BARTON HIGHWAY IMPROVEMENT STRATEGY

JANUARY 2017

Transport MASTER PLAN

Barton Highway IMPROVEMENT STRATEGY

Australian Government

BUILDING OUR FUTURE

NSW GOVERNMENT

EXECUTIVE SUMMARY

The Barton Highway is a strategically important two-lane rural highway linking the southern and western areas of NSW to the ACT. The highway is 52 kilometres long with 41 kilometres within the Yass Valley Council local government area in NSW and plays a significant role in the National Land Transport Network connecting the Hume Highway near Yass and the surrounding rural and residential areas to the ACT and Canberra.

This *Barton Highway Improvement Strategy* has been prepared in partnership with the Australian and NSW governments. The Improvement Strategy sets out the NSW Government's 20 year plan to manage and guide the development of the road corridor within NSW to improve safety, traffic efficiency and sustainability.

The commitment of the Australian and NSW governments to ongoing improvements to the Barton Highway can be seen in the investment for road safety improvements and in the reservation and partial purchase of the corridor to be used for future duplication.

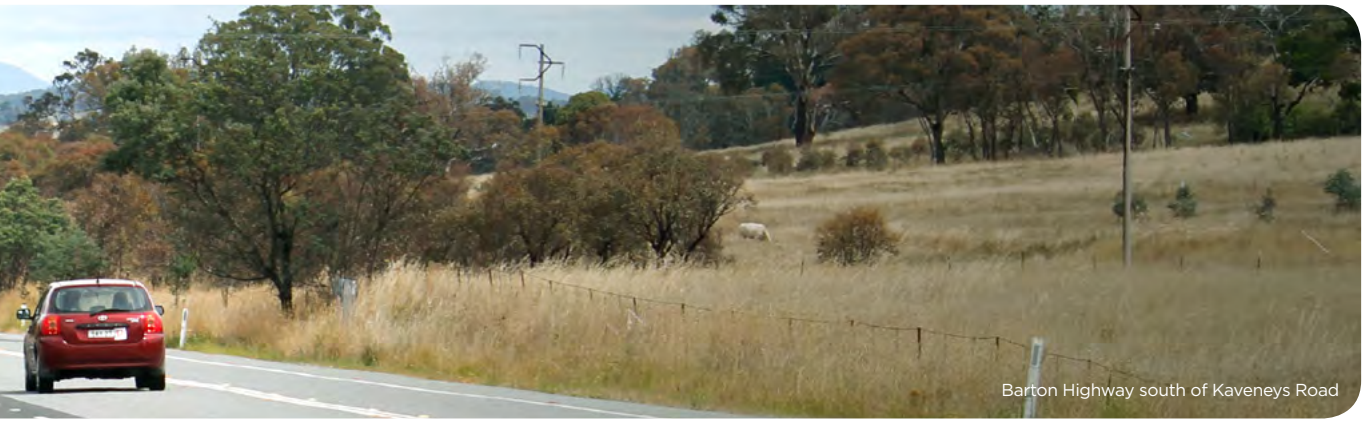
Preliminary work carried out some years ago estimated the cost of duplicating the Barton Highway to be $800 million. Although a more current estimate is yet to be prepared, it is considered that duplication could cost up to $1 billion in today's figures. For this reason, there is no doubt that duplication signifies a major investment by government in the country's road infrastructure.

The analysis of key performance data tells us that this investment cannot be justified in the immediate future. Evidence also suggests that duplication is not likely to be required within the 20 year framework of the current strategy. The Improvement Strategy highlights the need for other targeted road safety and travel reliability improvements.

The purpose of this strategy is to identify:

- Objectives specific to the Barton Highway that support the *NSW Long Term Transport Master Plan*, Regional Transport Plans and other State and National plans (Chapter 2).
- The concerns, values and issues that are important to the community along the highway (Chapter 3 and a separate Community Consultation Report).
- The sources of transport demand along the road corridor (Chapter 4).
- The performance of the highway in meeting specific targets, standards and objectives (Chapter 5). Measures include road safety, traffic and travel, road design and geometry and road pavement condition.
- How future transport demands that are likely to be placed on the highway over the next 20 years can be managed and what road corridor improvements are likely to be needed (Chapter 6).
- Current and future challenges in meeting these objectives (Chapter 7).
- Short, medium and long term priorities and actions to manage the highway (Chapter 8).

Cover image: Murrumbateman curves near Murrumbateman village


Barton Highway south of Kaveneys Road

The Improvement Strategy was completed in accordance with the Terms of Reference (**Appendix 1**). **Appendix 2** shows that the *Barton Highway Improvement Strategy* has addressed the outputs as outlined in the Terms of Reference.

The project team, working with consultants, measured current highway performance, assessed existing data, identified challenges and prioritised actions.

The road corridor was segmented into four smaller sections to assess its performance against a set of performance measures and targets.
These included:

- Section 1: Dual carriageway from the Hume Highway to near Kirkton Road and the Yass River.
- Section 2: Single carriageway from near Kirkton Road and the Yass River to Hillview Drive in the Murrumbateman village precinct.
- Section 3: Single carriageway through the Murrumbateman village precinct.
- Section 4: Single carriageway from the Murrumbateman village precinct to the ACT border (where dual carriageway begins).

The vision for the Barton Highway has been developed to explain what actions should be achieved over the next 20 years to improve the performance of the highway and meet the specific corridor objectives. The vision for the Barton Highway between the ACT border and Hume Highway over the next 20 years is that it:

- Provides safe and reliable commuter access to Canberra.
- Improves safety and amenity for the village of Murrumbateman.
- Provides an alternative access route to Canberra.
- Supports key freight movements between western and southern NSW and the ACT.
- Caters for the mix of through, local and tourist traffic along the corridor.

The users of the Barton Highway include commuters from the Yass Valley Council Local Government Area (LGA) travelling to the ACT for work, road freight from south west NSW and Victoria, tourists visiting local wineries and the ACT, and local traffic.

The traffic volumes in 2014 ranged from about 8000 vehicles per day near the Yass Valley Way to 12,500 vehicles per day near the ACT border. There are distinct weekday morning and afternoon peak periods with the largest peak leaving the ACT on a Friday afternoon. There is an additional afternoon peak into the ACT on Sunday afternoons. Heavy vehicles make up about eight per cent of the total traffic flow.

This study has examined historic traffic volumes and has predicted future growth trends using population projections from the NSW Department of Planning and Environment and land use development information from Yass Valley Council. Historic traffic growth is 1.8 per cent per year near Yass Valley Way increasing to three per cent per year near the ACT border. Projections over the

next 20 years follow similar patterns. This reflects the strong growth in residential and lifestyle land development in the Yass Valley Council area.

Community consultation formed a key part of the strategy. Planning for a Barton Highway duplication project began as far back as 1996 with a considerable amount of community engagement since then. This Improvement Strategy builds on the previous investigations, consultation and studies carried out for the *Barton Highway duplication: Preferred road corridor boundaries report* (2011). The community told us that driving on the road is stressful, particularly at peak times. They would like to see improvements in road safety and reduced travel delays. Locations of particular concern are Murrumbateman village to Mundays Lane and Nanima Road to the ACT border. Three commonly reported general issues were poor driver behaviour, lack of overtaking opportunities and difficulty in getting on and off the highway at intersections.

Key facts to support this *Barton Highway Improvement Strategy* include:

Road safety:

- There were 137 crashes between 2009 and 2013 with seven fatalities and 70 injury crashes. The majority of crashes recorded were between Murrumbateman village and the ACT border representing about 44 per cent of all crashes.
- About 40 per cent of these crashes occurred on weekends – more than on any weekday. The highest crash period occurring at the start and end of the weekend period.
- A high proportion of fatal crashes (5 of 7) involved vehicles crossing into or across opposing travel lanes.
- The peak weekday crash period is Friday afternoon, between 3.00 and 4.00pm.
- Thirty-five crashes were recorded at intersections, with at least 10 crashes as a result of turning movements at the intersections.
- The casualty crash rate of 0.37 crashes per kilometre per year along the corridor is significantly higher than the average crash rate for other roads with similar general traffic and heavy vehicle volumes.
- There are no significant pavement or geometric deficiencies along the route, although the road is narrow in many places, with narrow shoulders and inadequate clear zones. Conflict with pedestrians, horse riders and other vulnerable road users in Murrumbateman is an issue.

Travel speeds and level of service:

- The level of service along the route is acceptable with average travel speeds during the morning and afternoon peak periods (6.00 to 9.00am and 4.00 to 7.00pm) of between 81km/h and 95km/h. The performance of the route declines for a short period during the morning peak hour (7.15 to 8.15am) when average travel speeds for southbound vehicles travelling towards Canberra falls to 62km/h. Outside of peak hours, travel speeds are above 90km/h and approaching 100km/h. Overall, travel speed and levels of service are acceptable.
- There is a lack of alternate routes in case of road closures. Between 2009 and 2013 the route was totally closed for approximately 60 hours due to planned closures and unplanned incidents, causing significant delays and inconvenience to customers.
- There is also a lack of roadside infrastructure such as warning signs or variable message signs to inform customers about incidents and changed traffic conditions.

The *Barton Highway Improvement Strategy* has determined the following actions to address the highway's challenges and meet the objectives:

Short term actions:

To address the identified challenges of poor road safety performance, improve travel reliability and address community feedback, the short term priorities are:

- Develop and implement two new overtaking lanes along the corridor. One will nominally be a south bound overtaking lane between Nanima Road and Spring Range Road. A second (north bound) overtaking lane will be either between Spring Range Road and the ACT border, or between Mundays Lane and Kaveneys Road

depending on detailed design findings. Both locations will utilise the future duplication alignment with an upgraded pavement.

- Using Intelligent Transport Systems (variable message signs, closed circuit television cameras and real time traffic monitoring devices) to provide real time travel information to customers at key locations along the highway.
- Continue planning for future staged duplication, including a review of the strategic design, identification of stages and triggers to commence development, and updating the estimated costs and expected benefits realisation.
- Other targeted road safety works including intersection improvements, general delineation and line marking upgrades, and widening of lanes and road shoulders (including removing hazards from clear zones) to improve safety and access for all road users (particularly in the section closer to the ACT border).
- Investigate options to improve safety for cyclists, pedestrians and horse riders crossing the corridor within Murrumbateman village.
- Develop and design the upgrade of the curves between Vallencia Drive and Gooda Creek Road at the north end of Section 4. The proposed works will utilise the reserved duplication corridor to provide a new two-lane road (one lane in each direction) which will ultimately form part of a dual carriageway (two lanes in each direction).
- Monitor the performance of the corridor every three years to ensure the need for future works is reviewed and timelines for implementation can be adjusted in line with the need.

Medium term actions include:

- Construct the improvements to the curves between Vallencia Drive and Gooda Creek Road at the north end of Section 4. The proposed works will utilise the reserved duplication corridor to provide a new two-lane road (one lane in each direction) which will ultimately form part of a dual carriageway (two lanes in each direction).
- Continuing to review intersections to identify issues and upgrading intersections as required.
- Providing additional overtaking lanes to maintain traffic flow and reliability.
- Continue to provide the recommended clear zone requirements for the corridor.
- Continuing to progressively widen narrow lanes and shoulders.
- Monitor and evaluate the introduction of Intelligent Transport Systems to ensure ongoing journey reliability.

Long term actions include:

- Continue staged upgrades along the corridor to complement, or form part of, the future road duplication of this highway, including widening narrow lanes and road shoulders, reviewing and upgrading intersections, and monitor and manage the level of service for traffic on the highway.
- Any future roadwork along the corridor should complement, or form part of, the future road duplication of this highway. This includes purchasing any duplication corridor land as the pavement and clear zone widths are progressively improved. These and other actions form part of the longer term strategy to ensure that this important corridor link provides safe and efficient travel now and into the future.
- Monitoring the performance of the corridor on a regular basis to ensure the need for future works is understood and timelines for implementation can be adjusted accordingly.

Beyond long term actions include:

- Continue to monitor the traffic growth along the corridor. Sections with the highest traffic volumes would be targeted for partial duplication, although emerging safety issues would also be a strong influence.

Barton Highway at Hillview Drive looking north

CONTENTS

1 A QUICK OVERVIEW

Gounyan realignment near Long Rail Gully Road

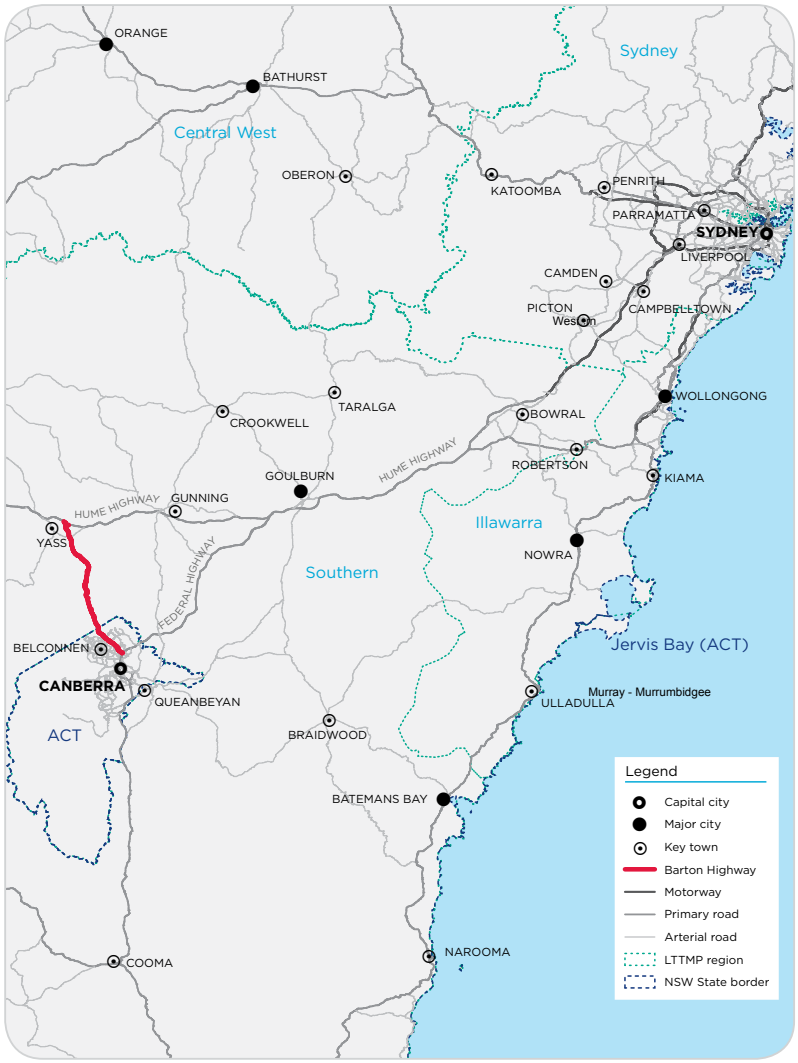
The Barton Highway runs north/south between the Hume Highway at Yass in NSW and Canberra in the ACT (See Figure 1-1). It is 52 kilometres long, with 41 kilometres located within the Yass Valley Council LGA.

The Barton Highway (route A25) forms one of the Sydney–Canberra corridors and part of one of the Sydney/Canberra/Melbourne corridors. It is strategically significant within the state's road network and is also an important link in the national road network. It connects south west NSW to the employment, health and education opportunities in Canberra and supports freight movements to the ACT.

The *Barton Highway Improvement Strategy* has been funded by both the Australian and NSW governments. This strategy sets out the 20 year plan to guide a staged upgrade of the road corridor to improve the safety and traffic efficiency. It addresses the current issues and constraints and takes into consideration the anticipated growth in traffic demand on the NSW section of the highway.

The Improvement Strategy has been prepared for the Australian and NSW governments with input from the Federal Department of Infrastructure and Regional Development, Transport for NSW, Roads and Maritime Services, Yass Valley Council and the ACT Government.

Figure 1-1 The Barton Highway connects south west NSW with the ACT



> The Barton Highway (route A25) forms one of the Sydney–Canberra corridors and part of one of the Sydney/Canberra/Melbourne corridors and is an important link in the national road network.

The actions outlined within this Improvement Strategy are expected to be delivered over a 20 year timeframe, in line with the *NSW Long Term Transport Master Plan*, Regional Transport Plans and other relevant national and State planning.

The highway is part of the defined National Land Transport Network which is funded by Federal, State and Territory governments. This network of road and rail transport links is made up of national and inter-regional transport corridors which are important to national and regional economic growth and connectivity.

The Barton Highway connects the Hume Highway with the ACT, and services the following towns:

- Yass
- Murrumbateman
- Hall
- Canberra.

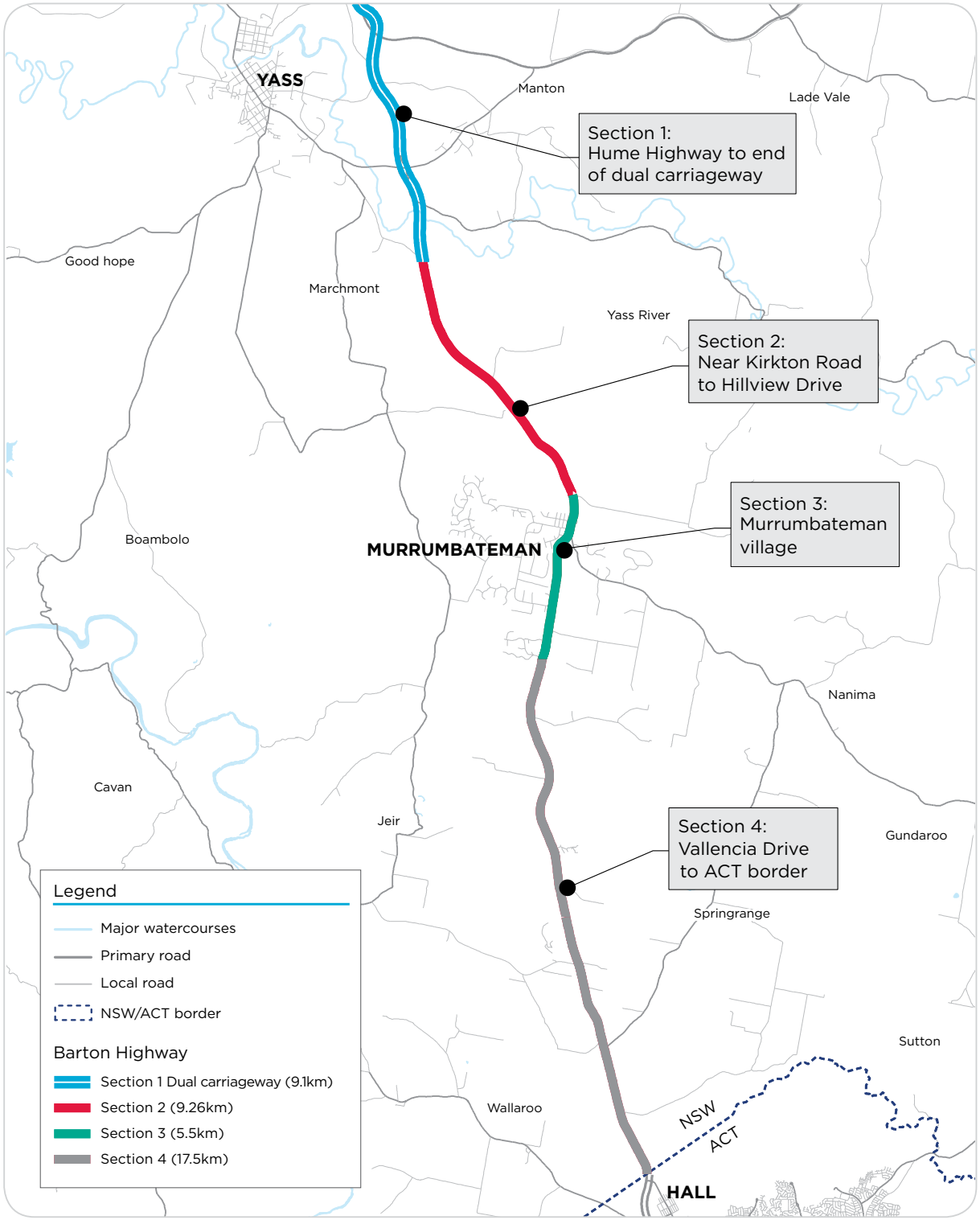
Within NSW, the Barton Highway is generally a two-lane, undivided rural road for the 32.5 kilometres north of the ACT. This stretch has few overtaking lanes, numerous intersections with feeder roads, and many residential and commercial access points. It also consists of a four-lane dual carriageway for the 8.5 kilometres south of the Hume Highway.

For the purposes of the strategy, the Barton Highway has been divided into four sections, each representing different land uses and challenges:

Corridor Section	Description
1	Dual carriageway from the Hume Highway to near Kirkton Road and the Yass River. This section was upgraded to dual carriageway in July 1994.
2	Single carriageway from near Kirkton Road and the Yass River to Hillview Drive in the Murrumbateman village precinct. This section is surrounded by rural properties.
3	Single carriageway through the Murrumbateman village precinct. Murrumbateman is a rural village with a small centre located in the north of the residential area.
4	Single carriageway from the Murrumbateman village precinct to the ACT border (where dual carriageway begins). This section is mainly rural land used for grazing and cropping. A quarry is located on Kaveneys Road to the west of the highway. The majority of the residential areas are located to the west of the highway.

The study area for the Improvement Strategy is shown in **Figure 1-2**.

Figure 1-2 *Barton Highway Improvement Strategy* study area



The study area for the Improvement Strategy has two components:

- The highway itself between the Hume Highway and the ACT border.
- The highway catchment which includes the ACT at its southern end, rural areas along the highway, Murrumbateman village and the town of Yass. Rural land uses include grazing, cropping, wineries and horse studs.

The Barton Highway serves a number of different road user groups including:

- Commuters
- Car users making local trips
- Recreational travellers
- Speed limited traffic (including P platers)
- Tourism
- Freight traffic
- Motorcyclists
- Public transport users (buses)
- Cyclists
- Pedestrians
- Horse riders
- Agricultural vehicles
- Emergency services vehicles.

Traffic volumes in 2014 along the Barton Highway vary significantly from around 8000 to 12,000 vehicles per day. The higher volumes are in the southern section closer to the ACT border, decreasing towards the Hume Highway. Within the village of Murrumbateman there are approximately 11,000 vehicles per day.

There are 300–500 heavy vehicles using the highway per day. As a proportion of total traffic, heavy vehicles range from 8.9 per cent near Yass, decreasing to 8.0 per cent near the ACT.

