEND

- Widened sealed road shoulders (both directions)
- Wide painted central median
- Road realignment
- Off road sealed shared path
- Relocation of lane merge
- Rail

NOTE
Refer to section 6 of this report for more detail about the proposed road safety upgrade works for this section of the highway.

Figure 22 - Preferred treatments for Section C
6.4 Section D: Blackheath township (Evans Lookout Road to Radiance Avenue)

Identified road safety issues:
- Insufficient protection against roadside hazards.
- Overtaking lanes merge at inappropriate locations.
- Unprotected right turns are located in inappropriate locations.
- Sight distance issues at some side road accesses.
- Short section of broken barrier line that allows mid-block overtaking (in one direction), without overtaking lanes.
- Uncontrolled crossing of the highway by pedestrians due to on-street parking on the western side.
- There is no wide centreline through the township or its approaches.
- There is an off-road track on the western side of the rail line that provides access to Blackheath.

Whole of section
Preferred treatments:
- Installation of safety barriers (or redirective kerb) at suitable locations to provide protection against roadside hazards.
- Relocation of the overtaking lane start and end merges to a safer location and double barrier lines to prevent overtaking where there are no overtaking lanes.
- A range of intersection improvements and changes to access (see specific details below).
- Two metre wide sealed road shoulder (where suitable and possible).
- Painted central median one metre - 1.2 metres wide (on approaches to the township).
- Off-road sealed shared path between Station Street/Belgravia Street, Medlow Bath and Blackheath (using existing track).

Specific location/intersection
Preferred treatments:
GWH at Brightlands Avenue:
- Provision of left in/left out only access.

GWH at Chelmsford Street:
- Provision of left in/left out only access.

GWH at Sutton Park access:
- Provision of a protected right turn bay.

GWH at Hargraves Street:
- Provision of a protected right turn bay.

GWH at Jellicoe Street:
- Closure of street access from the highway (access will be via Abbott Street).

GWH at Abbott Street and Prince George Street:
- Provision of protected right turn bays into Abbott Street and Prince George Street and a left turn lane into Abbott Street.

GWH at Leichhardt Street:
- Provision of left in/left out only access.
Gardiner Crescent intersection:
• Provision of left in/left out only access.

Govetts Leap Road:
• Dedicated left and right turn bays together with a through travel lane in both directions.

Preferred treatments:
GWH at Hat Hill Road:
• Provision of a protected right turn bay.

GWH at Sturt Street:
• Provision of left in/left out only access.

GWH at access to cemetery:
• Provision of a protected right turn bay.

GWH at side road access to Radiance Avenue:
• Provision of left in/left out only access.

Potential impacts:

On street parking
• Twenty parking spaces possibly reduced to 12 spaces on the western side of the highway just north of the Govetts Leap Road intersection to accommodate turning lanes (to be confirmed following further design development and investigation as part of the concept design stage and when survey has been carried out).

Trees/vegetation
• Possible removal or trimming of some trees on the highway at intersections with Leichhardt Street, Govetts Leap Road and Abbott Street (to be confirmed following further design development and investigation).

Access
• Closure of access to Jellicoe Street from the highway due to sight distance issues.
• Left in/left out only access at some streets will require access via other local routes.
• Left in/left out at Leichhardt Street is the preferred treatment and closure of this street at the highway (suggested in April/May 2014 community feedback) is a matter for council to investigate and consider further as it is a local road.
• Left in/left out at Gardiner Crescent is the preferred treatment (as opposed to the alternative option of a right turn bay). Due to the short distance between the intersections of Gardiners Crescent and Hat Hill Road (where a right turn bay is proposed), the provision of another right turn bay has the potential to queue out and block the highway and the signalised pedestrian crossing.
• Signage to the Rhododenron gardens needs to be clear at Hat Hill Road due to the left in/left out proposed at Sturt Street.

Visual/urban amenity
• Potential for intersection treatments to make the highway road environment seem more urbanised.
• Potential for the road to shift across further to the eastern side between Brightlands Avenue and Prince George Street (next to Sutton Park and the service road) to accommodate the turning bays.
• Future stages of design development (which will include survey) may identify other impacts and these will be considered at that time.

Figure 23 on the next page illustrates the preferred treatments for Section D.
NOTE
Refer to section 6 of this report for more detail about the proposed road safety upgrade work for this section of the highway.