This Improvement Strategy sets out the objectives, current performance, current and future challenges and the NSW Government's strategic response to managing the Barton Highway corridor over the long term. While investment will continue along the entire length of the corridor to meet current and future demands, the focus will be on the southern and central sections where there are higher traffic volumes and safety concerns.

1.1 Recent major achievements on the Barton Highway corridor

At a cost of $40 million, the Australian Government has fully funded recent road safety improvements and planning for the potential future duplication of the highway between Yass Valley and the ACT border.

A package of safety improvements on the highway identified in the Barton Highway Road Safety Review completed in 2008 by Roads and Maritime Services included:

- Realignment of a one kilometre section of the Barton Highway at Capricorn Corner – completed February 2010.
- Construction of 4.5 kilometres of new road at Gounyan curves to remove seven bends in the highway – completed November 2011.
- Murrumbateman Road intersection upgrade and curve improvement to the south of Murrumbateman – completed in May 2014.
- McIntosh Circuit intersection improvement, south of Murrumbateman – construction was completed November 2015.
- Euroka Avenue intersection improvement, south of Murrumbateman – construction completed November 2015.

2 INTRODUCTION

The start of Barton Highway at the exit from the Hume Highway

2.1 Why an improvement strategy?

Transport for NSW together with Roads and Maritime Services are progressively preparing long term strategies for every State Road in NSW to create consistency in the way that the State Road Network is managed and planned.

These strategies will make planning and investment decisions transparent to the community, councils and other government agencies.

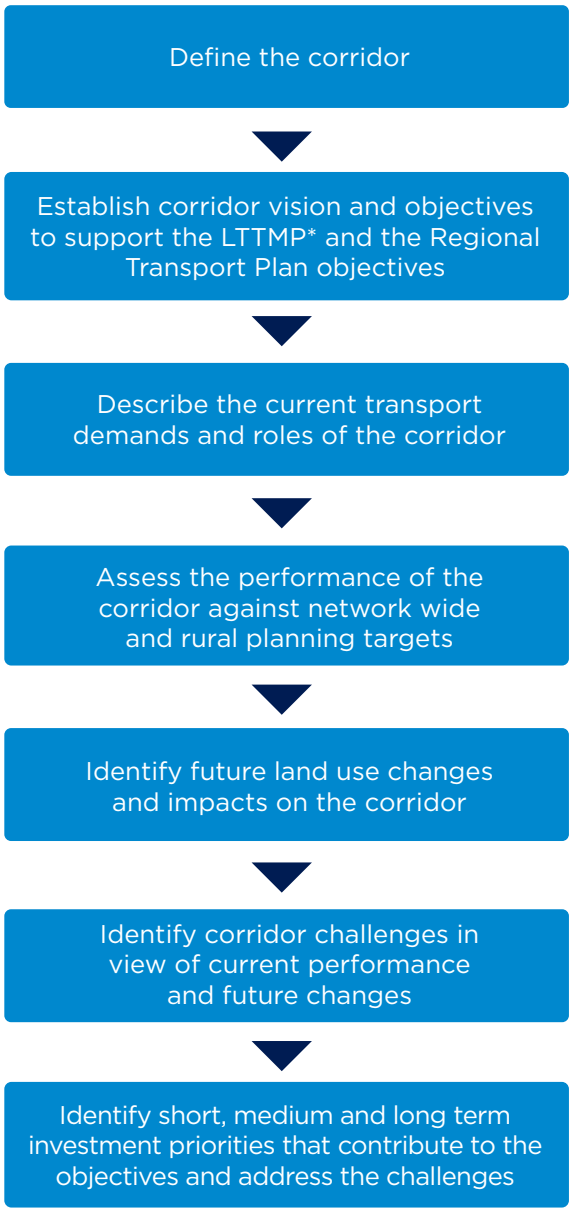
Drawing together a variety of elements, as shown in **Figure 2-1**, corridor strategies identify:

- Corridor specific objectives and vision statements that support the *NSW Long Term Transport Master Plan*, Regional Transport Plans, and other State and national plans.
- Current and future challenges in meeting these objectives.
- The performance of transport infrastructure in meeting these objectives.
- Key transport demands likely to be placed on the corridor over the next 20 years.
- Short, medium and long term priorities and actions to manage the corridor.

These strategies include priorities for future road maintenance, operation, safety, traffic and development. They set a 20 year framework, which brings together road safety, traffic efficiency and asset management activities, together with policy regarding freight access.

> Transport for NSW together with Roads and Maritime Services are progressively preparing long term strategies for every State Road in NSW.

Figure 2-1 Corridor planning process



**Long Term Transport Master Plan*

2.1.1 Why the Barton Highway?

In December 2013 the Australian and NSW governments announced funding for the preparation of the *Barton Highway Improvement Strategy*. The strategy builds on previous work that focused on identifying a corridor for the potential duplication of the highway.

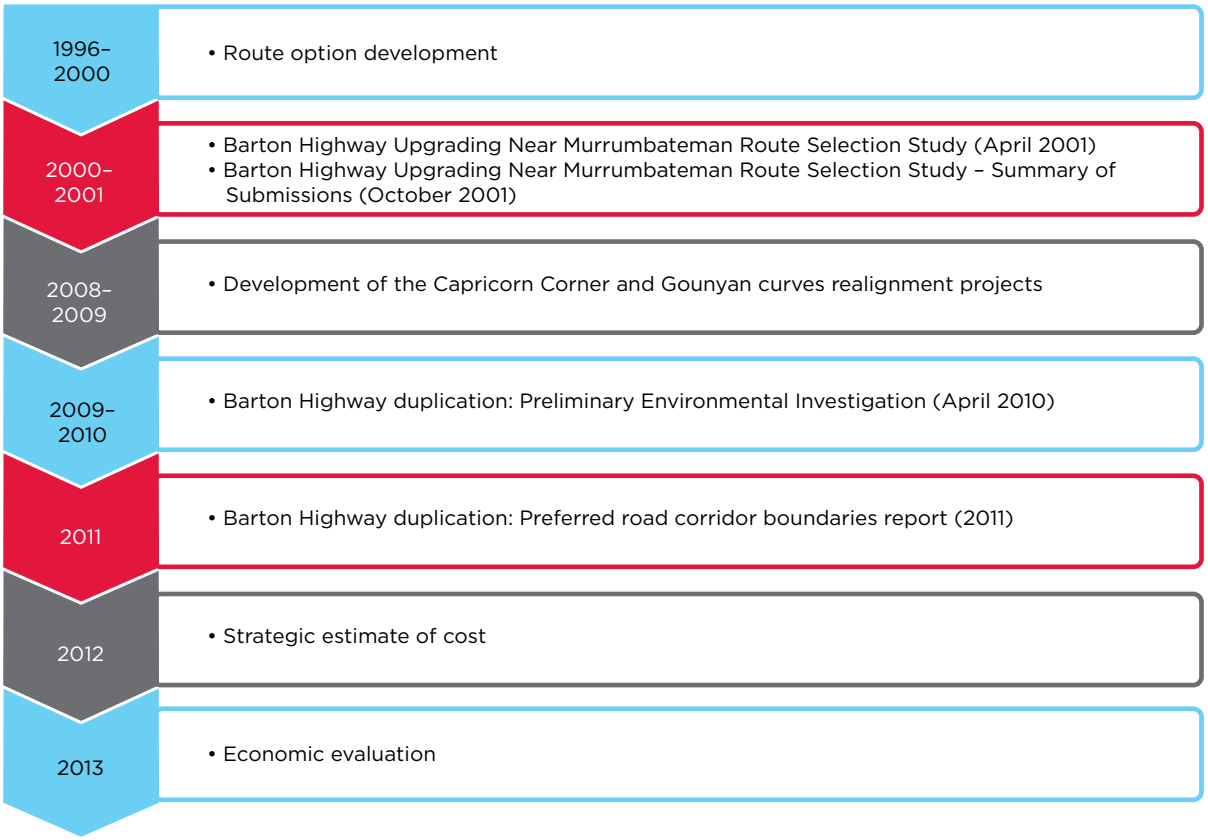
This Improvement Strategy sets out a 20 year plan for the NSW Government to guide the ongoing development of the road corridor and to improve the safety and traffic efficiency of the Barton Highway.

This strategy recommends a number of improvement projects for implementation in the short, medium and long term to address current issues and to meet the anticipated traffic growth on the highway, while complementing staged duplication of the highway as far as practical. These include construction and maintenance projects, operational changes and behavioural change initiatives related to safety.

The identification of improvement projects is based on community consultation and feedback, a needs assessment, technical investigations, economic appraisal as well as social and environmental factors.

Duplication of the Barton Highway has been considered in a range of studies and investigations for almost 20 years, beginning with route option development in the late 1990s. The duplication development process is presented in **Figure 2-2**. The most recent project assessment was an economic evaluation of the duplication proposal in 2013. Prior to that was the *Barton Highway duplication: Preferred road corridor boundaries report* (2011) which identified and mapped corridor boundaries to accommodate the future highway duplication. This included a strategic design and economic analysis of the future carriageways.

Figure 2-2 Barton Highway duplication: development to date



A strategic estimate of cost for full duplication of the highway prepared in 2012 valued the proposal at more than $800 million ($2012).

This strategy has been prepared to guide upgrade of the corridor over the next 20 years and to provide recommendations for a staged approach for improvement. This strategy builds on previous work which will be complementary to, or form part of, the future road duplication of this highway.

This strategy is based on the findings of a consolidated investigation into road safety, community concerns and desires, traffic and asset challenges, and current and future transport demand based on predicted population and land use changes. The purpose of this report is to identify infrastructure (engineered) and operational (non-engineered) initiatives aimed at improving road safety, reducing travel times and increasing reliability along the Barton Highway, complementary to any future highway duplication.

> “Improving the customer experience is an important aspect of the NSW Government’s commitment to putting the customer at the centre of transport planning and service delivery.”

2.1.2 Process and methodology

This Improvement Strategy has been prepared by a joint multidisciplinary project team involving Transport for NSW and Roads and Maritime Services with Cardno as the appointed consultant to assist with the technical analysis. The project team’s expertise ranged from road safety, traffic and asset management to land use development, transport and environmental planning.

The corridor has been considered within the broader strategic planning context provided by key national, State and local government planning documents. Current population and employment data, together with future land use plans for the corridor, have been sourced from the NSW Department of Planning and Environment, along with relevant local council documents and 2011 Australian Bureau of Statistics Census data. Transport for NSW and Roads and Maritime Services’ asset, traffic and safety data has been analysed to determine current levels of performance.

2.2 An integrated, customer focused transport network

2.2.1 Customer focus

Improving the customer experience is an important aspect of the NSW Government’s commitment to putting the customer at the centre of transport planning and service delivery.

This Improvement Strategy has been developed within a customer focused framework shown in **Figure 2.3.**

Figure 2-3 Transport for NSW result areas in the Corporate Framework

The key customer markets along the Barton Highway are summarised in **Table 2-1**. The highway corridor needs to cater for the different transport needs of these road users.

Table 2-1 Key customer markets

Key customer markets	Purpose of travel
Motorists – short trips	Travel for work, education, health, recreation, personal business
Motorists – inter-region and interstate trips	All purposes, predominantly work, recreation and health
Freight	Light and heavy goods – wider ranging e.g. courier parcels, building materials, waste and recycling, agricultural and mining
Commercial vehicle drivers	Providing trade services, maintenance, repairs, sales, health and community services
Bike riders	Travel for work, education, health, recreation, personal business
Motorcyclists	Travel for work, education, health, recreation, personal business
Pedestrians	Travel for work, education, health, recreation, personal business
Bus passengers	Travel for work, education, health, recreation, personal business

2.2.2 Community consultation

Planning for a Barton Highway duplication project began in 1996. A considerable amount of community engagement has since been carried out. This Improvement Strategy builds on these previous outcomes, asking the Barton Highway community about their priorities for the highway, the locations of issues and opportunities for improvement. Consultation methods included flyers, surveys, project displays and stakeholder workshops. The outcomes are detailed in Chapter 3 and a separate Community Consultation Report (2016).

The *NSW Long Term Transport Master Plan* released in December 2012 also involved a wide range of consultation with customers directly affected by the transport network. Feedback raised through the consultation process varied greatly across each region. The Barton Highway corridor is within the Southern Region **Figure 2-4**. The community consultation in this region highlighted a number of important aspects for the highway. Improved regional road maintenance was seen as vital in the Southern Region to ensure the road network is resilient and journeys are not disrupted by accidents or bad weather.

Better customer service across all public transport was seen as important, along with transport that meets the needs of all members of the community through access to centres and services. Customers thought improved security on public transport and safety on our roads were essential, and saw management of the road network to encourage safe cycling as another important issue.

South of Yass Valley Way, southbound

Figure 2-4 *NSW Long Term Transport Master Plan* regional boundaries

2.3 Planning frameworks

The NSW Government has made fundamental changes to infrastructure planning and investment. These changes ensure funding is allocated to initiatives that deliver the best value, based on compelling evidence. Following this approach, a number of new 20 year plans have been developed to guide the State's future, including the *NSW Long Term Transport Master Plan*. Each of these plans contribute to achieving the goals of NSW 2021 – to ensure a coordinated and community-driven approach to planning.

2.3.1 Premier's Priorities and State Priorities

The NSW Government has recently announced 30 priorities, or reforms, to grow the economy, deliver infrastructure, and improve health, education and other services across NSW. Of these priorities, 12 are the Premier's personal priorities.

The Improvement Strategy contributes to achieving the following State priority:

Reducing road fatalities: Reduce road fatalities by at least 30 per cent from 2011 levels by 2021.

Barton Highway Improvement Strategy: Supports a package of targeted safety improvements to provide a safer road environment for all road users such through additional overtaking lanes, wider lanes, shoulders and clear zones, and better delineation as well as improved access for cyclists, pedestrians and horse riders within Murrumbateman village.

2.3.2 *NSW Long Term Transport Master Plan*

The *NSW Long Term Transport Master Plan* (the Master Plan) outlines a clear framework to address transport challenges in NSW over the next 20 years. For the first time, it integrates planning for roads, freight and all other modes of transport and sets out initiatives, solutions and actions to meet NSW's transport challenges.

A key aim of the Master Plan is to **provide essential access for regional NSW**.

Barton Highway Improvement Strategy: Advances this objective by supporting efficient and safe connections along the highway to meet travel demand and provide access to increasingly important interstate freight networks.

The Master Plan also sets as a priority the need to support an **efficient and productive freight industry.**

Barton Highway Improvement Strategy: Includes actions to support the freight demand and travel efficiency along the corridor.

Figure 2-5 shows how the Master Plan integrates with other NSW plans to ensure a coherent, whole-of-government approach is taken to transport planning.

Figure 2-5 Planning framework

2.3.3 Regional Plans

The NSW Department of Planning and Environment (DPE) is currently working to review the existing NSW regional strategies to prepare new Regional Plans for the regional areas within NSW. The Regional Plans are being developed to plan for NSW's future population needs for housing, jobs, infrastructure and a healthy environment. The Improvement Strategy supports the Draft South East and Tablelands Regional Plan[1]. This Plan recognises the Barton Hwy is the main strategic transport routes connecting ACT and South East and Tablelands Region. The Plan also supports the finalisation and implementation of the Barton Highway Improvement Strategy.

2.3.4 NSW State Infrastructure Strategy

In November 2014 the NSW Government delivered a new State Infrastructure Strategy following extensive analysis and consultation. The strategy fully adopted the recommendations proposed by Infrastructure NSW.

The State Infrastructure Strategy highlights the importance of sustaining productivity growth in the major centres and regional communities of NSW, as well as supporting population growth toward more than nine million people in NSW.

2.3.5 NSW Freight and Ports Strategy

The NSW Freight and Ports Strategy aims to create a transport network where goods move efficiently to their markets. This strategy contributes to the following freight specific objectives and reflects the importance of the freight transport network in creating a competitive and productive NSW economy.

Delivery of a freight network that efficiently supports the projected growth of the NSW economy.

Barton Highway Improvement Strategy: Aims to provide an efficient road corridor with safe and efficient access arrangements and adequate overtaking opportunities for moving people and freight between the western and southern parts of NSW and the ACT.

Balancing of freight needs with those of the broader community and the environment.

Barton Highway Improvement Strategy: Aims to provide a safe and efficient corridor by recognising that it caters for all road users.

1 http://www.planning.nsw.gov.au/Plans-for-Your-Area/Regional-Plans/South-East-and-Tablelands/How-to-Get-Involved

The South Eastern and Murrumbidgee regions which surround the Barton Highway generate some of the lowest kilotonnes of commodities (consisting mainly of agriculture and manufacturing) across NSW, significantly less than the Hunter Region and the Illawarra which produce mining commodities.

The NSW Freight and Ports Strategy notes that by 2031 the volume of freight moved on the NSW transport network is predicted to increase by 94 per cent to 794 million tonnes per annum (3.35 per cent per annum compounded), up from the 2011 volume of 409 tonnes. The demand for freight movements on the Barton Highway is likely to increase in line with freight demand across NSW. Freight on the adjoining Hume Highway is predicted to increase from just over 30,000 kilotonnes per annum in 2011 to almost 60,000 kilotonnes per annum by 2031.

2.3.6 Road Safety Strategy 2012–2021

The NSW Road Safety Strategy 2012–2021 sets the direction of road safety in NSW for the next 10 years. NSW is committed to reducing fatalities to at least 4.3 per 100,000 population by 2016 together with at least a 30 per cent reduction in fatalities and serious injuries by 2021.

The Road Safety Strategy is based on the Safe System approach to improving road safety. This takes a holistic view of the road transport system and how the key components of that system affect each other – the road user, the roads and roadsides, the vehicle and travel speeds. It recognises that all these components have a role to play in helping to keep road users safe.

The key principles of the Safe System approach are relevant for the *Barton Highway Improvement Strategy*:

- Inclusive view of the whole road transport system and the interactions between all elements – roads and roadsides, vehicles, travel speeds and all users of the system.
- There are physical limits to what the human body can endure. The impact forces in any major crash type are well known and, if they are exceeded, can result in serious injury or death.

> “The Safe System approach is implemented in the Barton Highway Improvement Strategy.”

The strategy presents issues of focus for a number of areas including safer roads, safer vehicles, safer road users, safer speeds, safer heavy vehicle operation, road safety for Aboriginal communities, and post-crash response and trauma treatment. Of these, safer roads, more careful road users, safer speeds and safer heavy vehicle operations are relevant to the Barton Highway. Principles include:

- Identify and prioritise infrastructure safety improvement projects targeted at specific crash types.
- Continue to deliver Federal and State programs with road safety objectives, including the program of highway duplications.
- Increase visibility of police.
- Review speed limits and monitor and evaluate compliance.
- Target crash risk assessment on higher volume roads.
- Provision of heavy vehicle driver rest areas.

2.3.7 Southern Regional Transport Plan

The Regional Transport Plans are built on the strategic direction, initiatives and statewide context set by the *NSW Long Term Transport Master Plan*. The objectives for Regional Transport Planning are:

1. Providing better transport services
2. Ensuring effective regulation
3. Improving transport infrastructure.

The Southern Regional Transport Plan identifies specific challenges the regions’ transport networks face and prioritises actions to address these challenges. The plan provides a detailed analysis of local transport needs and priorities, and responds to issues raised during regional consultation.

The plan acknowledges that the Barton Highway is strategically significant for connections within the region as it provides an important connection between the ACT and the Riverina, Central West NSW, the Hume Highway and Yass.

As detailed in the plan, the NSW Government's Rural Highway Program will continue investment in the Barton Highway in order to improve road safety. The NSW Government supports development of a corridor strategy to identify and progress potential measures that could be implemented to improve the Barton Highway including:

- Needs analysis of upgrades for the Barton Highway – considering road safety, traffic flow and freight needs.
- Options development to identify potential upgrade options and prioritise these upgrades.
- Development of a Barton Highway improvements program that builds on current investments.

2.3.8 Sydney–Canberra Corridor Regional Strategy

The Sydney–Canberra Corridor Regional Strategy from the NSW Department of Planning (now the NSW Department of Planning and Environment) is a planning document presenting the NSW Government's position on the local government areas along the corridor, including Yass Valley Council. The Sydney–Canberra Corridor Regional Strategy recognises the Barton Highway's contribution to a high level of direct access to Sydney and Canberra, along with the Hume and Federal highways.

The Barton Highway is one of five strategic transport routes in the region and a part of the national highway system, along with the Hume and Federal highways. The strategy notes that a role of the national highway system is to control direct access and to limit traffic generating development to major regional centres in order to avoid 'ribbon development' or roadside development which is based along the highway network. An action from the Improvement Strategy is to ensure local environmental plans for areas along the identified strategic transport routes, including the Barton Highway, limit inappropriate adjoining development and access points.

Yass is defined in the corridor strategy as a major town, providing local and district services and facilities, with a well established town centre and a range of housing types. Murrumbateman is defined as a village, a smaller centre with local retail and a contribution to the region's tourism. Yass and Murrumbateman are located in the southern subregion and Yass, along with Queanbeyan, contributes to retail and business services for the larger Canberra–Queanbeyan area.

The Sydney–Canberra Corridor Regional Strategy, published in 2006, notes that the Barton Highway duplication (planning) between the ACT and the Hume Highway would be Federally funded and at the time of publication some planning was underway.

The NSW Department of Planning and Environment is reviewing the existing NSW Regional Strategies to prepare new Regional Plans to reflect the NSW Government's new integrated planning approach that incorporates land use planning, infrastructure planning and transport planning. A new Regional Growth Plan for the South East and Tablelands, which includes the Barton Highway, is being developed to guide future planning and investment decisions covering housing, economic development and jobs, open space and transport.

2.4 Barton Highway planning to date

2.4.1 Barton Highway Safety Review

A safety review of the Barton Highway in 2008 examined recent crashes along the highway between the ACT border and the Hume Highway to determine the contributing factors and make recommendations to improve safety performance. A number of issues were presented, some of which have since been addressed through improvements:

- Approximately 40 per cent of the highway's curves had a radius smaller than recommended for the speed environment – the worst of these have been addressed north of Murrumbateman by the Gounyan curves realignment carried out in 2011.
- The vertical alignment restricts sight distance in some locations.
- The road reserve width over the majority of the highway is below standard, which does not allow for adequate clear zones and run out areas. The narrow road reserve has sections where the vegetation has a high conservation value.

The review concluded that key road safety risks include those associated with the road environment, pavement condition, incident response, behavioural issues, and pedestrian and cyclist issues. Regarding the road environment: tight curves (creating a polished surface on bends), narrow shoulders and clear zones, roadside objects and restricted stopping sight distance were noted as contributing physical factors. The safety review also noted that signage and delineation does not conform to contemporary standards, which reduces effectiveness and contributes to driver uncertainty. The lack of overtaking lanes can lead to risk taking behaviour, and the presence of kangaroos on the road is an issue.

The 2008 safety review made a number of key recommendations and as a result Roads and Maritime Services has completed a number of projects to address safety.

2.4.2 The Barton Highway duplication Preliminary Environmental Investigation

The preliminary environmental investigation for the Barton Highway duplication focused on a 200 metre section within a 1.2 kilometre study corridor (500 metres on either side of the 200 metre study corridor).

Specialist studies were carried out for the preliminary environmental investigation including:

- Aboriginal and European heritage assessments
- Road traffic noise investigation
- Soil and water assessment
- Preliminary flora and fauna assessment
- Preliminary landscape character assessment
- Planning, land use and socio-economic assessment
- Contaminated land assessment (phase one).

Some of the key potential impacts and recommendations are relevant to any infrastructure project being considered:

- Aboriginal heritage: Future duplication should try to avoid potential archaeological deposits and if this is not possible, subsurface investigation of the archaeological deposits should be carried out.
- Non-Aboriginal heritage: Two non-Aboriginal heritage sites, the Wattle Park Church and the Dellwood property were recommended for a heritage assessment and another two, Vallencia and Murrumbateman Station were recommended for archaeological assessments if they were to be affected by any duplication.
- Noise: The noise assessment found that a Murrumbateman bypass would increase traffic noise levels in eastern Murrumbateman and decrease traffic noise levels in western Murrumbateman. The preliminary environmental investigation recommended that consideration be given to noise shielding where required.

- Soil and water: There are two areas near Murrumbateman where the study corridor runs parallel to a watercourse that is prone to flooding. It was recommended that the road boundaries avoid these creeks.
- Ecology: A number of high value flora species and threatened mammals (including bats), birds, reptiles and insects are supported by the vegetation and habitats within the corridor. It was recommended that a future duplication be located on the eastern side of the Barton Highway.

Taking into account the recommendations of the preliminary environmental investigation, Roads and Maritime Services progressed the project development to define road corridor boundaries.

2.4.3 Barton Highway duplication: Preferred Road Corridor Boundaries Report

The Preferred Road Corridor Boundaries report for the Barton Highway sets out the proposed road corridor boundaries, around 90 metres wide, for a future duplication of the highway. The corridors were determined as a result of community consultation, the preparation of the preliminary environmental investigation, consideration of environmental and engineering restrictions, consideration of design standards, maximising safety and minimising construction costs.

Identifying the road corridor boundaries provided property owners a greater level of certainty regarding potential property acquisition to secure the corridor in the future. Defining the boundaries also allowed the road corridor to be included and reserved in the revised local environmental plan for Yass Valley Council.

The report identified a number of engineering and design restrictions, and constructability and operational considerations that would impact the road corridor boundaries. These factors are summarised in the following sections.

Engineering and design constraints

- Tie-in with existing infrastructure: The boundaries design considered the existing infrastructure along the highway.
- Current road design standards: The duplication boundaries were established to comply with standards for dual carriageways including optimum horizontal and vertical alignment, access requirements for heavy vehicles to side roads and local property access.
- Access and interchange arrangements: A number of access and interchange limitations were considered in the design.
- The ability to balance cut-to-fill volumes would minimise the need to import or dispose of earth material.

Constructability and operational considerations

- Minimising the number of traffic switches required during construction has construction efficiency as well as road safety and road efficiency benefits.
- Space required for water quality control structures.
- Avoiding the quarry exclusion zone to the west of the existing highway.

2.4.4 Strategic estimate of costs

Strategic cost estimates were prepared by MacDonald International for the proposed duplication upgrade of the Barton Highway. The full length upgrade, constructed as one project, was estimated to cost in excess of $800 million ($2012) including contingency.

The cost estimates took into account the construction methods required, site and traffic conditions, project development, investigation and design costs, property acquisition costs, public utility adjustments, construction cost items, a mark-up for project overheads and contractors' profit, and a project risk allowance.

2.4.5 Economic Evaluation Report, 2013

An economic evaluation of the Barton Highway duplication was conducted internally in 2013 by SKM to assess the viability of the duplication and to assist with future network planning and works priorities. An economic analysis was carried out to compare the costs and benefits of the duplication, with construction completion timeframes of five years, 15 years and beyond 25 years. The analysis assumed a traffic growth rate of two per cent per year.

Benefit to cost ratios of less than one were determined for each of the construction timeframes. This ranged from 0.45 for the five year construction completion timeframe to 0.71 for the beyond 25 years timeframe. A benefit to cost ratio below one means that the value of benefits is less than the cost of providing the infrastructure.

The benefits in the analysis were assumed to be travel time savings, vehicle operating cost savings, environmental cost savings and crash cost savings. Costs in the analysis were assumed to be capital costs and operational costs.

2.5 Key corridor challenges

The Barton Highway issues and challenges are already evident or are expected to emerge as a result of future changes and transport demands. These issues need to be overcome to maintain and improve the highway's roles and services for the community.

The key corridor issues on the Barton Highway help to determine corridor objectives and vision statements.

Key corridor issues and challenges are:

- **Safe access:** All vehicles have difficulty turning onto and off the Barton Highway at intersections and private access points when traffic is heavy.
- **Unsafe speeds and overtaking:** Driver frustration at vehicles moving at different speeds along the corridor results in speeding and overtaking in unsuitable locations.
- **Pavement widths:** The lanes and shoulder widths are of inconsistent width along the highway, and sections of the highway are below the required standard.
- **Signage and delineation:** Insufficient/poorly maintained signage and poor delineation such as line marking and raised pavement markers.
- **Safety for all road users:** The mix of users of the Barton Highway including light vehicles, public transport users, pedestrians, horse riders, cyclists and freight vehicles creates conflict, particularly in Murrumbateman.
- **Roadside hazards:** Vegetation and other exposed hazards (such as trees or culverts) in the clear zone can obscure the vision of road users.
- **Support customer travel needs:** The different travel needs of both local and commuter traffic users must be balanced.
- **Impact of road closures:** The Barton Highway is the only major road corridor running north from Canberra in the direction of Yass. There are no viable alternative routes for planned or unplanned closures of the Barton Highway. This limits the opportunities for road maintenance and leads to significant disruption in the event of incidents occurring.

Key challenges and issues on the Barton Highway corridor are further discussed in Chapter 7 following detailed performance analysis in Chapter 5 of this document.

2.6 Corridor objectives

The key corridor challenges and issues have been used to determine corridor objectives for the Barton Highway. These objectives are specific tasks that are needed to address the identified issues along the highway.

The specific corridor objectives are in line with the following *NSW Long Term Transport Master Plan* objectives shown in **Figure 2-6** below.

Figure 2-6 *NSW Long Term Transport Master Plan* objectives

NSW LONG TERM TRANSPORT MASTER PLAN OBJECTIVES

- **Improve quality of service**: by putting the customer at the centre of transport planning and service delivery, improving the quality of travel experiences, offering more travel choices and providing integrated services that directly meet travel requirements.
- **Improve liveability:** by improving connectivity, customer service and ease of movement in our major cities and activity centres.
- **Support economic growth and productivity:** by providing a transport system that responds directly to customer needs, is more efficient, increases freight efficiency and improves the connectivity and accessibility of people to other people, opportunities, goods and services.
- **Support regional development:** by improving accessibility to jobs, services and people, improving freight connections to markets and providing better links between clusters of business activity.
- **Improve safety and security:** by placing a high priority on addressing the causes and risks of transport accidents and security incidents.
- **Reduce social disadvantage:** by reducing transport disadvantage through improved access to goods, services and employment and education opportunities for people across all parts of the State.
- **Improve sustainability:** by optimising the use of the transport network, easing congestion, growing the proportion of travel by sustainable modes such as public transport, walking and cycling and becoming more energy efficient.
- **Strengthen transport planning processes:** by improving integrated transport planning processes and identifying areas where evidence should be collated for future decision making and continually improving governance and administration of the transport system.

The specific objectives defined in this strategy will guide the corridor's long term management. These are mapped against the *NSW Long Term Transport Master Plan* objectives in **Table 2-2** and **Figure 2-7**.

Table 2-2 Meeting the Master Plan's Objectives: the Barton Highway Corridor

NSW Long Term Transport Master Plan objectives		Barton Highway Corridor Objectives
Improve liveability – reduce social disadvantage	CUSTOMER – Improve Quality of Service	• Separate local traffic from through traffic and heavy vehicles. • Assist safe and easy movements within Murrumbateman for all transport modes.
Economic growth – productivity		• Provide an efficient road corridor with adequate overtaking opportunities to move people and freight between the western and southern parts of NSW and the ACT.
Regional development – accessibility		• Provide safe and reliable connection for Yass and Murrumbateman residents to the economic, health and education opportunities and services in the ACT. • Cater for increased traffic demand from Yass Valley Council's growing population in existing and developing residential and commercial areas. • Minimise disruptions to road users resulting from planned and unplanned road closures, recognising the limited alternative access options.
Improve sustainability		• Support sustainable modes of transport along the corridor and within Murrumbateman. • Preserve the amenity and attributes of the corridor's village and rural-residential character.
Safety and security		• Provide road safety outcomes in line with Safe System approaches which would contribute to meeting the NSW Road Safety Strategy 2012–2021 aims: – Ensure road safety is considered throughout the design, construction, maintenance, operation and audit of the road network for all road users including targeting treatments to address head-on, intersection and run-off-road crashes. – Address safety at intersections and driveways. – Address substandard road alignment. – Ensure speed zones are appropriate and review speed limits where risk levels have been high and engineering solutions are not feasible or cost-effective.
Improve transport integration process		• Support transport planning processes by responding to current and future land uses. • Preserve the road reserve required for staged duplication of the highway. • Consider the Yass Valley Council Masterplan for Murrumbateman in planning for the highway. • Coordinate cross border planning, safety and efficiency related to the highway with ACT planning and transport agencies.

Figure 2-7 Putting the customer at the centre: *NSW Long Term Transport Master Plan* objectives

2.7 A vision for the future

The vision for the future explains what actions should be achieved on the Barton Highway over the next 20 years to improve the performance of the highway and meet specific corridor objectives.

The vision for the Barton Highway between the ACT border and the Hume Highway over the next 20 years is that it:

- Provides **safe and reliable commuter access** to Canberra.
- Improves **safety and amenity** for the village of **Murrumbateman**.
- Provides an **alternative access route to Canberra**.
- **Supports key freight movements** between western and southern NSW and the ACT.
- **Caters for the mix** of through, local and tourist **traffic** along the corridor.

2.8 Taking action

The key challenges for the Barton Highway corridor will be progressively addressed through short, medium and long term improvements, in line with the Regional Transport Plan and the *NSW Long Term Transport Master Plan* as shown on the following page. These actions will ensure that the objectives and vision for the Barton Highway are achieved. The Barton Highway priorities for responding to these challenges are explained in Chapter 8.

Specific actions relevant to the Barton Highway corridor in the *NSW Long Term Transport Master Plan* and the *Southern Regional Transport Plan*:

Short term

- The NSW Government will continue to work with the Victorian and ACT governments to achieve a better outcome that makes travelling to Canberra and Victoria easier and more convenient.

Medium to longer term

- The NSW funded Rural Highway Program will continue investment in the Princes, Barton, Kings, Federal, Monaro and Snowy Mountains highways to address capacity limitations and unsafe areas as they emerge.
- We will work with community groups, regional transport coordinators, local councils and local bus operators to continue to enhance the public transport system to make sure that it meets the needs of the region's residents and businesses.

Gounyan Road signage

3 COMMUNITY INVOLVEMENT

Start of the overtaking lane south of Murrumbateman

Strategic planning for the Barton Highway began in 1998 and a significant amount of community engagement has already been carried out. The consultation for this Improvement Strategy builds on this previous work.

During development of the *Barton Highway Improvement Strategy*, consultation was carried out with:

- The community
- Stakeholders (including community groups)
- Elected representatives.

As part of developing this Improvement Strategy, the community and stakeholders were consulted twice:

1. During the development of the draft Improvement Strategy in August and September 2014. That consultation is covered in this chapter.
2. When the draft Improvement Strategy was released for comment in October and November 2015. This consultation is summarised in a more detailed report titled *Barton Highway Improvement Strategy. Community Consultation Report* (2016).

3.1 Approach to community involvement

The NSW Government as a matter of policy recognises the importance of community involvement in its activities and decision making, and is committed to upholding its responsibilities in an open, consultative and inclusive manner. Improving the customer experience is an important aspect of the NSW Government's commitment to putting the customer at the centre of transport planning and service delivery.

The NSW Government has listened closely to what our transport customers want from the NSW transport system through the development of the *NSW Long Term Transport Master Plan* and Regional Transport Plans which involved a wide range of consultation with customers directly affected by the transport network.

The consultation principles set out in **Table 3-1** guided engagement with the community throughout the development of the Improvement Strategy.

Table 3-1 Overview of consultation principles

Principle	Statement of approach	How this was applied to the development of the *Barton Highway Draft Improvement Strategy*
Accessibility	Provide a project team that is highly accessible for the duration of the Improvement Strategy's development.	• Access to the project team was provided via email, phone and postal address. • The assignment of a project team member (consistent contacts) to each enquiry. • Welcoming feedback, information and other input from the community during the Improvement Strategy's development.
Transparency and public accountability	Record, publish and make information publicly available. Ensure the community and stakeholders are provided with information on the decision making processes for the Improvement Strategy.	• Key information was published on the project website. • Discussions with the community at stakeholder roundtable workshops and at the Murrumbateman farmers' markets explained the purpose of the *Barton Highway Improvement Strategy* and how this will be used in the decision making process. • Reporting of community meeting outcomes within this Improvement Strategy and at future events. • Future activities will be conducted by Roads and Maritime Services to progressively implement improvements to the highway and to keep the community and stakeholders informed about how this is being carried out.

Principle	Statement of approach	How this was applied to the development of the *Barton Highway Draft Improvement Strategy*
Equitable participation and fair process	Allow the comments and input of all community members and stakeholders to be considered equitably in the decision making processes.	• Distribution of materials advising of the project and inviting community input to a large project area including Murrumbateman, Yass, Hall and other surrounding areas. • It was recognised that interest in the Improvement Strategy extends well beyond the main project investigation area. • Participation opportunities were provided for all communities and stakeholders who are interested in, or may be impacted by the activities and decision making. • The project was advertised to advise how the community could become involved using a range of techniques including postcards and newspapers. • Online facilities were provided for participation. • Information was distributed in a timely manner. • Displays and other materials were easy to read. • All issues raised were recorded and considered in the consultation processes. • A decision making process was created that was inclusive of diverse community opinions and respectful of all views. • Decisions were made that considered community and stakeholder needs and expectations in a balanced way. • Issues raised by the community with regard to fairness and equity were recorded and responded to.
Continuous improvement	Build mechanisms to review, evaluate and improve the consultation program.	• The Community Involvement Plan was reviewed, evaluated and updated at appropriate intervals. • Media coverage was monitored and reviewed to understand the information and tone delivered to the public. • Innovation in consultation was encouraged within the project team. • A 'lessons learnt' session was held at the end of each stage of the project, to identify successes and areas for improvement.

3.2 The community: road users and different customer segments

The Barton Highway is used in many different ways and there is a wide range of customer markets (or road users). The different customer markets can be expected to have different expectations of the road and there is the potential for conflict between the different groups. It is important to understand the trip types made by the different customer markets to be able to respond to their different travel needs.

A number of road user groups have been considered during the development of this strategy and these are summarised in the sections below.

3.2.1 Commuter groups

Traffic statistics and the responses to the community survey show that there is significant traffic movement along the Barton Highway by commuters travelling between their place of residence (including Yass and Murrumbateman) and their place of work in Canberra, particularly during the morning peak period travelling south and the evening peak period travelling north.

These trips are generally characterised by a single point of access and a significant distance travelled on the highway. The route travelled is generally consistent and repetitive. Drivers of these trips are generally familiar with the road and prefer to travel at the speed limit.

3.2.2 Car users making local trips

Residents of areas along the highway make local trips between locations served by the highway – for example to visit friends, participate in local sporting activities, or to visit shops.

These trips are generally characterised by being variable and may have multiple points of access and departure, with distances travelled on the highway typically short.

Drivers of these trips are generally familiar with the road but may not be concerned with driving at the speed limit at all times.

3.2.3 Recreational users

The community survey identified that there were a range of journeys being made for recreational purposes, particularly on the weekend when journeys were made for local sporting events, or sport and shopping trips in Canberra.

3.2.4 Speed limited users (including 'P' platers)

Some of the traffic using the Barton Highway is legally obliged to travel below the speed limit. In particular, it is noted that Provisional P1 licence holders (red 'P' platers) are restricted to travelling at 90km/h, which is below the posted speed limit of 100km/h on some sections of the highway.

Speed limited traffic may be travelling for a range of purposes, including commuting, recreational or local trips.

Pedestrian refuge in Murrumbateman

3.2.5 Tourists

The Barton Highway is also used by tourists accessing local tourism destinations (for example wineries) and as a route to tourist destinations further afield. These trips are generally characterised by being highly variable and may have multiple points of access and departure along the highway.

Drivers of these trips are generally unfamiliar with the road and may drive at variable speeds.

3.2.6 Heavy vehicle drivers

The Barton Highway is used by freight traffic. Typically this is travelling to or from Canberra but the origin of the journeys is highly variable.

Community responses during the preparation of this report often referred to the use of the Barton Highway by trucks carrying timber and by vehicles travelling from supermarket distribution centres at Albury-Wodonga or from Melbourne.

Drivers of these trips have generally travelled long distances and will favour major roads. Generally the drivers travel at the speed limit.

3.2.7 Motorcyclists

The motorcyclists who use the road do so for both commuting and recreational purposes. In general, it is considered that this user group travels at the speed limit.

3.2.8 Public transport users (buses)

There are a number of bus services running along the Barton Highway. These are most frequent during the peak hours and may be specialist school services.

Bus journeys are generally characterised by multiple but predictable points of access to and departure from the highway, regular stops and a significant distance travelled on the highway.

The route travelled is generally consistent and repetitive. Bus drivers are familiar with the road and travel at variable speeds, frequently slowing, stopping and re-joining traffic at bus stop locations.

3.2.9 Cyclists

Cyclists travelling in the vicinity of the Barton Highway are known to travel both long and short distances. There are local cycle networks in both Murrumbateman and Yass, and cyclists travelling short distances at these locations are likely to have limited interaction with the highway.

It is understood that there are cyclists who travel significant distances along the highway, either for commuting purposes or recreational rides. There are no dedicated cycle lanes on the highway and these cyclists use the existing road shoulders for their journeys, travelling significantly slower than other traffic using the highway.

3.2.10 Pedestrians

There is a pedestrian refuge island for pedestrians crossing the Barton Highway opposite the Murrumbateman showground, however there are no other pedestrian facilities along the length of the highway. Pedestrian activity is mostly limited to the Murrumbateman village precinct and to the edges of properties along the highway.

3.2.11 Horse riders

None of the studies have identified horse riding activity along the Barton Highway itself, however significant equestrian activity is known to occur across and around the highway, including at the Murrumbateman showground and at a number of stud farms along the highway.

Movement of horses in horse floats are typically relatively short in nature and involve slow turn movements onto and off the highway. Travel speeds along the highway may also be lower than the posted speed limit.

3.2.12 Agricultural vehicles

The highway passes through rural and agricultural areas and is used by agricultural vehicles. These journeys are typically short local journeys and they may be made by vehicles travelling at slow speeds. It is also noted that agricultural vehicles may be wider than other road vehicles.

3.2.13 Emergency services vehicles

Emergency services vehicles use the highway as required. At times these vehicles may travel above the posted speed limit.

3.3 Opportunities for community involvement

Community involvement opportunities during the development of the Improvement Strategy were well publicised using a combination of postcards, advertisements in the media and engaging with community groups to distribute information through existing community networks.

The key opportunities for community and stakeholder engagement during development of the *Barton Highway Draft Improvement Strategy* were:

- Participation in a community survey which was open from 4 August – 26 September 2014 and could be completed online or submitted in hard copy.
- Roundtable discussions with key stakeholders. Two sessions were held on 21 August 2014.
- A meeting and roundtable with elected representatives on 5 September 2014.
- Face-to-face discussion with the project team at a community drop-in stall at the Murrumbateman farmers' markets on 13 September 2014.
- Communication with the project team using the project email address and phone number.

> "The survey proved to be an effective way of identifying community concerns and suggestions for the Improvement Strategy."

3.4 What we asked the community and other stakeholders

Similar questions were posed to the community and other stakeholders through the engagement methods listed above.

The community and stakeholders were encouraged to identify:

- The locations along the highway where improvements are required and ideas for improvements (Question 1).
- The issues which have been experienced by the community when using the Barton Highway (Question 1).
- Road user information (Questions 2–6).
- The road characteristics, environmental and social considerations associated with the Barton Highway which are most valued by the community (Question 7).
- Any other concerns they would like the project team to consider during the development of the *Barton Highway Draft Improvement Strategy* (Question 8).

3.5 What the community survey told us

The survey proved to be an effective way of identifying community concerns and suggestions for the Improvement Strategy. The survey generated 446 responses over eight weeks – 418 through the online Survey Monkey program and 28 via hard copy posted or emailed to the *Barton Highway Draft Improvement Strategy* Team.

3.5.1 Locations requiring improvements

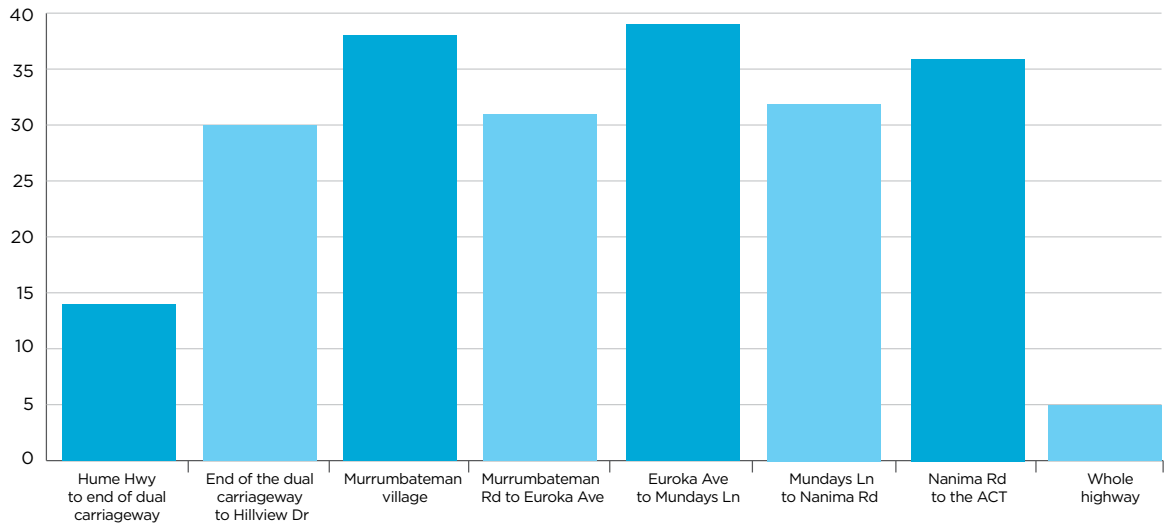
Question 1 of the survey was the primary means of understanding where the community believed improvements were required along the Barton Highway.