Figure 23 - Preferred treatments for Section D
6.5 Section E: Blackheath (Radiance Avenue) to Mount Victoria (Browntown Oval entrance)

Identified road safety issues:
- Narrow road shoulders and no provision for cyclists.
- There is no wide painted median.
- There is no right turn bay into the cemetery.
- Right turn access from the highway into the Radiance Avenue side road is unsafe.
- Line marking and painted chevrons on the central median at the Mount Boyce HVCS are faded.
- Lane merges at the entry/exit to the Mount Boyce HVCS are misleading.
- Insufficient delineation on the safety barrier through Soldiers Pinch.
- The sealed shoulder on approach to Browntown Oval (westbound) is next to a chevron and also the left turn bay into the oval which is misleading.

Whole of section

Preferred treatments:
- Two metre wide sealed road shoulders.
- Painted central median one metre - 1.2 metres wide.
- Provision of a protected right turn bay for access to the cemetery.
- Provision of left in/left out only access at the Radiance Avenue side road access.
- Painted traffic island at exit/entry and improved lane line marking at Mount Boyce HVCS.
- Signage for Mount Boyce HVCS access left lane from the eastbound approach.
- Upgrade to safety barrier delineation through Soldiers Pinch.
- Extension of painted chevrons on shoulder area before entry to Browntown Oval.

Potential impacts:
There are no identified potential impacts from the proposed road safety upgrades along this section at this stage of design development. Future stages of design development (which will include survey) may identify potential impacts and these will be considered at that time.

Figure 24 on the next page illustrates the preferred treatments for Section E.
NOTE
Refer to section 6 of this report for more detail about the proposed road safety upgrade works for this section of the highway.
7. Environmental and technical considerations

7.1 Overview
The preferred treatments proposed for the Great Western Highway between Katoomba and Mount Victoria would improve road safety and travel efficiency while working within the environmental, community and heritage constraints of the study area.

The study area is a combination of urban and natural environments, consisting of a 14 kilometre section of the Great Western Highway located between Albion Street, Katoomba in the southeast and Browntown Oval, Mount Victoria in the northwest.

7.2 Preliminary environmental investigation (PEI)
A PEI report was prepared by GHD in August 2013. The purpose of the PEI was to identify constraints that may influence the design of potential treatments and highlight important considerations for the design development process.

The PEI process integrates the environmental and social concerns into the Roads and Maritime decision making processes. This integration not only assists in a project's balance between environmental, social and economic factors but also satisfies part of the legislative obligation governing the development approval at both State and Federal level for ecologically sustainable development. The PEI is therefore a tool that reflects Roads and Maritime's commitment to the legal and moral obligations associated with ecologically sustainable development.

7.2.1 Key constraints
The key constraints identified in the study area are listed below. These need to be considered throughout the design development process:

- The Blue Mountains National Park is located to the east of the highway. If road safety upgrade work were to encroach on this land, an environmental impact statement would need to be prepared.
- Blue Mountains Shoalhaven Hanging Swamps, hosting habitats for a variety of threatened and migratory species, may occur north of the study area. Field work is required to confirm if the vegetation meets the EPBC criteria for an endangered ecological community.
- Areas of high and medium biodiversity constraint have potential to provide habitat for a range of threatened flora and fauna.
- A small area north of the study area is within the Greater Blue Mountains World Heritage Area. This is considered to be a high level constraint.
- Three Aboriginal heritage items have been recorded to the north of the study area, together with areas of high archaeological sensitivity in the Blue Mountains National Park and the Greater Blue Mountains World Heritage Areas. There are also watercourses and intact bushland nearby.
- Other identified heritage items include the Medlow Bath Railway Station Group, Blackheath Railway Station Group and railway shops, and 103 locally listed heritage items, 91 of which are located in the northern section of the project, around Blackheath.
- The integrity of the Blue Mountains drinking water catchment must be maintained.
- Noise management is likely to be a requirement where work is carried out nearby or within the urban areas of Blackheath and Medlow Bath.
- Access for residential dwellings, local streets and commercial areas, as well as pedestrian and cycle paths need to be considered.
- The visual appeal for road users, rail users and local residents is considered to be a moderate to high level constraint. The provision of screening vegetation for nearby properties should be considered during the design development.
• The existing road corridor next to the Blue Mountains National Park and Greater Blue Mountains World Heritage Area is considered to be a land use constraint.