One objective of Question 1 was to determine specific problem areas along the length of the highway. Individual participants were able to locate problem areas, outline the kind of problems experienced and suggest potential solutions.

The community response suggested considerable detailed knowledge and experience of the road and problematic areas.

Survey participants nominated one or more problematic areas along the highway providing the results shown in **Figure 3-1**.

Figure 3-1 Percentage of respondents identifying issues at specific locations along the Barton Highway



The Euroka Avenue to Mundays Lane, Murrumbateman village and Nanima Road to the ACT sections along the highway generated the greatest number of responses.

Each section of the road is of different length and an analysis was carried out to identify the number of responses per kilometre of road within each of the highway sections.

The analysis in **Table 3-2** showed that significantly more issues (140) were reported within Murrumbateman village per kilometre than at any other location. The sections from Murrumbateman Road to Euroka Avenue and Nanima Road to the ACT also generated a significant number of responses per kilometre of road (43 and 37).

It is likely that this analysis is skewed to some degree due to the Murrumbateman area being the most densely populated along the highway, however the analysis suggests that projects improving these sections of the highway will generally be supported by the community over those at other locations.

The northernmost section from the Hume Highway to the end of the dual carriageway was identified significantly less often than all other sections of the Barton Highway.

Table 3-2 Locations identified by the community as requiring improvement

Section of the Barton Highway	Length of section (km)	Number of times this location was identified	Rank by number of comments received	Number of times this location was identified per km of road	Rank (per km)
Hume Highway to end of dual carriageway	9.1	64	7	7.0	7
End of the dual carriageway to Hillview Drive	9.2	135	6	14.7	6
Murrumbateman village	1.2	168	2	140	1
Murrumbateman Road to Euroka Avenue	3.2	138	5	43.1	2
Euroka Avenue to Mundays Lane	8.8	175	1	19.9	5
Mundays Lane to Nanima Road	5.3	144	4	27.2	4
Nanima Road to the ACT	4.3	162	3	37.2	3
Whole highway^	41.1	21	8	0.5	8

^Some responses identified issues across the whole length of the highway.

3.5.2 Issues experienced by the community

Question 1 of the survey was also the main source of understanding the issues being experienced by the community when using the Barton Highway. This question provided the opportunity for respondents to identify issues they knew of within each section of the highway, shown in **Figure 3-4**.

The responses received have been reviewed and categorised into one of the 17 categories shown in **Table 3-3**.

The survey results show that the three issues most commonly experienced by the survey participants are:

- Poor driver behaviour (117 responses)
- Lack of overtaking opportunities (116 responses)
- Difficult access to or exit from intersections (115 responses).

Table 3-3 Number of issues by type identified by the community along the Barton Highway

Issue	Number of times the issue was identified by survey respondents	Rank
Poor driver behaviour	117	1
Lack of overtaking opportunities	116	2
Difficult access to and exit from intersections	115	3
Heavy traffic volumes	101	4
Inadequate road design	82	5
Poor condition of pavement/other infrastructure	45	6
Lack of visibility	31	7
Inappropriate speed limits	21	8
Presence of roadside hazards	21	8
High proportion of casualty/fatality crashes	16	10
Difficult access to and exit from property	16	10
Poor delineation	13	12
Conflicts between road users	10	13
Poor incident management	10	13
Unpredictable travel times	5	15
Forecast traffic growth	4	16
Lack of signage	4	16
TOTAL	**727**	

3.5.3 Suggestions for improvement made by the community

Question 1 also asked the respondent to suggest potential solutions to the issues they identified. This was an effective way of sourcing community suggestions for highway improvements and 494 suggestions were made.

The improvement suggestions made by the community have been categorised and are shown in **Table 3-4**.

Analysis of the responses received showed that the most often suggested improvement measure involved major civil engineering works such as full or partial duplication of the carriageway (199 suggestions), provision of overtaking lanes or extra lanes (103 suggestions) and modifying road behaviour (63 suggestions). Together, these three improvement types accounted for 74 per cent of all suggestions made.

The suggested solutions included a wide range of both engineering (for example intersection upgrades and additional lanes) and non-engineering solutions (such as enforcement and speed control).

Table 3-4 Types of improvement suggested by the community

Issue	Number of times the issue was identified by survey respondents	Rank
Additional lanes or carriageway duplication	199	1
Extra overtaking lanes and overtaking opportunities	103	2
Modifying road user behaviour	63	3
Concerns with speed differences of different road users e.g. Learner and 'P' plate drivers	29	4
Other (including kangaroo issues, safety barriers and guard rails, concrete bollards, heritage protection)	20	5
Intersection improvements	16	6
Lane and road shoulder widening	16	6
Signage and pavement marking improvements	13	8
Revising speed limits	11	9
Public transport, horse rider, cyclist and pedestrian improvements	8	10
Sight distance visibility improvements	7	11
Clear zone hazard removal	5	12
Property access improvements	4	13
TOTAL	**494**	

3.5.4 Use of the Barton Highway

Questions 2–6 of the survey were designed to help the project team understand how the road is used by the community. These questions include:

Q2 – How do you travel along the Barton Highway?

Q3 – How often do you travel along the Barton Highway?

Q4 – At what time of the day do you most often use the Barton Highway?

Q5 – What is the postcode where you live?

This allowed the project team to identify whether the majority of the respondents lived within, or outside the immediate catchment for the Barton Highway.

Q6 – What is your main reason for using the highway?

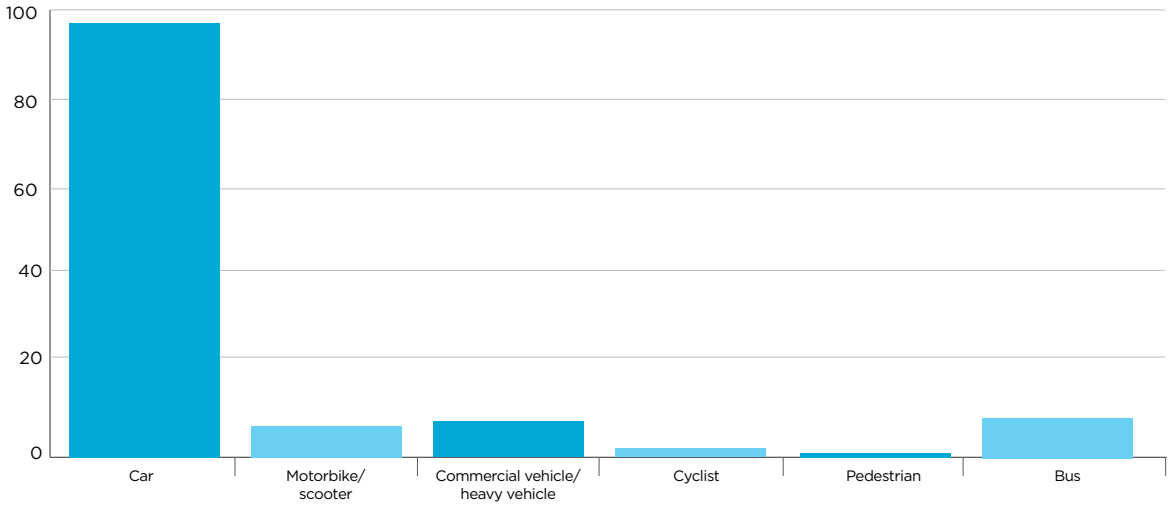
The results identified that:

- Seventy-four per cent of respondents were from north of Canberra in locations such as Yass, Yass River and Murrumbateman. A further 20 per cent of respondents lived in the ACT and six per cent were from addresses further from the Barton Highway. The majority of the respondents live in close proximity to the highway, and so the survey responses are highly representative of those whose lives are most closely affected by the Barton Highway. The responses from those who live outside the immediate area are also considered important as they include the views of those using the Barton Highway for longer journeys.

- Ninety-seven per cent of respondents travel along the highway by car. Other transport modes were used significantly less with bus (nine per cent), commercial/heavy vehicles (eight per cent), motorbike/scooter (seven per cent), cyclists (two per cent) and pedestrians (one per cent).
- Of the 446 respondents, 61 per cent travel along the highway every day and 63 per cent commuted to/from Canberra for employment.
- Fifty-eight per cent of people travel in peak times (7.00–9.00am or 4.00–6.00pm), and many respondents feel that traffic is moving slower than people feel is appropriate. The data revealed 54 per cent of people use the highway to access Canberra for shopping, sport or medical purposes.

Canberra serves residents of rural areas and respondents consider it important that consistent and adequate access is available.

Figure 3-2 Percentage of respondents identifying method of transport along the Barton Highway*



* These categories are not mutually exclusive.

3.5.5 Issues of importance

Question 7 of the survey sought to identify the issues of most importance to the community when considering the Barton Highway.

Survey respondents were asked to rate from one (least important) to five (most important) criteria within the three categories of Road Characteristics, Environmental Considerations and Social Considerations.

The results have been averaged to determine which of these elements is of greatest importance to the community. The results are shown in **Table 3-5**.

> “The results have been averaged to determine which of these elements is of greatest importance to the community.”

Table 3-5 Issues of importance identified by the community in the survey

Issue/value	Average score
Road Characteristics	**3.73**
Improved road safety and fewer crashes	4.74
Reduced traffic delays	4.05
Quicker travel times	3.74
More consistent travel times	3.69
Improvements for pedestrians and cyclists	2.41
Environmental Considerations	**3.15**
Protecting or improving waterways	3.36
Protecting native animals and plants	3.14
Protecting heritage and places of importance	3.11
Reducing greenhouse gas emissions	3.07
Maintaining or improving local air quality	3.09
Social Considerations	**3.31**
Maintaining or improving access to towns and properties	3.77
Protecting local businesses and agriculture	3.58
Improving public transport	3.54
Minimising impacts of road construction works	3.20
Reducing traffic noise	2.83
Protecting attractiveness and quality of views	2.93

Note: the criteria are sorted by score within each category.

The survey results show that the community places the greatest value on Road Characteristics (with an average score of 3.73), followed by Social Considerations (3.31) and Environmental Considerations (3.15). These are presented in more detail below.

These findings are consistent with the outcomes of the stakeholder workshops.

Road Characteristics

Within the Road Characteristics category, the results show that the community's greatest concern across all categories is road safety with an average score of 4.74 followed by reduced traffic delays with 4.05.

There were a number of comments on factors that contribute to traffic delays; in particular poor incident management and the need to significantly reduce speed to exit the highway, which creates traffic build up.

Environmental Considerations

Within the Environmental Characteristics category, similar importance was given to each of the five considerations, with all the average scores falling within the range 3.07 to 3.36.

Social Considerations

Within the category of Social Considerations there were six considerations. The results from the survey showed that the average scores fell within the range of 2.83 to 3.77.

The highest rated issue was 'Maintaining and improving access to towns and properties' with an average score of 3.77. This was closely followed by 'Improving public transport' which generated an average score of 3.58.

Other community values

Question 8 asked respondents to identify any other concerns that were not already mentioned.

The data revealed Road Characteristics and improvement to road functionality as the most important issues when considering improvement works. This recognises the function of the road and the need for balance between commuter and local traffic use.

3.5.6 Contact information and follow up

Questions 9 and 10 asked people if they would like to be kept informed of the project's progress or to talk to a member of the project team.

Of the 446 respondents:

- 73 requested a phone call from a member of the project team
- 24 requested to be added to the postal mailing list
- 208 requested to be added to the email contact list.

Up to 69 per cent[2] of the survey participants requested some form of follow up demonstrating a significant level of interest from the community.

The phone call follow ups enabled people to discuss their experiences, issues and potential solutions. This was highly beneficial for the project team as it provided detail and personal experiences, which contributed to an improved understanding of the issues and concerns of the community. (It should be noted that of the 73 respondents requesting a phone call, 15 calls could not be completed due to incorrect or disconnected phone numbers, or because the respondent could not be reached. At least three attempts were made to all numbers.)

3.6 What the stakeholder workshops told us

Two stakeholder workshops were held in Yass on 21 August 2014. Attendees included representatives from the organisations shown in **Table 3-6**. The majority of the participants lived locally. This mix of participants brought a wide range of perspectives to the table, which lead to an informative and balanced discussion.

Table 3-6 Organisations attending the stakeholder roundtable events on 21 August 2014

Workshop attendees
Murrumbateman Progress Association
Canberra Business Council
Transborder Express/Qcity Transit
Canberra District Winemakers
Greening Australia
NSW Trade and Investment
NSW Police Force
Office of Environment and Heritage
Murrumbateman Rural Fire Brigade
NSW Rural Fire Service
Murrumbateman Landcare Group
Duplicate the Barton Highway Action Group
Ambulance Service of NSW
Yass Valley Council

2 It was possible to request both a phone call and to be added to the mailing list so a slight decrease in this percentage is likely.

Figure 3-3 Stakeholder workshop

3.6.1 Issues identified by stakeholders

During the workshops, the stakeholders worked together to identify and record the issues impacting the highway. The key findings of the workshop are:

- Driving along the Barton Highway was often described as a stressful experience and there was considerable support for any project which resulted in improving the road user experience. Particular causes of stress were identified as:
  - Poor or inconsiderate driver behaviour.
  - A conflict in the types of road users on the Barton Highway, particularly with those who travel at a different vehicle speed, or with horse riding related activities at certain locations.
  - Inadequate safe overtaking opportunities resulting in 'bunching of traffic' and 'racetrack behaviour' at the start and end of overtaking lanes.
- Traffic volumes were reported as being heaviest during the morning peak travelling south, increasing as you approach the ACT border.
- Many participants had been involved in, witnessed or attended crashes or near misses along the highway.
- There is little room for driver error along certain sections due to narrow road pavements, narrow road shoulders and the presence of roadside hazards.
- Particular issues requiring attention include:
  - Providing adequate and safe overtaking opportunities.
  - Enabling safe access to and departure from intersections and with properties along the highway.
  - Removing conflict points with intersections at the end of overtaking lanes.
  - Bus stop facilities were limited. There is no pedestrian access to bus stops at McIntosh Circuit and other locations south of Murrumbateman village. The school bus stop on the corner of Gooda Creek Road and the Barton Highway has no barriers, which leaves school children waiting close to fast moving traffic. Concerns were also raised about the school bus stop at Kaveneys Road. These observations were also made by respondents to the community survey.

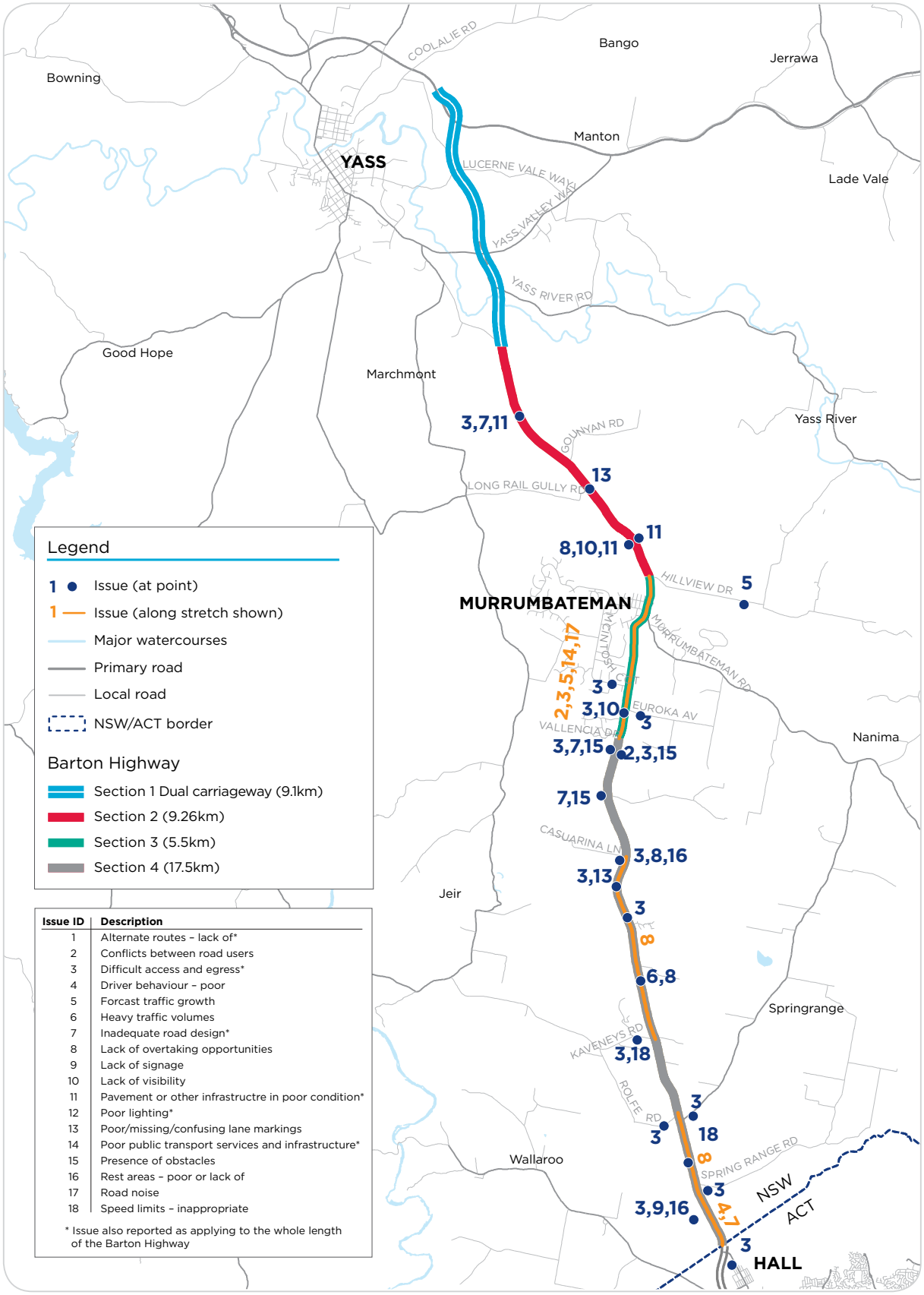
- In several locations it was not easy for buses to re-join the traffic flow on the highway. These locations included Vallencia Drive, Spring Range Road and Euroka Avenue where lack of visibility (Vallencia Drive) or heavy traffic (Spring Range Road) makes right turns by buses difficult. At Vallencia Drive buses travelling south are reported to turn north onto the Barton Highway and then make a 'U' turn to travel south due to the difficulty of the right turn from Vallencia Drive.
- Some of the vegetation alongside the highway is of high ecological value and is either classified as an endangered ecological community (EEC), or provides breeding habitat for the Superb Parrot which is listed as vulnerable in the *Environment Protection and Biodiversity Conservation Act 1999.*
- Maintaining traffic flows during management of any incidents or during road upgrade and maintenance works.

3.6.2 Locations at which issues were reported by stakeholders

The specific issues raised and their locations are provided in **Figure 3-4**. Relatively few issues were identified north of Murrumbateman but otherwise were fairly evenly distributed along the rest of the highway.

Northbound bus stops in Murrumbateman

Figure 3-4 Locations of concern identified during stakeholder workshops



Issue ID	Description
1	Alternate routes – lack of*
2	Conflicts between road users
3	Difficult access and egress*
4	Driver behaviour – poor
5	Forcast traffic growth
6	Heavy traffic volumes
7	Inadequate road design*
8	Lack of overtaking opportunities
9	Lack of signage
10	Lack of visibility
11	Pavement or other infrastructre in poor condition*
12	Poor lighting*
13	Poor/missing/confusing lane markings
14	Poor public transport services and infrastructure*
15	Presence of obstacles
16	Rest areas – poor or lack of
17	Road noise
18	Speed limits – inappropriate

* Issue also reported as applying to the whole length of the Barton Highway

3.6.3 Stakeholder values

In each workshop, stakeholders were asked to collectively nominate values associated with the Barton Highway, and each participant then voted anonymously for the five values they believed were most important. The results of this exercise are shown in **Table 3-7**.

45 preferences for Road Characteristics, 35 for Social Considerations and 12 preferences for Environmental Considerations were received. This order of prioritisation is consistent with the feedback from the community survey as reported in Section 3.5.

Table 3-7 Stakeholder values as prioritised during stakeholder workshops

Category	Value	Number of votes	Total
Safety	Road safety	20	**45**
	Site distances and site views at intersections	4	
	Traffic flow and driver education	7	
	Driver behaviour: mobile phone use, risk taking	6	
	Emergency response, police presence	4	
	Room/forgiveness for driver error	4	
Environment	Conservation of vegetation	6	**12**
	Impact on native animals, Superb Parrots	2	
	Weed control	1	
	Protection of European/Aboriginal heritage	3	
Social	Amenity	4	**35**
	Removal of dead animals, protecting animals from the highway	1	
	Travel times	6	
	Congestion	9	
	Opportunities for pedestrians, cyclists, horse riders, public transport	7	
	Economic growth through new local businesses	8	

McIntosh Circuit intersection roadworks looking southbound

3.7 What the elected member workshop told us

A workshop was held with elected members and Council Officers in Yass on 5 September 2014. Elected representatives and steering committee representatives attending the workshop were:

- The Mayor of Yass, Rowena Abbey
- Yass Valley Councillors Jasmin Jones and Greg Butler
- Yass Valley Council General Manager, David Rowe
- Member for Burrinjuck, Katrina Hodgkinson MP
- Member for Hume, Angus Taylor MP
- Member for Goulburn, Pru Goward MP
- Roads and Maritime Services South West Regional Manager, Lindsay Tanner.

The key messages from the elected member workshop included:

- All the elected members believed the upgrade of the Barton Highway to be of high priority to the local community and were supportive of the development of the *Barton Highway Improvement Strategy*.
- The *Barton Highway Improvement Strategy* would be an important initiative enabling the elected representatives to lobby for funding for improvements on the Barton Highway on the basis of a rational and well documented strategy.
- Preferred projects would be those which delivered safety and travel time benefits.
- It is likely that the upgrade of the Barton Highway will need to be staged. As such, the *Barton Highway Improvement Strategy* needs to consider timeframes (or trigger points) when each of the improvement projects would be required, based on best available traffic growth estimates.
- It would be preferable for improvement projects to be consistent with the future full duplication of the Barton Highway but this is not essential if significant benefits can be achieved through other projects.

3.8 Key findings of the community and stakeholder engagement activities

The key findings of the community and stakeholder engagement activities, prior to the release of the draft Improvement Strategy, were:

- Travelling on the Barton Highway is often described as stressful, particularly at peak times.
- The values of most importance to the community and stakeholders were improving road safety, reducing the number of crashes and reducing traffic delays.
- The section of road from Murrumbateman village to Mundays Lane was where the greatest number of issues were reported.
- Per kilometre of road, the sections from Murrumbateman village to Euroka Avenue and from Nanima Road to the ACT border were most frequently identified as the locations the community would like to see improved.
- The three issues most commonly reported by the community and stakeholders were poor driver behaviour, lack of overtaking opportunities and difficult access to or exit from intersections. These issues received significantly more responses than other issues.
- It was considered likely that the upgrade of the Barton Highway will need to be staged.

The information gathered from the community, elected members and other stakeholders has been considered alongside the findings of the technical studies (described in Chapter 5) to develop the Improvement Strategy (shown in Chapter 8). When analysing the individual improvement projects identified during the course of the study:

- Improvement projects which will result in an improvement at the locations most commonly identified by the community and stakeholders have been weighted more highly than those resulting in improvements at other locations.
- Improvement projects which will result in improved access to and departure from the Barton Highway, improving safe overtaking opportunities (or otherwise improving traffic flows), or improving driver behaviour have been favoured over other improvement projects.
- Improvement projects which address the most commonly identified concerns have been weighted more highly than those addressing concerns less frequently identified by the community and stakeholders.
- Improvement projects which support the community values attributed to the Barton Highway have been assessed more favourably than those which do not. A separate "Barton Highway Improvement Strategy; Community Consultation Report" has been prepared to summarise the feedback received during the formal exhibition of the draft Improvement Strategy in October and November 2015. This report is available at **http://www.transport.nsw.gov.au/projects-road-network-corridor-planning**

> "The values of most importance to the community and stakeholders were improving road safety, reducing the number of crashes and reducing traffic delays."

4 TRANSPORT DEMANDS AND ROLES

Near Kaveneys Road

4.1 Highway role and characteristics

The Barton Highway is part of the National Land Transport Network, a single integrated network of land transport links, both road and rail, which are considered to be of national importance to economic growth, development and connectivity. The network is funded by Federal and State governments and is based on national and inter-regional transport corridors to connect people, communities, regions and industry.

The Barton Highway is one of two 'Canberra Connector' road links in the network, along with the Federal Highway. The Barton Highway provides a key connection between Canberra and Melbourne as well as between southern parts of NSW and Canberra.

It connects the Hume Highway, NSW in the north and the Federal Highway, ACT in the south. The highway also intersects Yass Valley Way as well as a number of other local roads.

The Barton Highway caters for:

- Commuter traffic – mostly residents of Yass Valley Council LGA travelling to employment in Canberra
- Through traffic – between Canberra and Victoria and southern NSW
- Local traffic – trips within Yass Valley Council LGA between Murrumbateman and other residential and commercial areas of Yass.

> "The Barton Highway is one of two 'Canberra Connector' road links in the network, along with the Federal Highway."

4.2 Land use development

Land uses in the vicinity of the Barton Highway include rural uses – predominantly grazing – and two urban settlements at Yass and Murrumbateman.

Local Government Area

The Yass Valley Council LGA comprises a total land area of 4000 square kilometres. The majority of land within the LGA supports rural uses, largely sheep grazing (zoned RU1 – Primary Production). Urban land uses occur in the township of Yass, and the villages of Binalong, Bookham, Bowning, Gundaroo, Murrumbateman, Sutton and Wee Jasper. Tourism is an important industry with the main attractions being a range of National Parks, State recreation areas and nature reserves as well as numerous wineries.

Trunk access to and through the Yass Valley LGA is via the Hume, Barton and Federal highways and the main southern railway line.

Increasingly the Yass Valley LGA is functioning as a tourist destination and 'lifestyle living' option for Canberra based employees who commute via the Barton Highway. These emerging functions have resulted in increased interest in residential development within the town boundary and on its periphery.

The townships of Yass and Murrumbateman are the two concentrations of population along the length of the Barton Highway. Outside of these concentrations, rural uses dominate the landscape within the highway corridor. Brief descriptions of functions and land use within each of the two townships follow.

Yass

The township of Yass has traditionally functioned as a local service centre. It provides a town centre with adjacent broader business and low density residential uses. A number of primary and secondary schools, the Yass Showground and indoor stadium, Yass Livestock Saleyards, the TAFE Illawarra Institute, the Yass District Hospital, and substantial public open space also serve the broader community.

Murrumbateman

Murrumbateman is a small rural village located on the Barton Highway approximately 25 kilometres south of Yass and 40 kilometres from the centre of Canberra. The village is rural/residential in character with scattered commercial uses fronting the Barton Highway. The village sits among rural lands which are largely dedicated to grazing. Its geographical location on the Barton Highway contributes to the potential for population growth and growth of commercial and industrial land uses.

Urban planning background

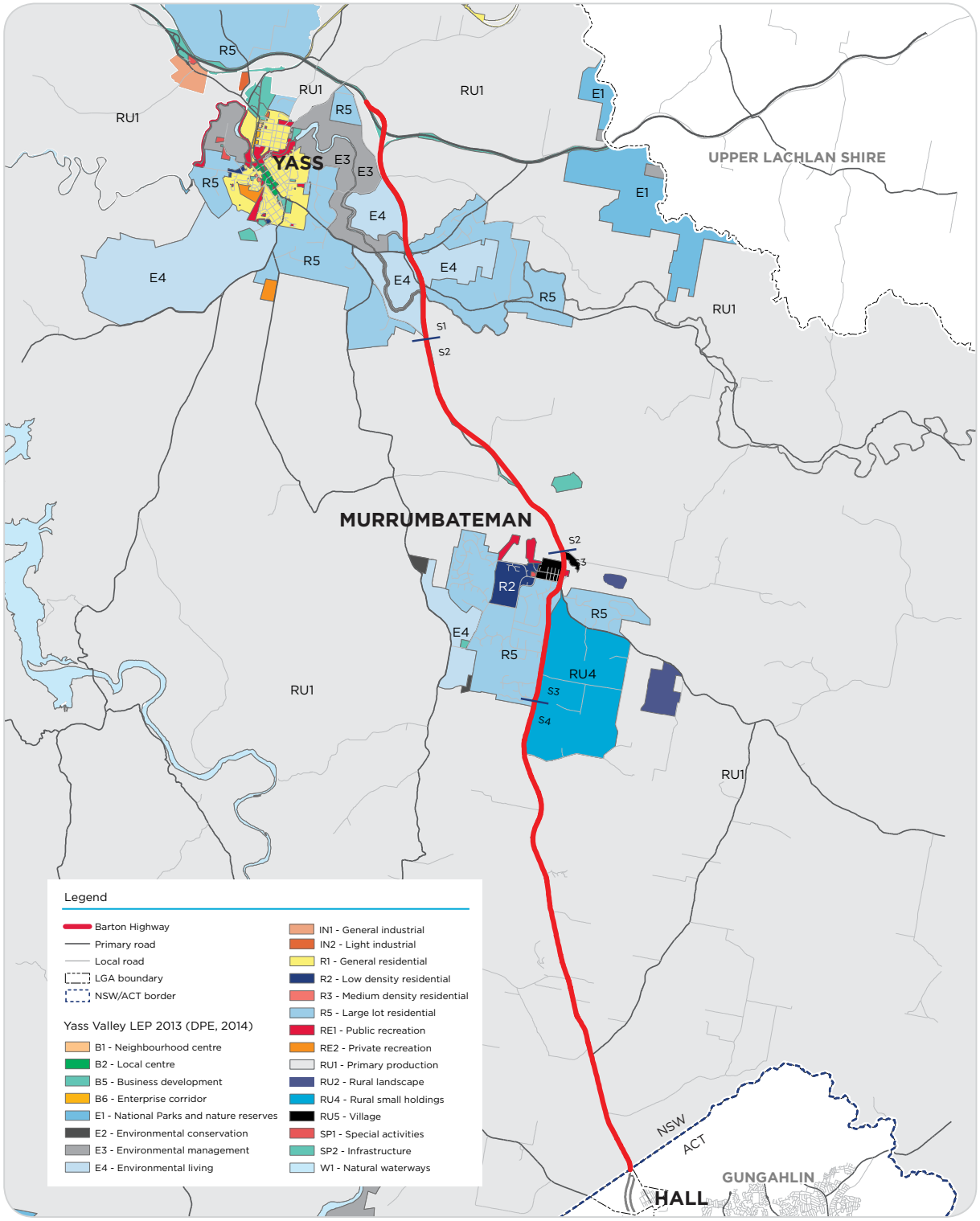
Local land use planning in the vicinity of the Barton Highway is guided by the *Yass Valley Local Environmental Plan, 2013* (LEP, 2013). The LEP, 2013 replaced the *Yass Local Environmental Plan, 1997*. It determines land use zones for the Yass Valley Council LGA including the township of Yass, the village of Murrumbateman and the surrounding rural and natural lands.

Figure 4-1 indicates that the great majority of land within the vicinity of the Barton Highway corridor is zoned RU1 – *Primary production under the LEP, 2013*. Zonings within the townships of Yass and Murrumbateman are predominantly *R5 – Large Lot Residential* around cores of higher density *(R2 – Low Density Residential)* and local service centres *(B2 – Local Centre and RU5 – Village)*. A small pocket of industrial land *(IN1 – General Industrial)* sits on the north west edge of the Yass township. Aside from this there is no other industrial land near the Barton Highway corridor.

Generally the zoning mix in the population centres allows for a range of residential densities and lot sizes but leaves little potential for higher population concentrations or for employment growth.

Murrumbateman Road intersection, looking southbound

Figure 4-1 Land zoning along the Barton Highway corridor (extract from Yass Valley Local Environmental Plan, 2013)



Barton Highway duplication corridor

The corridor boundaries for the potential duplication of the Barton Highway were determined in 2011 and have been included in the LEP, 2013. During the development of recent safety works projects along the highway, Roads and Maritime Services has purchased the land required plus adjacent land required for the duplication corridor. Opportunities have also been taken to purchase sections of the duplication corridor elsewhere along the highway in accordance with appropriate legislation.

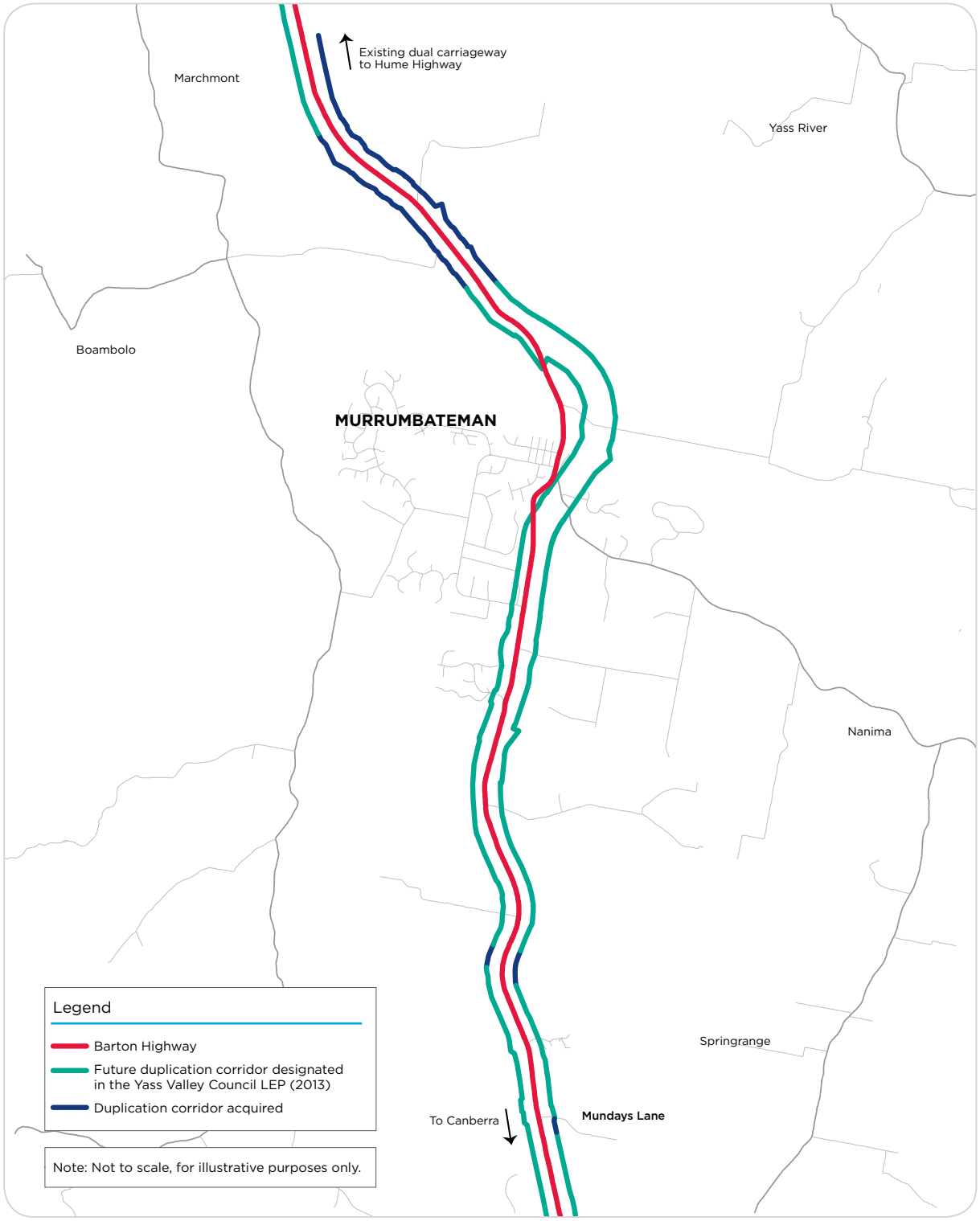
About eight kilometres of the remaining 32 kilometre duplication corridor is owned by the NSW government. This land includes:

- Section 2: seven kilometres from the end of the existing dual carriageway near Yass River to the southern end of the Gounyan realignment
- Section 3: about 750 metres opposite McIntosh Circuit
- Section 4: about 250 metress just south of Mundays Lane.

The duplication corridor and the lengths owned by the Government are shown in **Figure 4-2**.

Start/end of duplicated highway, looking northbound

Figure 4-2 Duplication corridor and lengths



4.3 Current population and employment profile within the corridor

Population and employment figures for the Yass Valley Council LGA are from the NSW Department of Planning and Environment's 2014 NSW Population, Household and Dwelling Projections and from the Australian Bureau of Statistics' 2011 Census data.

Focus areas are the Yass Valley Council LGA, Yass town and district, and Murrumbateman town and district, and data for each of these towns is summarised in **Table 4-1**.

Table 4-1 Population/demographics – LGA and urban centres

Area	2011 population	% aged over 65 years	% aged 0–14 years	Modal age group	% labour force employed full time	Main employment by industry
Yass Valley Council LGA	15,600	13.4	7.1	40–44	63.1	Public administration and safety (19.1%); Construction (10.2%); Health care and social assistance (8.6%)
Yass and districts	6921	16.6	7.4	40–44	62	Public administration and safety (17.8%); Retail trade (10.7%); Construction (10.5%)
Murrumbateman and districts	3297	7.6	7.1	40–44	65.9	Public administration and safety (26.2%); Professional, scientific and technical services (10.7%); Education and training (9.5%)

Source: 2011 Census data + NSW DPE population and household projections, 2014.

Local Government Area

The Yass Valley Council LGA is home to 15,600 people, with a land area of 399,837 hectares. Age groups in this population range from 0 to over 85 years, and the most common age group is 40–44. The 2011 Census showed that 66.4 per cent of the population are aged 15+, and are included in the labour force. Of this group, 97.6 per cent were employed (7765 people), 65 per cent full time and 33 per cent part time.

Yass residents have easy access to work and education opportunities in Canberra. There were 3852 (49.6 per cent) working residents who travelled outside of the area to work; and 2831 (36.5 per cent) people who lived and worked in the area. Of those that work in the area, 15.3 per cent (512 people) lived elsewhere.

Yass

The Yass town centre and its residential periphery covers a total area of 55,903 hectares, and was home to 6921 residents according to the 2011 Census. Sixty-three per cent of this population was considered part of the labour force with 97.9 per cent of these in employment (3363 people).

Murrumbateman

In 2011, Murrumbateman and its residential periphery had a total population of 3297 people in an area of 36,827 hectares. The Census data indicates that 1838 Murrumbateman residents were considered part of the labour force; 98.9 per cent of these were employed (67 per cent full time and 32 per cent part time).

4.4 Travel behaviour

Data from the 2011 Census regarding travel behaviour in Yass Valley Council LGA, and the towns of Yass and Murrumbateman is presented in **Table 4-2**. This table provides travel behaviour across NSW for comparison, though it should be noted that the travel behaviour across NSW includes both regional and capital city data.

Table 4-2 Transport mode share – 2011 Census

Area	Yass Valley Council LGA		Yass (town)		Murrumbateman		NSW	
	No.	%	No.	%	No.	%	No.	%
Train	0	0.0	3	0.1	0	0.0	193,098	7.7
Bus	87	1.4	51	2.1	17	1.4	116,657	4.6
Car, as driver	4839	79.7	1915	77.5	1042	84.5	1,807,359	71.8
Car, as passenger	540	8.9	241	9.7	111	9.0	157,359	6.3
Truck	202	3.3	85	3.4	20	1.6	38,584	1.5
Motorbike/scooter	32	0.5	9	0.4	9	0.7	19,629	0.8
Bicycle	10	0.2	7	0.3	3	0.2	23,358	0.9
Other	59	1.0	21	0.8	6	0.5	32,043	1.3
Walked only	300	4.9	140	5.7	25	2.0	128,340	5.1
TOTAL	**6069**	**100**	**2472**	**100**	**1233**	**100**	**2,516,427**	**100**

The information can be interpreted for those that live in Yass Valley Council LGA, the town of Yass or the village of Murrumbateman as follows:

- Workers who live around the Barton Highway are most likely to travel to work by car.
- Few people catch the bus to work.
- Two per cent of Murrumbateman and six per cent of Yass Valley Council LGA residents use active transport (cycling/walking/horse riding).

The high proportion of 'travel to work by motor vehicles' (including buses) demonstrates the reliance on the Barton Highway by commuters.

4.5 Industry and economic development

Goods produced in the regions are transported to domestic and international markets, which contributes to the NSW economy. The regional road and rail freight network supports agricultural, manufacturing and mining industries, along with the local businesses associated with these sectors. Regional ports and airports also support freight movement to export markets.

The Barton Highway is an important route for freight movements between Melbourne and Canberra and carries an increasing volume of traffic from warehousing and distribution centres in Albury-Wodonga.

In regional NSW, a large area is dominated by agriculture. Agricultural land in the Barton Highway corridor varies across different sectors, but generally includes:

- Viticulture
- Horse studs and related equestrian activities
- A quarry
- Small farms.

The demand for freight transport from these agricultural industries is impacted by seasonal fluctuations and crop sizes.

4.6 Current traffic volumes and heavy vehicle access

Traffic volumes along the length of the Barton Highway varied between 8000 and 12,000 vehicles per day in 2014. The higher volumes were closer to the ACT border, gradually decreasing towards the Hume Highway. The volume within Murrumbateman village was approximately 11,000 vehicles per day.

The Barton Highway is not listed as a key inter-regional or interstate freight flow in the NSW Freight and Ports Strategy, as very little of the state's commodities volume is produced in the regions surrounding the Barton Highway. While not a corridor for large freight volumes, the Barton Highway is part of the nationally recognised Key Freight Route network and supports freight movements to and from the ACT, the NSW south coast, and local businesses along the corridor.

Freight movements along the Barton Highway:

- Travel end to end – from the Hume Highway (Victoria and south west NSW) to the Federal Highway (ACT).
- Originate along the highway and use part of the highway – from the Kaveneys Road Quarry, farms and wineries to either the ACT or the Hume Highway (Victoria and south west NSW).
- Originate away from the highway and use part of it – from the Hume Highway (Victoria and south west NSW) to Murrumbateman Road or to the Kaveneys Road Quarry.

Heavy vehicles along the Barton Highway currently account for about eight per cent of the daily traffic (around 700 to 900 heavy vehicles) varying between the north and south of the highway.

The Barton Highway is approved for:

- Higher Mass Limits – B-doubles up to 25/26 metres long
- Livestock vehicles – B-doubles up to 25 metres long.

4.7 Public transport in the corridor

Rail

The closest railway station to the Barton Highway is Yass Junction, on the Sydney–Melbourne line. As an interstate train line there are only two services through Yass Junction on weekdays in each direction. The station is located 3.7 kilometres north of Yass and 4.4 kilometres west of the Barton Highway interchange with the Hume Highway.

With no rail connection between Yass and Canberra, travel by train is only for long distance trips and does not provide an alternative to car travel along the Barton Highway.

Bus

A number of commuter and school bus services use the Barton Highway to transport people between Yass and Canberra.

Commuter services

Limited commuter bus services run between Yass and Canberra on weekdays during the AM and PM peak periods. These services are provided by bus and coach company Transborder and the trip between Yass and Canberra centre takes around an hour.

NSW TrainLink services

Daily bus services are also provided by NSW TrainLink and Victorian V/line. The NSW TrainLink service runs between Cootamundra and Queanbeyan, stopping at Yass Junction train station, Yass, Murrumbateman and Canberra once a day in each direction. The Victorian V/line service runs between Canberra and Albury, stopping at Yass and Murrumbateman once a day in each direction.

School services

School bus services operate on weekdays during school terms along the Barton Highway between Yass and Canberra.

Bus stops

The majority of commuter bus stops along the Barton Highway are indicated only by a bus stop sign. There are generally no other facilities such as shelter and seating, other than at the bus stop on Yass Valley Way near the Barton Highway roundabout (Canberra bound) which has a shelter with seating. There are also car parking spaces at this bus stop which enables commuters to park and ride (the car park is not a formal park and ride facility).