• The vulnerability of the community to traffic condition changes should be cushioned by the maintenance of safe access to shops, services, community facilities and pedestrian pathways for the elderly and the broader community.

• Negative impacts to local businesses through changed traffic conditions, changed access or the removal of on-street parking needs to be carefully considered.

The key environmental and technical considerations identified within the study area are discussed in more detail in the PEI and the Potential Treatments Report.

7.3 Other technical considerations

7.3.1 Traffic impact assessment

A number of intersection treatments are proposed as preferred treatments along the highway and these have been developed with consideration of issues raised by the community and identified road safety issues. Typically the types of treatments consist of right turn bays or left in/left out restrictions and there are several potential treatments being considered through Blackheath.

The proposed safety improvements at intersections are likely to change the local traffic arrangements by redirecting a portion of traffic at intersections when turn bans are implemented. However to understand the potential impact of the proposed intersection treatments, a traffic impact assessment (TIA) was carried out by SMEC separate to the PEI. The TIA was carried out in Blackheath between Evans Lookout Road and Ridgewell Road and 16 intersections along the highway in this section were investigated.

A series of 24-hour, mid-block classified traffic volume and speed surveys were also commissioned to assess weekday and weekend peak period traffic trends.

The results of the speed surveys on the Great Western Highway through the Blackheath town centre indicate that the 85th percentile travel speeds between Leichhardt Street and Sutton Lane and between Govetts Leap Road and Gardiner Crescent are within the 60 km/h posted speed limit. Table 13 shows the 85th percentile speeds through Blackheath town centre.

<table>
<thead>
<tr>
<th>Location</th>
<th>Direction</th>
<th>85th percentile speed (km/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Western Highway, between Leichhardt Street and Sutton Lane</td>
<td>Northbound</td>
<td>57.1</td>
</tr>
<tr>
<td></td>
<td>Southbound</td>
<td>59.4</td>
</tr>
<tr>
<td>Great Western Highway, between Govetts Leap Road and Gardiner Crescent</td>
<td>Northbound</td>
<td>59.4</td>
</tr>
<tr>
<td></td>
<td>Southbound</td>
<td>54.9</td>
</tr>
</tbody>
</table>
The key findings of the TIA are:

- There are minimal impacts on the operation of the intersections, with all intersections operating at a good level of service both in the existing situation and also with the proposed changes.
- The intersection layouts are unlikely to be influenced by the queue lengths resulting from changed traffic conditions.
- Some parking spaces may be affected at the Great Western Highway/Govetts Leap Road/Bundarra Road intersection to accommodate the treatment, however, this is subject to further design investigation and community input into the next stage of the project.
- Safety of the intersections is likely to improve with the provision of turning bays.
- There are no impacts on the existing pedestrian and cyclist facilities.
- There are no impacts on the existing public transport services.

7.3.2 Speed cameras

The speed surveys carried out though Blackheath town centre as part of the TIA indicated that the 85th percentile travel speeds are within the 60km/h posted speed limit. As a result of this the installation of a speed camera is not possible as it does not meet the necessary criteria. NSW Police have advised that they regularly patrol this section of the Great Western Highway, which includes speed enforcement activities. Additionally there are identified locations for mobile speed camera enforcement which is the most suitable method of enforcement through the town centre.

7.3.3 Red light speed cameras

Feedback from community consultation identified concerns with vehicles (particularly heavy vehicles) running the red light at the traffic signals at Govetts Leap Road, Blackheath. Roads and Maritime will continue to evaluate this issue through the next stage of the project and ongoing liaison with the NSW Police.

7.3.4 Traffic signals at Govetts Leap Road

Right turn arrows

Feedback from community consultation identified concerns with the lack of right turn arrows at the traffic signals at Govetts Leap Road. The potential provision of right turn arrows will require further intersection traffic modelling and design investigation in the next stage of the project. This is required to better understand the length of the right turn bays needed to meet design standards for a signalised intersection and whether the bays can be provided with minimal impact to existing parking along the highway and Govetts Leap Road.