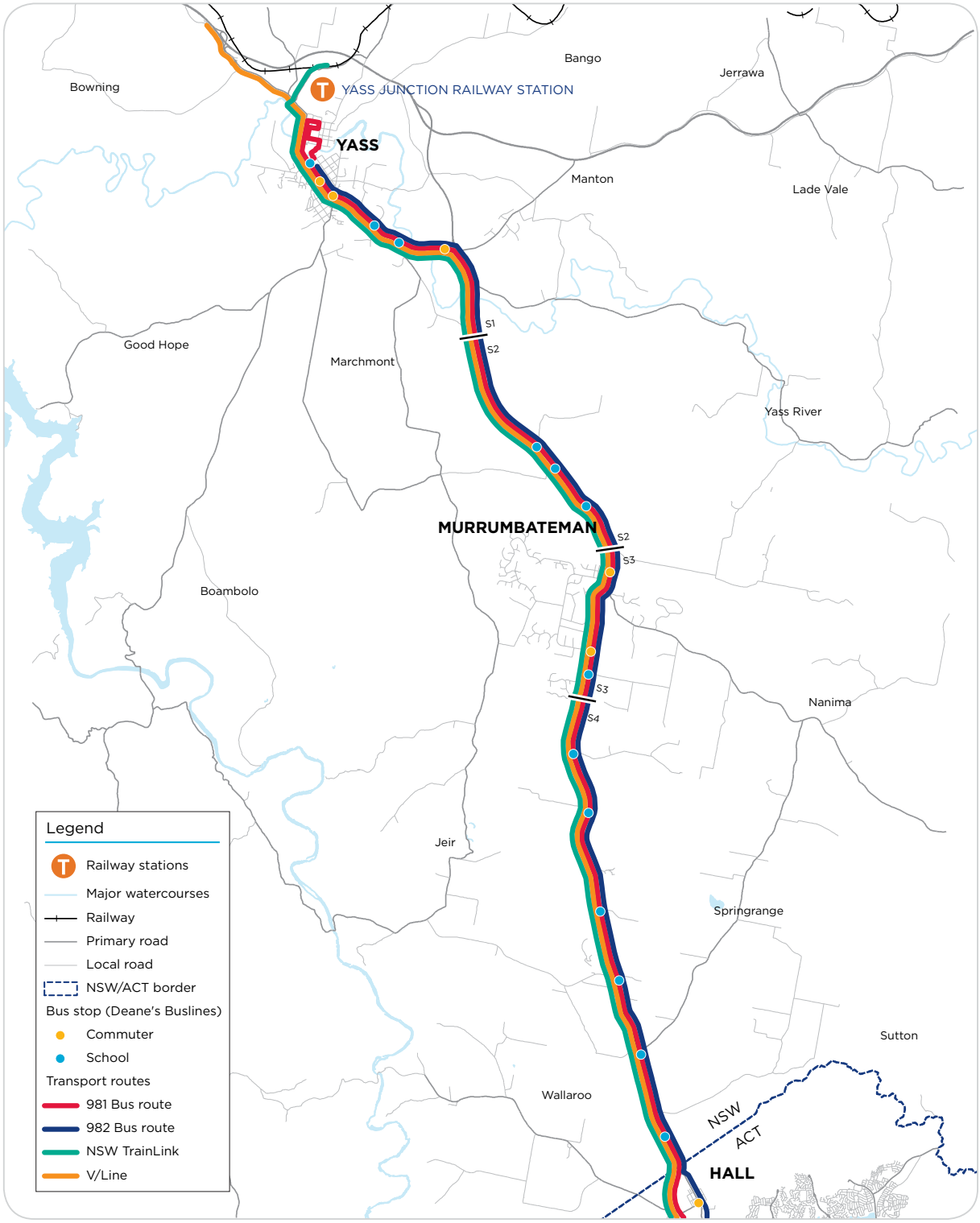
The school bus services stop more frequently along the highway but at less defined bus stops. Some school bus stops may have signage for motorists warning that school buses will be stopping up ahead.

The bus routes and bus stop locations are shown on **Figure 4-3**.

Community transport

Community transport operates in the Yass Valley Council LGA with a focus on transporting people to health appointments in the ACT. Shopping services for people who live in villages are also provided. Some informal carpooling may occur between Yass and Canberra, and taxi services operate in Yass and Murrumbateman.

Figure 4-3 Bus routes and bus stops along the Barton Highway



4.8 Active transport in the corridor

Yass Valley Council revised its integrated pedestrian access and mobility plan (PAMP) and bike plan in 2011. While the main focus is on the town of Yass, an overview of other areas in the LGA is also provided.

Cyclists

Yass Valley Council is encouraging local cycling trips in Murrumbateman through construction of a shared user path on the western side of McIntosh Circuit and along Merryville Drive. It is possible to cycle to the ACT along the Barton Highway via limited road shoulders. Cycling routes in Murrumbateman are shown in **Figure 4-4**.

Pedestrians

Pedestrian use of the Barton Highway occurs most around Murrumbateman village where there are a number of shops and businesses that front the highway as it passes through the village. These include a restaurant, service station with general store, hotel/motel, church, bus stop and public library on the western side of the highway, and Jones Park with car parking, public toilets, Australia Post, farmers' markets and a recreation ground on the eastern side.

Feedback for a previous PAMP (2005) in Murrumbateman was focused on difficulties for pedestrians crossing the highway in the village. A pedestrian refuge was built in a key desire line – the 50km/h speed zone between the hotel/motel and Jones Park, which connects the western residential area with the eastern recreational area.

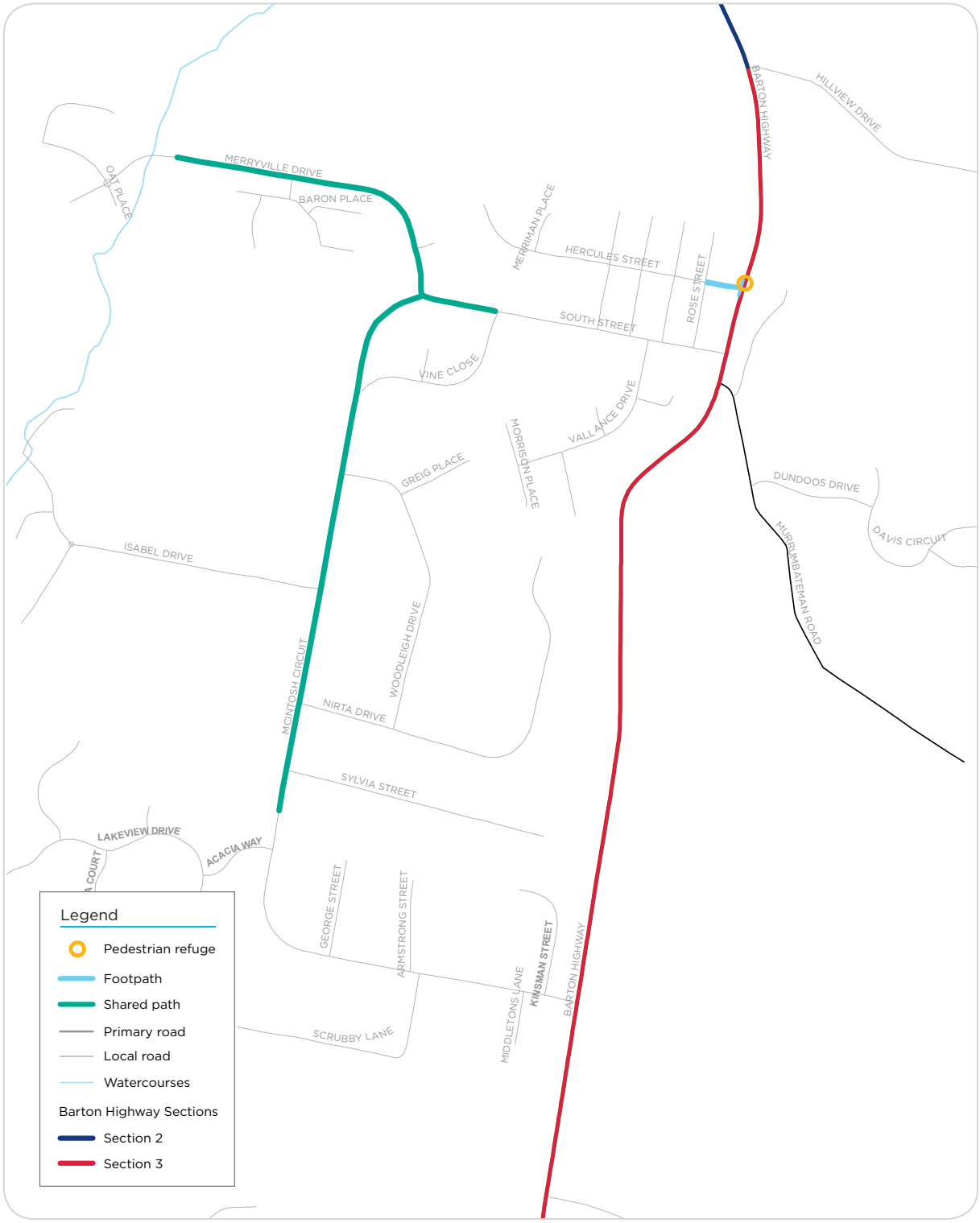
Footpaths in Murrumbateman along the Barton Highway are focused around the pedestrian attracting hotel/motel and general store. A footpath extends west from the highway along Hercules Street to the shopping strip. Another connects the bus stop on the western side of the highway and Hercules Street. The footpath along the highway is directly adjacent to the travel lanes. Pedestrian routes in Murrumbateman are shown in **Figure 4-4**.

Horse riders

A number of residents in Yass Valley Council LGA own and ride horses. A desire line for horse riders is a crossing point within Murrumbateman village near Hercules Street, between the western and eastern side of the village where the sports recreation ground is located.

Footpath on Hercules Street at Barton Highway

Figure 4-4 Cycling and walking facilities within Murrumbateman



5 CURRENT CORRIDOR PERFORMANCE

Kaveneys Road intersection

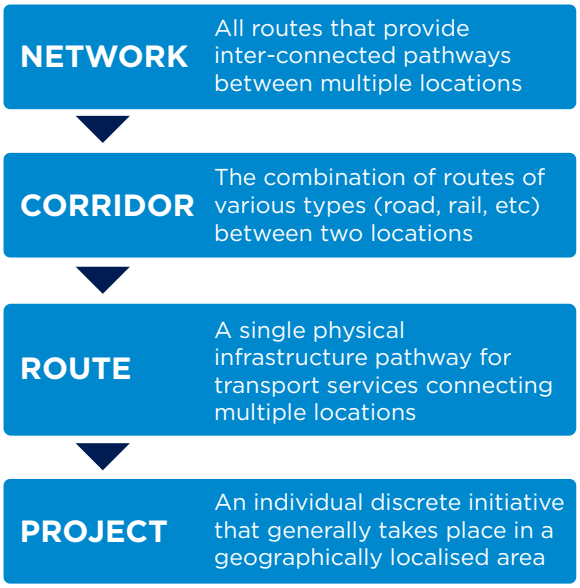
5.1 Overview

Transport for NSW has adopted the *National Guidelines for Transport System Management in Australia*[3] to guide its advice to the NSW Government on the future of the road network.

Decision making in transport is complex. A robust planning framework is needed to break down this complex process into phases.

The framework starts at the high level of network and corridor planning, progressing through to specific route and project levels, as shown in **Figure 5-1**.

Figure 5-1 Road transport system planning levels[4]



5.1.1 Road Network Management Hierarchy and corridor strategies

For strategic planning purposes, Transport for NSW uses the Road Network Management Hierarchy to classify all roads across the State Road Network according to their relative importance. The classifications range from Class 6 urban (6U) and Class 6 rural (6R) standard roads through to lower order Class 1 urban (1U) and Class 1 rural roads (1R).

This means roads with the same classification can be compared in terms of network planning targets – such as road safety, traffic efficiency and asset condition.

This hierarchy is directly linked to the Infrastructure Maintenance ranking system used for asset management. It is important for planning and asset management that both hierarchies are consistent, so that they meet the objectives of providing an integrated management framework for the State Road Network.

3 Australian Transport Council 2006, National Guidelines for Transport System Management in Australia, ATC, Canberra

4 Australian Transport Council 2006, National Guidelines for Transport System Management in Australia, ATC, Canberra, p. 9 & 15

The Barton Highway is classified 4R according to the Network Performance Measures and Network Planning Targets[5].

Class *4R* roads typically experience:

- Average daily traffic volumes exceeding 10,000 vehicles per day
- Average heavy vehicle volumes exceeding 1000 vehicles per day
- Speed limits ranging from 80km/h to 110km/h.

5.1.2 Corridor planning sections

As well as road classification, roads are often separated into 'planning sections' so planning targets can be tailored to specific areas. Planning sections are manageable lengths of road that are uniform in nature.

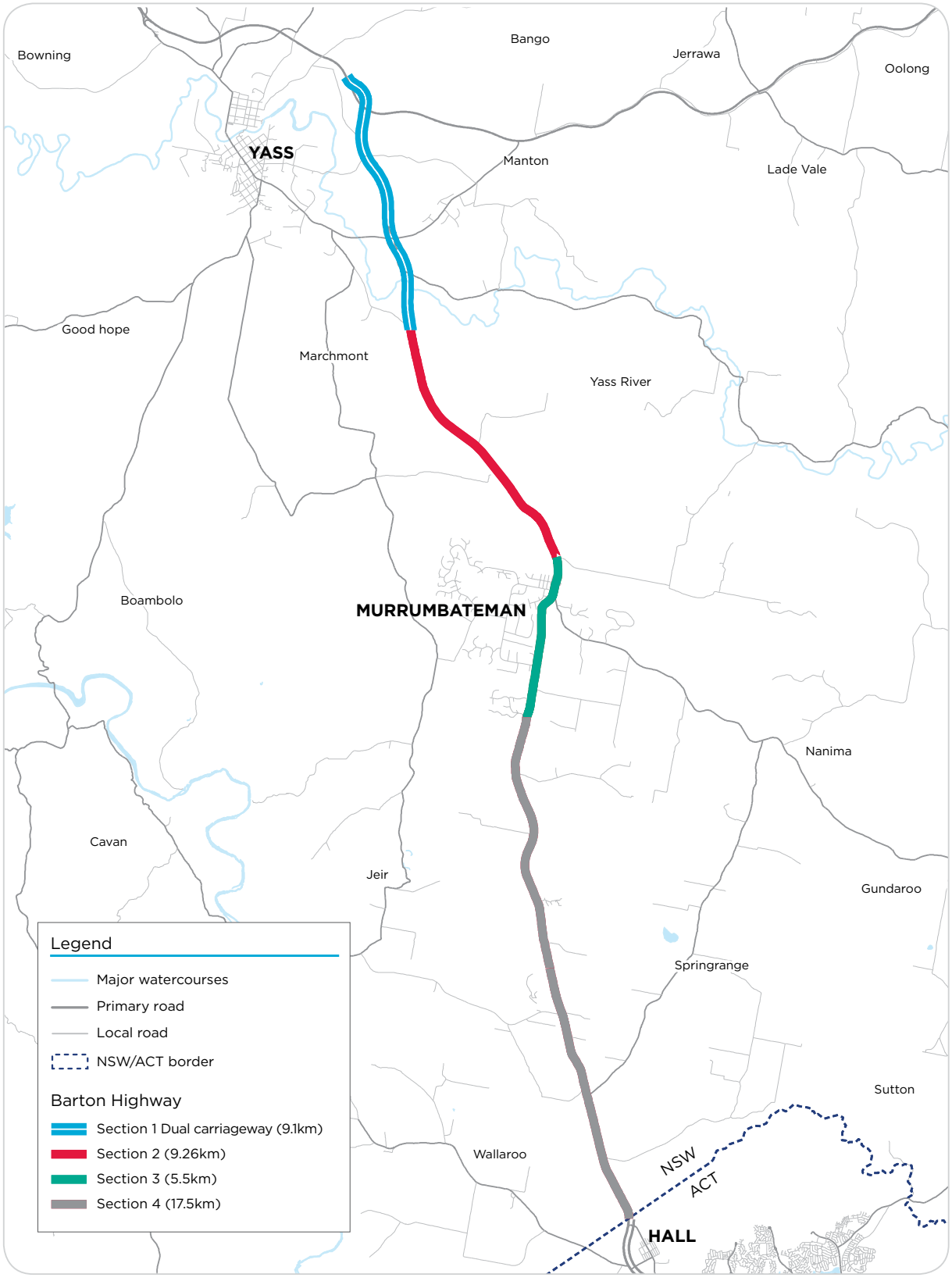
For the purpose of this analysis, the Barton Highway corridor has been divided into four corridor planning sections. These are shown in **Table 5-2** (refer to **Figure 5-2**).

Table 5-1 Corridor planning sections

Corridor section	Description	Land use	Length of the planning segment (km)
1	Between Hume Highway and near Kirkton Road and the Yass River (dual carriageway section)	Rural	9.1
2	Between end of existing dual carriageway and Murrumbateman	Rural	9.3
3	Murrumbateman village precinct	Fringe Urban and Urban	5.5
4	Between Murrumbateman village and the ACT border	Rural	17.5
	TOTAL CORRIDOR		**41.4**

5 Roads and Maritime Services 2010, Network Performance Measures and Network Planning Targets, Roads and Maritime Services, Sydney, p. 17

Figure 5-2 Corridor planning sections along the Barton Highway



5.1.3 Performance measures and targets

The *NSW Long Term Transport Master Plan* sets out the NSW Government's 20 year vision for delivering a world-class public transport, road and freight network across the State.

Meeting community expectations of safe, efficient and well-maintained roads requires a clear set of performance measures. Transport for NSW and Roads and Maritime Services measure and monitor road performance against network performance measures and targets to achieve this.

Network measures enable current and future performance to be assessed, and are used to identify priorities across the network and guide funding over the long term. They are also a way of comparing performance both geographically and over time, and can form the basis for strategy development.

Network planning targets set out in this document are either:

- Network wide targets – cumulative condition targets that apply to the entire network, unless otherwise specified.
- Rural planning targets – that apply to regional NSW, not including Wollongong, Newcastle and Sydney.

To assess the Barton Highway's current corridor performance, the following sources have been used:

- Network Performance Measures and Network Planning Targets[6].
- Network and Corridor Planning Practice Notes[7].

Network planning targets have been developed to complement the Austroads guides. They ensure consistency between identified user requirements of a road and the design solutions available through Austroads guides.

5.1.4 Road characteristics

There are two types of road characteristics. The first type is the **road's geometric or physical layout**, which does not usually change greatly over time, examples include lane width, alignment and shoulder width.

The second type is the **road condition** – a characteristic of the road that may vary significantly over time due to wear, loading or physical degradation, for example cracking or roughness of the road surface. Road conditions are managed by setting network targets. The 'minimum acceptable condition' is based on risk analysis (for example, below a certain point an increase in cracking or roughness can make driving the road unsafe) and the 'upper end performance' is based on the level of available investment.

This document groups the Barton Highway's current corridor performance into the following chapters:

- **5.2** – Road safety
- **5.3** – Traffic
- **5.4** – Road geometry
- **5.5** – Road pavement condition
- **5.6** – Environment.

5.1.5 Road characteristics data sources

Information on the road characteristics and performance for each planning section is stored in various Roads and Maritime Services databases.

For this study, data has been drawn from the following sources:

- Road Asset Management System (RAMS) database
- NSW Centre for Road Safety's crash database (CRASHLink)
- Road Slope Management System (RSMS) database
- Global-Inertial Positioning Systems Image Capture for Asset Management (GIPSICAM).

6 Roads and Maritime Services 2010, Network Performance Measures and Network Planning Targets, Roads and Maritime Services, Sydney

7 Roads and Maritime Services 2008, Network and Corridor Planning Practice Notes, RMS, Sydney

5.2 Road safety

Improving road safety is the most important goal of this Improvement Strategy. Assessment of crash data and community feedback, as well as a safety review of the highway have been conducted for this study.

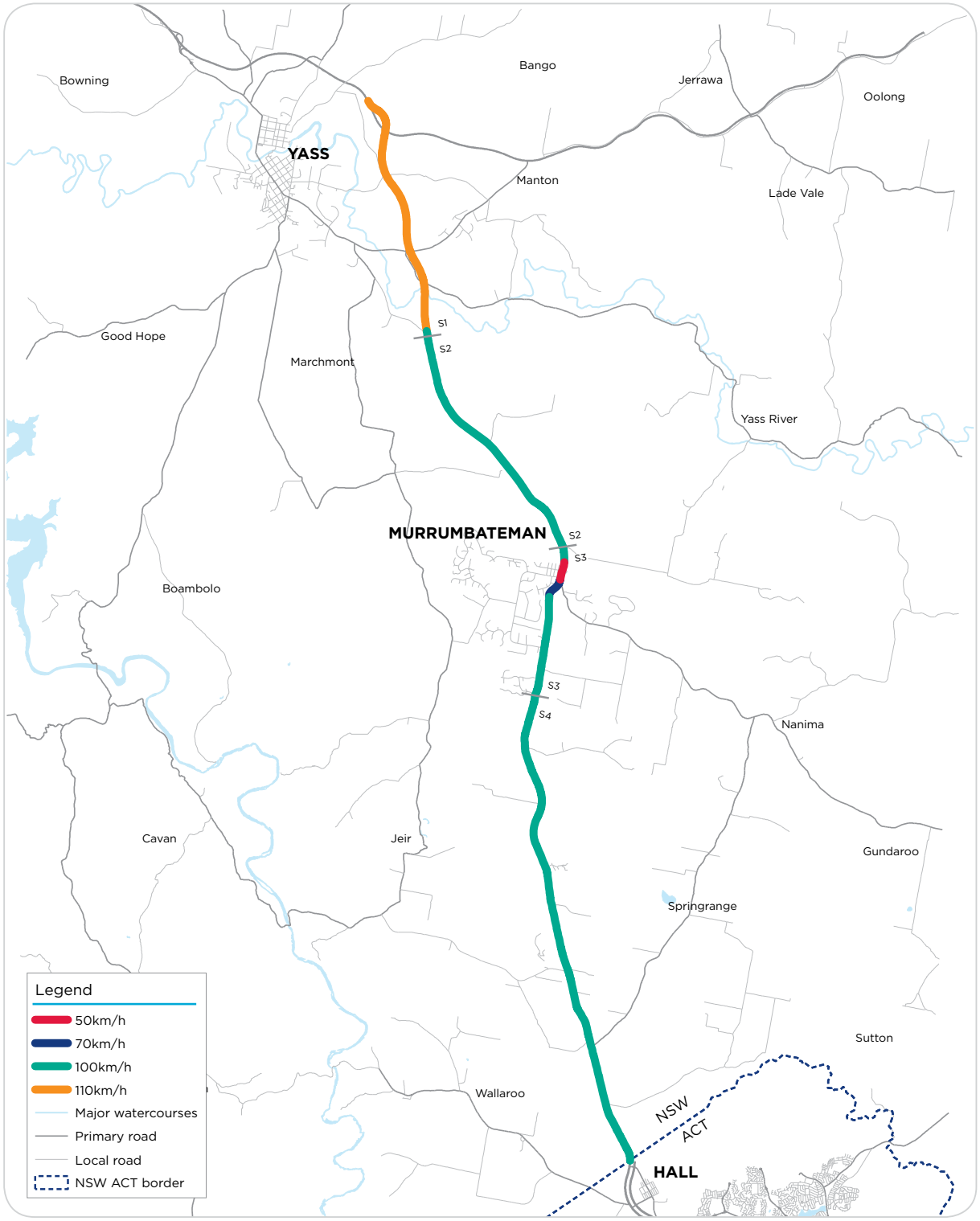
5.2.1 Posted speed limits

The Roads and Maritime Services Speed Zoning Guidelines are used to set appropriate speed limits for all roads, and are considered along with engineering treatments, education and enforcement. Roads and Maritime Services regularly reviews speed limits in NSW, taking account of factors such as the road geometry, surrounding conditions, road use, adjacent development, vehicle types and volumes, crash histories and the number of access points along a route.