Angle of the traffic signal lanterns

Feedback from community consultation also indicated a concern with the angle of the traffic signal lanterns and that it can be difficult to see the traffic lights from some locations. Roads and Maritime has considered this issue however the lanterns are angled for the following important reasons:

- To maintain pedestrian safety by reducing the possibility of drivers incorrectly sighting the signals at the intersection with the signals at the mid-block pedestrian crossing.
- To meet safety requirements of RailCorp by making sure that train drivers are not distracted by traffic signal lanterns at the intersection due to the close proximity of the rail line.

Although the angle of the lanterns is needed to provide for the above safety measures, Roads and Maritime will investigate this further in the next stage of the project to identify suitable improvement measures.
8. Cost estimate and Benefit to Cost Ratio (BCR) of preferred treatments

8.1 Cost estimate

Strategic cost estimates for the identified preferred treatments were prepared based on the strategic concept designs and in accordance with the Roads and Maritime Project Estimating Manual (2008). The cost estimate for the total package of preferred treatments along the whole route (Sections A-E inclusive) is $42.2M (2014 dollars).

The breakdown of cost across the five sections is shown in Table 14 below.

Table 14 - Strategic cost estimate for Sections A-E

<table>
<thead>
<tr>
<th>Section</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>$1M</td>
</tr>
<tr>
<td>B</td>
<td>$4.5M</td>
</tr>
<tr>
<td>C</td>
<td>$28M</td>
</tr>
<tr>
<td>D</td>
<td>$7.6M</td>
</tr>
<tr>
<td>E</td>
<td>$1.1M</td>
</tr>
</tbody>
</table>

In the next stage of the project more detailed concept designs will be prepared based on road survey and other investigations and the cost estimate will be refined based on this more detailed information.

8.2 Benefit to Cost Ratio (BCR)

Safety Benefit to Cost Ratios (BCR’s) were prepared for each section of the highway and used to assess each section against the technical criteria as part of a multi criteria assessment (MCA) process. The safety BCR’s were prepared in accordance with the Roads and Maritime procedure Calculating Safety Outcomes for Road Projects (2012). All casualty crashes recorded for the five-year reporting period (1 July 2008 to 30 June 2013) were included as part of the safety BCR analysis.

The safety BCR process identifies the road safety engineering treatments that are proposed at locations where crashes have taken place. A benefit from a treatment is captured when the type of treatment is identified in the safety BCR database as providing a quantifiable benefit by reducing the occurrence and severity of that type of crash.

Each casualty crash was identified in the safety BCR spreadsheet and the potential benefit from each relevant treatment was calculated to provide an overall safety BCR for the section.

The safety BCRs that were calculated for Sections A-E of the highway based on the casualty crash data and the treatments that are proposed for each section is shown in Table 15 below.

Table 15 - Safety BCRs for Sections A-E

<table>
<thead>
<tr>
<th>Section</th>
<th>BCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.63</td>
</tr>
<tr>
<td>B</td>
<td>0.42</td>
</tr>
<tr>
<td>C</td>
<td>0.37</td>
</tr>
<tr>
<td>D</td>
<td>0.15</td>
</tr>
<tr>
<td>E</td>
<td>0.03</td>
</tr>
</tbody>
</table>
9. Prioritisation and selection of preferred treatments

9.1 Multi criteria analysis (MCA) assessment

To enable the prioritisation of preferred treatments on a section-by-section basis an MCA assessment was carried out by the project team against the following technical criteria.

Safety

• Improve road safety for all road users with the application of suitable road safety treatments that aim to reduce the occurrence and severity of crashes.

Consistency

• Provide similar treatments to address road safety issues along the route to provide consistency along the route.

Access

• Improve the accessibility for all road user groups; to cater for a mix of through, local and tourist traffic, pedestrians and cyclists; and to not create any disadvantage.

Environment

• Minimise the impact on the natural environment and sensitive surrounding land uses.

Community

• Minimise the impact on the community and address their issues and needs where possible with minimal disadvantage to the local community and / or businesses.

Economic (value for money – safety BCR)

• Provide the best value for money with suitable safety treatments applied to address crash types.

To carry out the MCA assessment it was necessary to establish weightings for each of the technical criteria. The project team followed a pair wise comparison approach which determined the weightings by assessing their relative importance to each other against the following scale:

0 = equal importance
1 = minor difference in importance
2 = medium difference in importance
3 = major difference in importance

The pair wise comparison carried out by the project team was based on the following agreed factors:

• Improved road safety outcomes is the key project objective.

• Safety BCRs provide an indication of value for money but only on a safety basis.

• Access is an important issue (particularly for village areas) however the provision of access is often tied to providing safe facilities along the highway at intersections.

• Consistency of treatments along each section (and along the route) is important to achieve optimal road safety outcomes.

• Environmental considerations are important however meeting environmental requirements is a key part of the design and project approval process which must happen for all preferred treatments.

• Community issues vary along the highway and there are more complex issues to address in village areas where there is a wider range of issues and community needs to address.
The assessment by the project team and the agreed criteria weightings is shown in Figure 25 below.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Comparison</th>
<th>Weighted Score</th>
<th>Percent Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Safety</td>
<td>A A2 A3 A1 A2 A2</td>
<td>10</td>
<td>48</td>
</tr>
<tr>
<td>B Value for Money (Safety BCR)</td>
<td>B B1 D1 B1 B1</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>C Access</td>
<td>C D1 C1 C1</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>D Consistency</td>
<td>D D2 D1</td>
<td>5</td>
<td>24</td>
</tr>
<tr>
<td>E Environment</td>
<td>E F1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>F Community</td>
<td>F</td>
<td>1</td>
<td>5</td>
</tr>
</tbody>
</table>

Figure 25 - Results of the pair wise comparison assessment

The pair wise assessment led to the following percentage weightings of the technical criteria agreed by the project team:

- Safety – 48 per cent.
- Value for Money (safety BCR) – 14 per cent.
- Access – 10 per cent.
- Consistency – 24 per cent.
- Environment – 0 per cent.
- Community – 5 per cent.

It was agreed by the project team that safety should have the highest weighting as road safety and providing improved safety outcomes is the main objective of the project. The project team also agreed that environment should not have a weighting as meeting environmental requirements must take place before any preferred treatments are approved for construction (e.g. as part of the environmental assessment and approval process).
9.2 Technical assessment

Following the agreement of the criteria weightings the project team then assessed each section and how it performs against the criteria in comparison to the other sections. A score between 1 (poor performance against the criteria) to 10 (high performance against the criteria) was agreed by the group and assigned to each section. The score related to either the section addressing the criteria or the relative importance of the criteria (and issue) for that section e.g. a section with a higher number of crashes received a higher score (and therefore priority) compared to a section with a lower number of crashes.

Table 16 below shows the MCA assessment of the sections against the weighted criteria and the overall score for each section.

Table 16 - MCA assessment of the sections against the criteria

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
<th>Weight %</th>
<th>Section A</th>
<th>Section B</th>
<th>Section C</th>
<th>Section D</th>
<th>Section E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety</td>
<td>48</td>
<td>5</td>
<td>2.38</td>
<td>4</td>
<td>1.90</td>
<td>8</td>
</tr>
<tr>
<td>Value for Money (safety BCR)</td>
<td>14</td>
<td>9</td>
<td>1.29</td>
<td>7</td>
<td>1.00</td>
<td>5</td>
</tr>
<tr>
<td>Access</td>
<td>10</td>
<td>4</td>
<td>0.38</td>
<td>5</td>
<td>0.48</td>
<td>4</td>
</tr>
<tr>
<td>Consistency</td>
<td>24</td>
<td>4</td>
<td>0.95</td>
<td>5</td>
<td>1.19</td>
<td>5</td>
</tr>
<tr>
<td>Environment</td>
<td>0</td>
<td>6</td>
<td>0.00</td>
<td>6</td>
<td>0.00</td>
<td>2</td>
</tr>
<tr>
<td>Community</td>
<td>5</td>
<td>3</td>
<td>0.14</td>
<td>6</td>
<td>0.29</td>
<td>3</td>
</tr>
</tbody>
</table>

Based on the assessment by the project team the order of priority for the future program of works (pending funding approval) should be based on the order as indicated by the overall weighted score shown in Table 17 below.

Table 17 - Overall weighted score and section priority

<table>
<thead>
<tr>
<th>Priority</th>
<th>Section</th>
<th>Weighted score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C</td>
<td>62.38</td>
</tr>
<tr>
<td>2</td>
<td>D</td>
<td>59.52</td>
</tr>
<tr>
<td>3</td>
<td>A</td>
<td>51.43</td>
</tr>
<tr>
<td>4</td>
<td>B</td>
<td>48.57</td>
</tr>
<tr>
<td>5</td>
<td>E</td>
<td>33.33</td>
</tr>
</tbody>
</table>
9.3 Comparison of the sections as part of the MCA assessment

Safety
The scores for safety were related to the number of casualty crashes that have taken place in the five year reporting period. For scoring against this criteria the approach was to provide a higher score to a section that performed more poorly in safety because it had a higher number of casualty crashes. This approach reflected the need to assign a higher score (and therefore priority) to that section to address the issue of safety.