If a speed limit (or zone) is perceived by the majority of motorists as suitable, there will be higher levels of voluntary compliance. This contributes to road safety by achieving appropriate, uniform travel speeds.

There are four different speed zones along the Barton Highway, as shown in **Figure 5-3**. These vary from 110km/h in Section 1 (dual carriageway), reducing to a low of 50km/h through the Murrumbateman village. The majority of the Barton Highway is posted at 100km/h.

Figure 5-3 Barton Highway: posted speed limits



5.2.2 Number of crashes

This section of the Improvement Strategy considers crash data (five years of data from 1 January 2009 to 31 December 2013).

The locations and crash severity are shown in **Figure 5-4** to **Figure 5-8**. In total there were 137 crashes along the Barton Highway recorded during this period.

Figure 5-4 Barton Highway Section 1 – crash locations (2009–2013 inclusive)

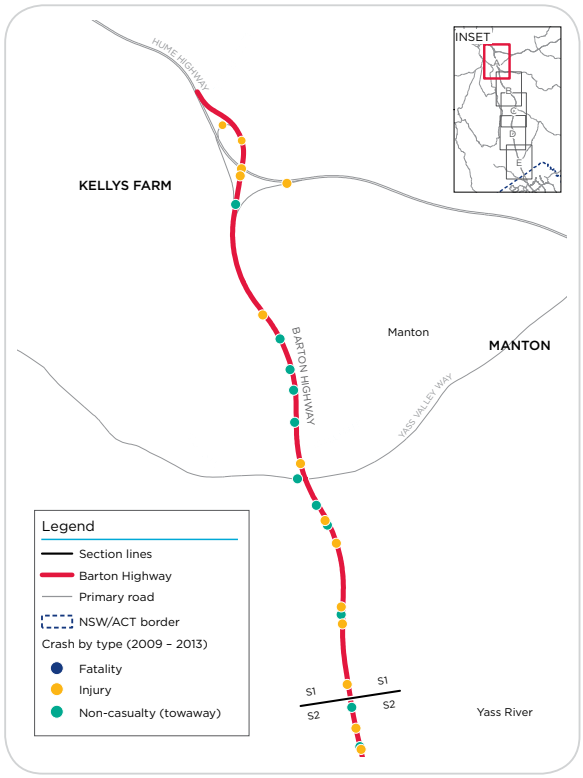


Figure 5-5 Barton Highway Section 2 – crash locations (2009–2013 inclusive)

Figure 5-6 Barton Highway Section 3 – crash locations (2009–2013 inclusive)

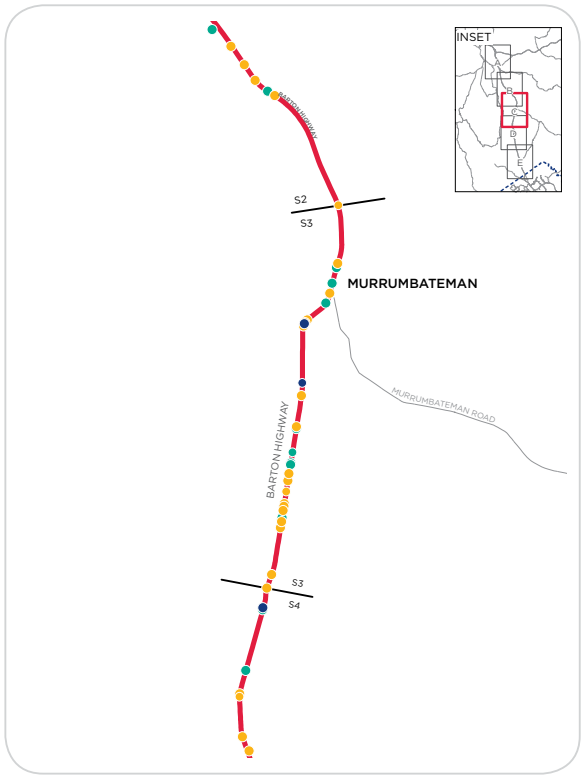
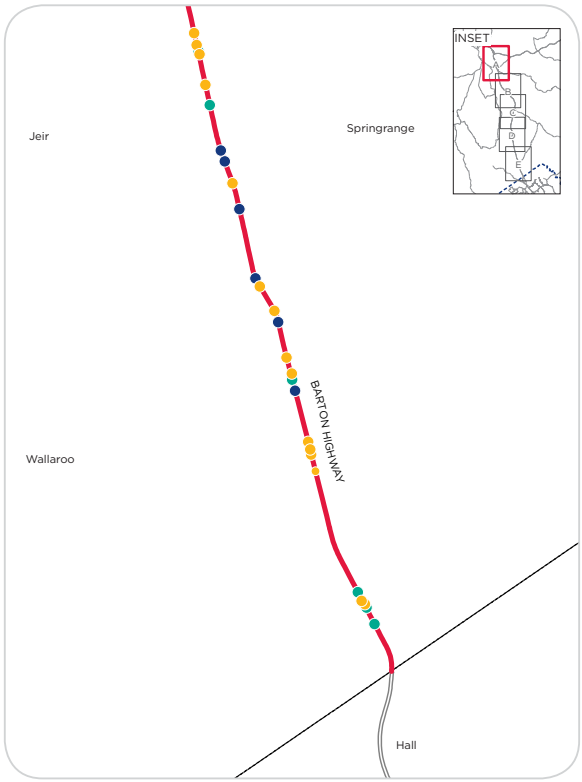


Figure 5-7 Barton Highway Section 4 (north) – crash locations (2009–2013 inclusive)

Figure 5-8 Barton Highway Section 4 (south) – crash locations (2009–2013 inclusive)



Of the 137 crashes recorded on the Barton Highway during the five year period to December 2013, 77 (56 per cent) were casualty crashes. Casualty crashes are those which resulted in at least one (but possibly more) injury or fatality. Of the 77 casualty crashes recorded, seven were fatal crashes and 70 were injury crashes.

- Section 1 (9.1 kilometres) had 21 crashes, 12 of which were casualty crashes with no fatalities.
- Section 2 (9.26 kilometres) had 25 crashes, 14 of which were casualty crashes with no fatalities.
- Section 3 (5.5 kilometres) had 31 crashes, 19 of which were casualty crashes including two fatality crashes. This section had the highest proportion of casualty crashes (61 per cent).
- Section 4 (17.5 kilometres) had 60 crashes, 27 of which were casualty crashes including five fatality crashes. This section had the majority of crashes.

Preliminary data shows that 10 crashes were recorded from January to August 2014 (not included in this study) – seven injury crashes and three (non-casualty) crashes. Seven of the crashes occurred within Section 4, and two occurred in Section 3. One crash was recorded in Section 1.

5.2.3 Times of crashes

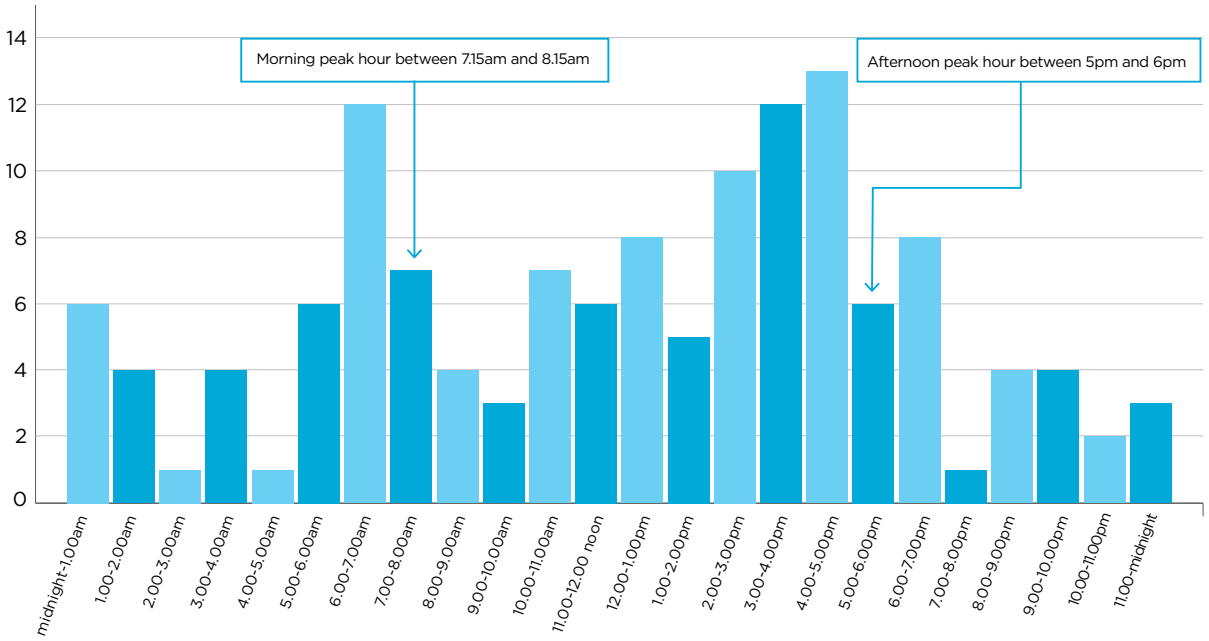
The majority of the 137 crashes recorded between 2009 and 2013 occurred during the morning and afternoon peak periods. There were:

- Thirteen crashes between 4.00 and 5.00pm
- Twelve crashes each between 6.00 and 7.00am and between 3.00 and 4.00pm
- There were ten crashes between 2.00 and 3.00pm.

Figure 5-9 shows the crash record from 2009 to 2013 by the time of day in hour blocks.

> “Of the 137 crashes recorded on the Barton Highway during the five year period to December 2013, 77 (56 per cent) were casualty crashes.”

Figure 5-9 Summary of crashes by time of day



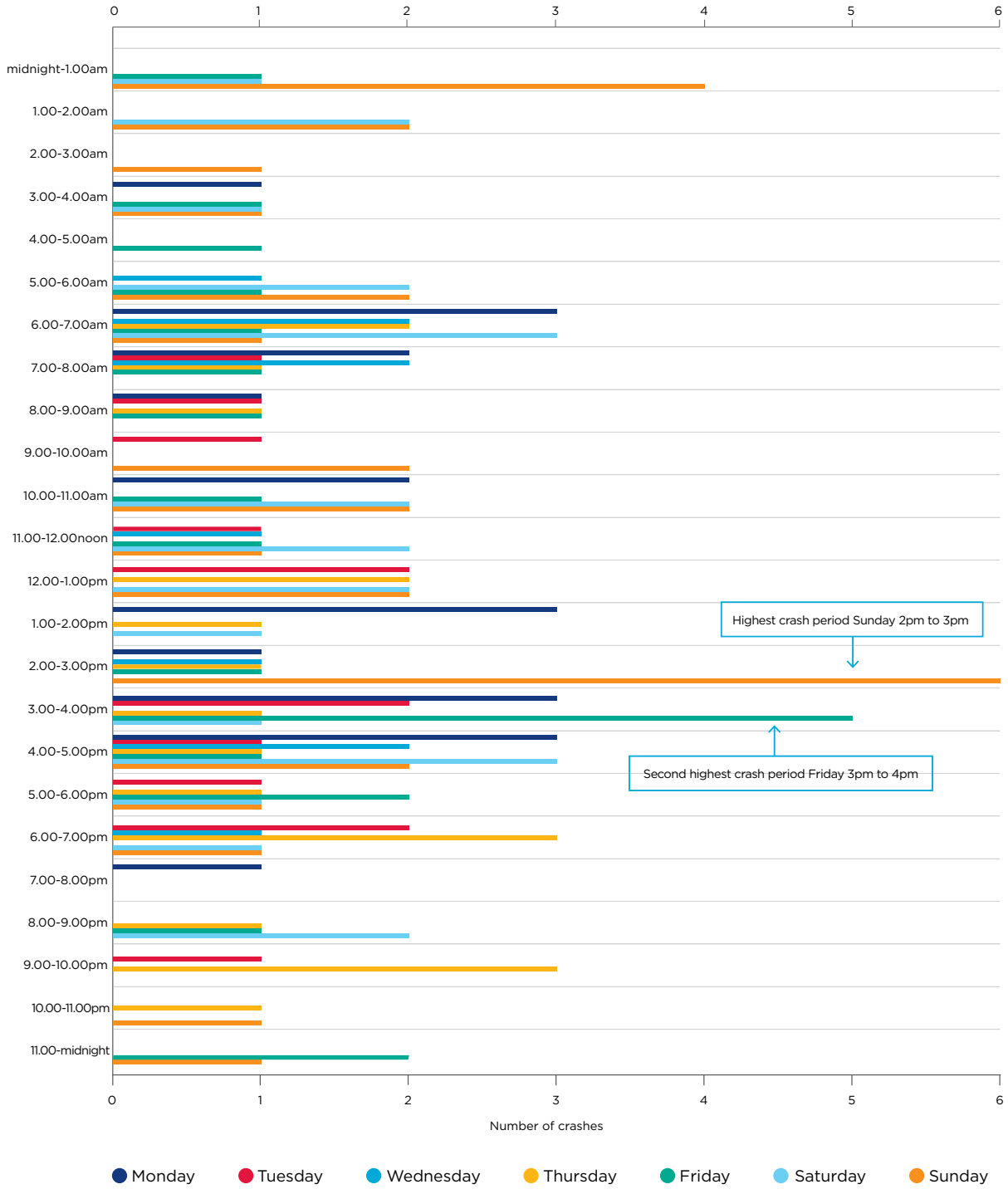
About 39 per cent of crashes occurred on a weekend (Saturday 18 per cent, Sunday 21 per cent). About 15 per cent of crashes occurred on Mondays, Thursdays and Fridays. Fewer crashes occurred on Tuesdays and Wednesdays. **Table 5-3** presents the crash record from 2009 to 2013 by day of the week.

Table 5-2 Summary of crashes by day of week

Day	Number of crashes	% of crashes
Monday	20	15%
Tuesday	13	9%
Wednesday	10	7%
Thursday	19	14%
Friday	22	16%
Saturday	24	18%
Sunday	29	21%
TOTAL	**137**	**100%**

Figure 5-10 shows the connection between the time of the day, and the day of the week of crashes. The highest number of crashes between 2009 and 2013 occurred on a Sunday between 2.00 and 3.00pm with the second highest number of crashes occurring on Fridays between 3.00 and 4.00pm. It should be noted that these crashes did not occur during the weekly peak hourly traffic volumes. They occurred during higher than average traffic volumes along the Barton Highway – the high crash periods at the start and end of the weekend, when motorists are generally travelling for the weekend.

Figure 5-10 Summary of crashes by time of day and day of week




Looking south from Hillview Drive intersection

5.2.4 Casualty crash rates

Roads and Maritime Services determines the road safety performance of the network by monitoring the number of crashes that occur, with a focus on casualty crashes. This monitoring produces an 'average safety performance' for each of the rural Road Network Management Hierarchy classes, which are shown in **Table 5-4**. Class 4R rural roads across NSW have an average performance of 0.195 casualty crashes per kilometre for land uses defined as 'Fringe Urban, Rural and Vegetation Conservation'.

Table 5-3 NSW average casualty crash rate by road hierarchy class

Rural hierarchy class	Casualty crash rate per km (2008-2012)
6R	0.333
5R	0.332
4R	0.195
3R	0.183
2R	0.070
1R	0.027

Source: Roads and Maritime Services 2014

> The Barton Highway's average casualty crash rate over the whole route between 2009 and 2013 was 0.37, about double the network Class 4R average performance of 0.195.

The casualty crash rate on the Barton Highway ranged from 0.26 to 0.62 when considered by section, as shown in **Table 5-5**. Each of these sections have average casualty crash rates higher than the network average for Class 4R roads.

Table 5-4 Barton Highway annual average casualty crash rates (per kilometre)

Corridor section	Location	Casualty crashes per km per annum	NSW class average casualty crash per km per annum (2008–2012)
1	Dual carriageway from Hume Highway	0.26	0.195
2	End of existing dual carriageway to Murrumbateman	0.30	0.195
3	Murrumbateman village precinct	0.62	0.195
4	Murrumbateman village to the ACT border	0.31	0.195

5.2.5 Severity index

To enable a comparison of the impact of crashes from a wider community perspective, a severity index has been developed which considers the total number of crashes on a road and assigns a weighting to fatal and injury crashes.

The severity index is calculated as:

$$\text{Severity index} = \frac{3x + 1.5y + z}{t}$$

Where:

x = number of fatal crashes
y = number of casualty crashes
z = number of tow away crashes
t = total number of crashes

The severity weightings for the four sections of the Barton Highway are presented in **Figure 5-11** and **Table 5-6**. The crashes in Sections 1 and 2 of the Barton Highway have a severity index of 1.29 and 1.28. Sections 3 and 4 have higher crash severity indexes of 1.4 and 1.39; this tells us that when crashes occur on these sections of the highway they tend to be more severe than those occurring on other roads with similar characteristics.

Figure 5-11 Summary of crashes by severity index

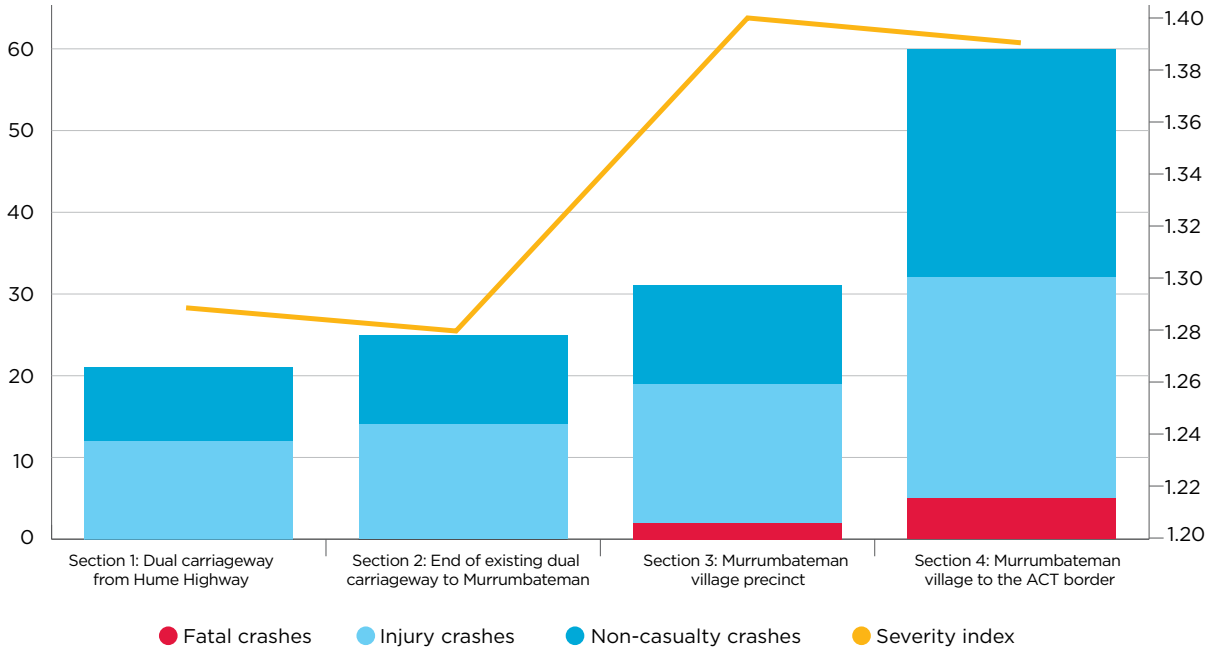


Table 5-5 Summary of crashes by crash type and severity index

Corridor section	Total non-casualty crashes	Injury crashes	Fatal crashes	Severity index
Section 1: Dual carriageway from Hume Highway	9	12	0	1.29
Section 2: End of existing dual carriageway to Murrumbateman	11	14	0	1.28
Section 3: Murrumbateman village precinct	12	17	2	1.40
Section 4: Murrumbateman village to the ACT border	28	27	5	1.39
TOTAL	**60**	**70**	**7**	**1.36**

5.2.6 Crash types

Of the 137 crashes on the highway from 2009 to 2013 the most common crash type was run off road crashes.

Of the 62 run off road crashes (45 per cent of all crashes):

- Forty occurred on a straight section of road (29 per cent of all crashes) with 33 hitting an object.
- Twenty-two occurred on a curve (16 per cent of all crashes), with 18 hitting an object.
- Twelve of the crashes occurred on the duplicated portion of the highway.
- Nine of the crashes occurred on the Gounyan curves alignment before November 2011. There were no crashes on the upgraded Gounyan realignment from its opening in November 2011 to December 2013. There was one hit animal crash on this length in 2014.

Crashes involving vehicles crossing the opposing direction of traffic is a serious issue along the single carriageway section of the highway.

- Of the 62 run off road crashes, 25 crashes (18 per cent of all crashes) involved vehicles leaving the right hand side of the road.
- Seven of these occurred on the duplicated carriageway with vehicles entering the median. Four of these seven crashes were injury crashes.
- The remaining 18 crashes occurred on the single carriageway section of the highway with vehicles crossing the opposing travel lane. This resulted in two fatal crashes and 11 injury crashes.
- Two of these crashes occurred on the Gounyan curves alignment (one injury crash) prior to its upgrade.
- In addition, head-on crashes accounted for 12 crashes (nine per cent of all crashes; one overtaking and 11 not overtaking). This resulted in three fatal and seven injury crashes.