Based on this approach Section A scored 5 as it is a section that rated as third in the overall ranking of casualty crashes compared to other sections. Section B scored 4 as it had less crashes than Section A. Section C had the highest number of crashes and was scored the highest with 8. Section D had the second highest number of crashes and scored 7. Section E had the lowest number of crashes and scored 3.

Value for Money (safety BCR)
The safety BCR was used as the indicator to assess value for money. It was recognised by the group that the safety BCR is a parameter that does not consider other factors such as environment, community issues, access, and consistency, and that these would be considered separately.

Based on the safety BCR results the scores for Sections A-E were assigned in descending order, which was reflective of the same trend in the safety BCR results. A section with a higher safety BCR was assigned a higher score as it illustrated a better outcome for value for money in terms of the proposed treatments addressing the occurrence and severity of casualty crashes.

Access
The assessment of access was based on a rural or village basis. For those sections that were within rural sections (Sections A, C, E) a lower score of 4 was assigned, as access was less of a priority for these sections when compared to the village sections.

Sections B and D were scored higher as these are in the village areas of Medlow Bath and Blackheath respectively. Section B was scored 5 compared to a score of 7 for Section D as the village area of Medlow Bath is smaller in comparison to Blackheath and the issues relating to access, although still important, are less complex.

Environment
The assessment against the environment criteria was based on the approach that a section deemed to have the potential for a higher number of environmental impacts (based on the type of treatments proposed) would be scored lower than sections that had a lower potential for impacts.

Based on this approach Section E scored the highest as it has the least potential impact. This was closely followed by Sections A and B. Sections C and D were scored lower in comparison due to the potential for these sections to have more complex environmental issues to address based on the potential impact of the proposed treatments in these sections.

Community
The assessment of the community criteria was based on the level of feedback and the issues raised by the community for each section. Typically there was more feedback and issues raised for the Medlow Bath and Blackheath village sections (Sections B and D respectively) when compared to the rural sections (Sections A, C, E).

The scoring was reflective of this with Section D scoring this highest due to the high number (and complexity) of community issues raised. Section B scored a 6 with similar issues although smaller in number and complexity. Section E scored a 4 as there were issues raised on the approach to Blackheath (Section D) and Sections A and C scored a 3 as there was a lower number (and complexity) of issues raised.
10. Program of works based on the prioritisation of sections and approved funding

The prioritisation of the preferred treatments is based on a section-by-section approach so that treatments can be delivered as a package of works to consistently address the issues within the section. Delivering the preferred treatments on this basis will provide a more efficient delivery of treatments and use of resources. It will also ensure that sections are consistently treated so that road safety issues are effectively addressed and road safety outcomes are achieved.

As the final funding for the project as a whole is not confirmed it may be necessary to prioritise sections against each other if sufficient funding is not available. However, the delivery of the preferred treatments would most likely be carried out where full funding is available for each section as a whole and partial completion of sections will be avoided where possible.

11. What happens next?

11.1 Next steps

Consultation in April/May 2014 allowed the community to review the potential treatments and provide feedback. Taking the community feedback into consideration, the project team assessed potential treatments against technical criteria and the preferred treatments have been confirmed.

The preferred treatments will proceed to the design and environmental assessment phase of the project. The prioritisation of preferred treatments will be on a section-by-section approach so that treatments can be consistently delivered as a package of works pending confirmation of project funding.

Figure 26 illustrates the process that was followed to confirm the preferred treatments.
11.2 Concept design and environmental assessment approval

Future stages of the project following the confirmation of the preferred treatments will involve:

- Development of concept designs based on road boundary survey.
- Refinement of designs to address any identified constraints and community feedback from April-May 2014.
- Environmental field investigations and mapping of constraints.
- The preparation (and approval) of a Review of Environmental Factors (REF).
- Community consultation at key stages of the concept design development and public display of the REF.
- Secure funding.
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