> “Overall, on the single carriageway section of the highway, 30 crashes (22 per cent of all crashes) involved a vehicle crossing into or across the opposing direction carriageway, resulting in five of the seven fatalities in the data analysed (71.4% of all fatalities), as well as 18 of 70 injury crashes (25.7% of injury crashes).”

A summary of crash types and the highway section they are in are presented in **Table 5-6** and **Figure 5-12**.

Table 5-6 Summary of crashes by crash type

Vehicle movement	Crash types	Number of crashes	% of crashes
Off path on straight	Off road on straight, includes hitting an object	40	29%
Off path on curve	Off road on curve, includes hitting an object	22	16%
On path	Struck animal	19	14%
Other	Other	19	14%
Vehicles both travelling from one direction	Rear end	19	14%
	Right rear	6	4%
Vehicles from opposing directions	Head-on not overtaking	11	8%
	Head-on overtaking	1	1%

Figure 5-12 Summary of crashes by crash type

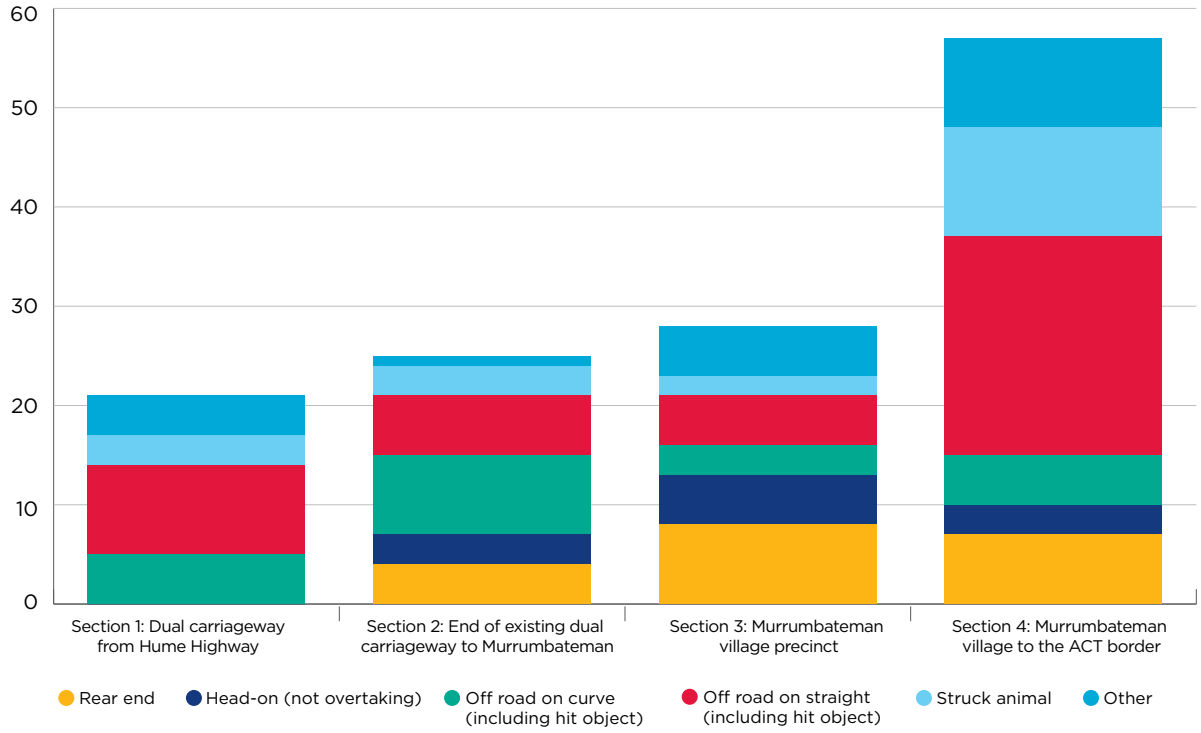


Table 5-7 outlines the crash types identified as casualty crashes along the Barton Highway.

Table 5-7 Crash types identified as casualty crashes

Vehicle movement	Crash types	Number of crashes
Fatal crashes		
Vehicles from opposing directions	Head-on (not overtaking)	3
Off path on straight	Off road on straight, includes hitting an object	2
Pedestrian	Pedestrian walking against traffic	1
Overtaking	Overtaking turning vehicle	1
Injury crashes		
Off path on straight	Off carriageway to left into object	7
	Off carriageway to right into object (carriageway crossover)	7
	Off carriageway to left	3
	Off carriageway to right (carriageway crossover)	2
	Out of control on carriageway	2
Vehicles – from one direction	Rear end	9
	Right rear	4
	Lane change right	2
	Lane sideswipe	1
	Left rear	1
Off path on curve	Off carriageway to right, on left hand bend, into object	5
	Off carriageway to left, on right hand bend, into object	4
	Off carriageway to left, on left hand bend, into object	2
	Off carriageway to left on right hand bend	2
	Off carriageway to right on right hand bend, into object	1
Vehicles from opposing directions	Head-on (not overtaking)	6
	Right through	2
On path	Struck animal	5
	Previous crash or broken down	1
Overtaking	Head-on (overtaking)	1
	Other overtaking	1
Passengers and miscellaneous	Object struck vehicle	1
Manoeuvring	U-turn	1

5.2.7 Contributing factors

An assessment of the contributing factors leading to these crashes showed that the majority of crashes occurred during dry conditions with fine weather; sixty per cent occurred with ample natural lighting. Seventy-seven per cent of all crashes involved light vehicles only.

Table 5-8 Summary of crashes by contributing factors

Crash factor	Number of crashes	% of crashes
Vehicle type involved		
Light vehicles only	105	77%
Light and heavy vehicles	14	10%
Heavy vehicles only	18	13%
Road surface condition		
Dry	112	82%
Wet	25	18%
Natural lighting		
Daylight	82	60%
Darkness	41	30%
Dusk	8	6%
Dawn	6	4%
Weather		
Fine	100	73%
Rain	19	14%
Overcast	14	10%
Other	4	3%

5.2.8 Crashes near intersections

Police reports for crashes describe the movements and actions of any vehicle involved, including vehicle movements approaching and travelling in and out of intersections. As vehicles can queue or reduce speed some distance from the intersection, there can be incidents that are related to the intersection, but would not be recorded as a specific 'intersection' crash. For example where a car swerves off the road to avoid colliding with other vehicles waiting to turn into or out of an intersection. Crashes within 100 metres of intersections have been assessed separately to identify associated safety concerns.

The number of crashes that occurred at or within 100 metres of intersections along the Barton Highway are shown in **Table 5-9**. Of these 32 crashes, 15 resulted in an injury to one or more people and 17 resulted in a vehicle being towed away. There were no fatal crashes recorded.

- The Euroka Avenue intersection had the highest number of reported crashes over the five year period, with six crashes occurring within 100 metres of the intersection.
- The intersections of the highway with Hercules Street, Nanima Road and McIntosh Circuit had three crashes each. These crashes were within 100 metres of their respective intersections, and are attributable to either the turning movements at the intersection or vehicles preparing to turn at the intersection.
- Overall, turning movements at intersections contributed to five crashes:
  - There were three rear end crashes with right turning vehicles; two at Hercules Street and one at Euroka Avenue intersections.
  - One rear end crash with a left turning vehicle occurred at the Nanima Road intersection.
  - One right turning vehicle collided with oncoming traffic at the Vallencia Drive intersection.

Table 5-9 Summary of crashes by intersection

Intersection locations	Number of crashes
Euroka Ave	6
Hercules Street	3
McIntosh Circuit	3
Nanima Road	3
Gooda Creek Road	2
Casuarina Lane	2
Gounyan Road	2
Hume Highway	2
Murrumbateman Road	1
Vallencia Drive	1
Yass Valley Way	1
Boundary Lane	1
Church Lane	1
Kaveneys Road	1
Rolfe Road	1
South Street	1
Hillview Drive	1
TOTAL	**32**

Of the crashes that occurred at or close to intersections, the highest incidences were rear end at 36 per cent and off road on straight or curve, accounting for 31 per cent. The crash types at intersections are detailed in **Table 5-10**.

Table 5-10 Summary of crashes at intersections by crash type

Vehicle movement	Type of crash	No. of crashes (100m)	% of intersection crashes
Vehicles both travelling from one direction	Rear end	9	28%
	Right rear	3	9%
Vehicles from opposing directions	Right through	1	3%
	Head-on (not overtaking)	2	6%
Off path on straight	Off road on straight (including hitting an object)	5	16%
Off path on curve	Off road on curve (including hitting an object)	3	9%
On path	Struck animal	6	19%
Other	Other	3	9%

Vallencia Drive intersection and northbound overtaking lane

5.2.9 Safety hazard identification and classification

A safety hazard assessment for the *Barton Highway Improvement Strategy* involved the collection of data regarding existing safety hazards in order to classify and evaluate each hazard. This involved a desktop review followed by site inspections.

The identification of safety hazards was guided by the *Transport for NSW Guidelines for Road Safety Audit Practices (2011)* and *Austroads: Guide to Road Safety Part 6: Road Safety Audit (2009).*

The Austroads: Guide to Road Design (2009–2011) and the Roads and Maritime Services *Supplement to Austroads Guide to Road Design (2011)* were also referenced.

The principal safety hazards on the Barton Highway are detailed in **Table 5-11**.

Table 5-11 Principal hazards

Principal hazard	Sub hazards		
Horizontal alignment	Sight distance	Super-elevation	Curve radius
	Diverge	Merge	
Vertical alignment	Sight distance	Crest/sag length	
Intersection/property access	Sight distance	Acceleration	Deceleration
Safety barrier	Terminals	Point of need	Hazard free zone
Delineation	Guideposts	Line marking	Raised pavement markers
Shoulder/verge	Vegetation	Vertical drop	Culvert/headwall
	Narrow sealed shoulder	Pavement edge drop	Loose material
Signage	Chevron alignment markers (cams)	Reflectivity	
Heavy vehicle rest areas	Sight distance	Acceleration/ deceleration	Access/egress
Bus bay	Layout	Location	Sealed

5.2.10 Road user behaviour

Stakeholder feedback suggests that road user safety is threatened by unsafe behaviours, such as speeding by 'other' road users. This and other behavioural issues are major factors for cyclists and pedestrians, particularly when facilities are not sufficient for these users.

Initiatives that could modify road user behaviours include:

- Education campaigns for drivers, cyclists, pedestrians and horse riders
- Increased police focus
- Camera technology such as fixed, mobile or point-to-point speed cameras.

Education programs and additional focus from the NSW Police Force would require 'third party' commitments but deserve further consideration. Further studies would be needed to determine if camera technology is a suitable option.

5.2.11 Vulnerable road users

Vulnerable road users, such as pedestrians, cyclists, and horse riders, are particularly at risk in the event of a crash as they can be exposed to impact forces that are beyond the limit of human tolerance. Separation of these user groups from traffic is the best means of providing protection. An example of this is the pedestrian refuge located in the 50km/h speed zone in Murrumbateman that provides an opportunity to cross the Barton Highway in two stages at a key desire line, providing time and spatial separation. Desire lines in Murrumbateman for cyclists, pedestrians and horse riding activities are discussed further in Section 4.8.

Bus passengers are a specific group of vulnerable pedestrians that require consideration on the Barton Highway. The community identified safety concerns for waiting passengers as they are so close to the highway. Fifty to 60 per cent of the southbound shoulders in Sections 3 and 4 are of a substandard width, particularly south of Murrumbateman. There is minimal or no local widening near bus stops and no safety barriers to protect waiting passengers.

Many bus passengers walk to the bus stop or drive, park nearby and complete their trip to the bus stop by walking. Access to bus stops along the highway varies: the bus stops near Hercules Street are accessible via footpaths and a pedestrian refuge from the residential part of the Murrumbateman village; however, the bus stops near Gooda Creek Road have no pedestrian access, nor do the school bus stops outside of Murrumbateman.

5.2.12 Summary of road safety issues

A Road Safety Assessment based on Roads and Maritime Services' crash data 2009–2013 and preliminary Roads and Maritime Services statistics for January to August 2014 shows:

- There were 137 crashes recorded between 2009 and 2013 including seven fatality crashes and 70 injury crashes.
- The casualty crash rate (per kilometre per annum) was considerably higher than the NSW average for the period 2008–2012 along all four sections of the highway.
- Section 3 has the highest casualty rate (per kilometre per annum 2009–2013) and greatest severity of crashes along the Barton Highway.
- The majority of crashes recorded were in Section 4 – about 44 per cent of all crashes.
- There were 37 per cent of crashes recorded during the morning (17 per cent) and afternoon (20 per cent) peak periods.
- Thirty-nine per cent of all crashes occurred on weekends.
- Forty-six per cent of crashes were due to vehicles leaving the road (including hitting an object).
- Head-on collisions were the reason for most fatality crashes (three).
- Run off road to the right crashes accounted for a further two fatalities.
- Seventy-seven per cent of crashes involved light vehicles only.
- Ten per cent of crashes involved both light and heavy vehicles.
- Thirteen per cent of crashes involved only heavy vehicles.
- Nearly three-quarters of all crashes occurred in fine weather conditions (73 per cent).
- Eighty-two per cent of crashes occurred during dry pavement conditions.
- Sixty per cent of crashes were recorded in daylight.
- Thirty-five crashes were recorded at intersections, with at least 10 crashes as a result of turning movements.
- Six crashes were recorded within 100 metres of the Euroka Avenue intersection.
- Five crashes were recorded as a result of turning movements at intersections (includes vehicles waiting to turn). Two of these occurred at Hercules Street, one at Euroka Avenue, one at Nanima Road, and one at Vallencia Drive.
- The community of Murrumbateman has expressed concern about the safety of cyclists, pedestrians and horse riders in the township, despite the pedestrian refuge. A pedestrian fatality occurred in 2010.

5.3 Traffic

This section outlines the traffic assessment carried out for the *Barton Highway Improvement Strategy*, and the overall traffic performance over several years. It explores current traffic volumes and past traffic growth trends for light and heavy vehicles.

5.3.1 Data collection

Traffic count data has been collected along the Barton Highway since 1965. During this time, specific count locations have been established.

2014 Traffic Data Collection

For the purpose of the strategy intersection traffic counts, automated tube counts and origin–destination surveys were carried out at various locations to determine current traffic demands along the Barton Highway. Locations include:

1. Intersection traffic counts were carried out on 30 July 2014 at the intersection of the Barton Highway and:

- Long Rail Gully Road
- Hillview Drive
- South Street
- Murrumbateman Road
- McIntosh Circuit
- Euroka Avenue
- Vallencia Drive
- Kaveneys Road
- Nanima Road
- Spring Range Road.

2. Automated tube counts were carried out on the highway between 26 July 2014 and 1 August 2014:

- Five hundred metres north of Long Rail Gully Road – historic data is available for this location from 1995–2014
- Between McIntosh Circuit and Euroka Avenue
- North of the ACT border – historic data includes traffic counts between 1995 and 2014.

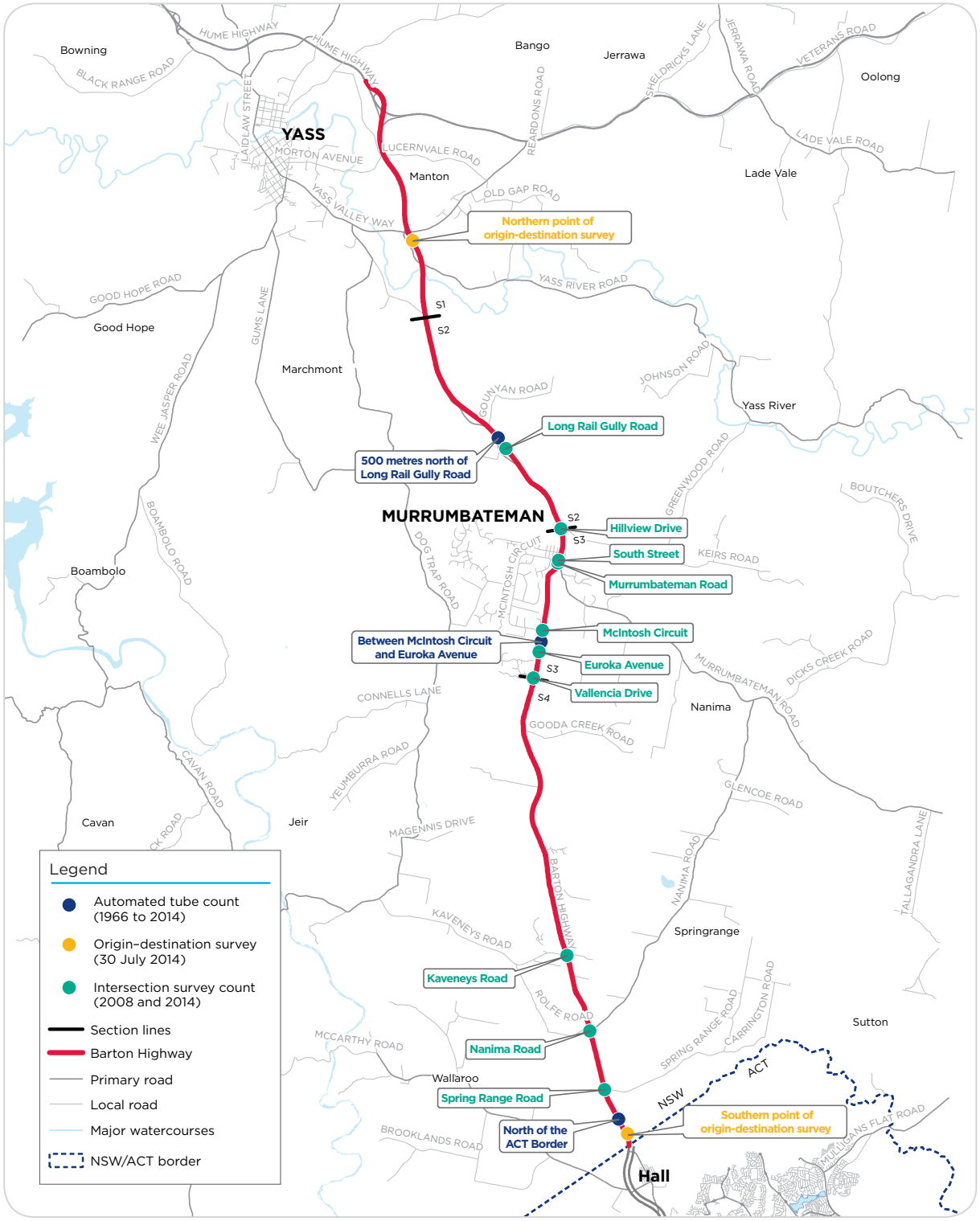
3. An origin–destination survey was carried out between 26 July 2014 and 1 August 2014 with survey locations:

- Just south of Yass Valley Way
- Just north of the ACT border.

Figure 5-13 shows the location of all conducted surveys.

South Street, Murrumbateman

Figure 5-13 Location of survey counts



The survey results show that the traffic volumes along the Barton Highway (2014) vary between 8404 vehicles per day closer to the Hume Highway and 11,725 vehicles per day closer to the ACT border. The traffic volume through the village of Murrumbateman is around 11,000 vehicles per day.

The number of heavy vehicles as a proportion of total traffic decreases approaching the ACT – ranging from 8.9 per cent near Yass to 8.0 per cent near the ACT.

Traffic numbers from the automated tube counts, daily traffic volumes and the percentage of heavy vehicles at key locations are detailed in **Figure 5-14** and **Table 5-12.**

Figure 5-14 Barton Highway – daily traffic volumes 2014

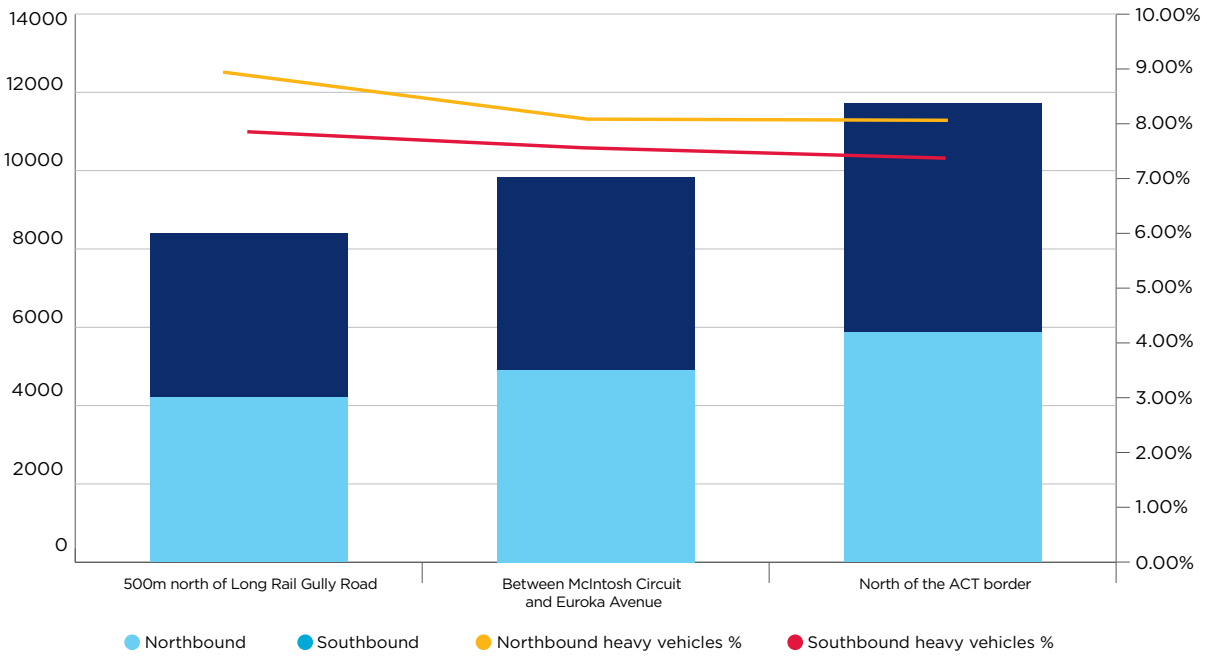


Table 5-12 Barton Highway: daily traffic volumes 2014

Barton Highway	N-bound Vehicles per day	S-bound Vehicles per day	N-bound heavy vehicles % Vehicles per day	S-bound heavy vehicles % Vehicles per day
500m north of Long Rail Gully Road	4205	4199	376 (8.9%)	322 (7.9%)
Between McIntosh Circuit and Euroka Avenue	4905	4925	395 (8.0%)	374 (7.6%)
North of the ACT border	5863	5862	468 (8.0%)	426 (7.3%)

5.3.2 Growth rates and trends

Measuring the volumes of traffic along a route over time can be used to determine a growth rate which can be used to forecast future traffic volumes. Vehicle growth rates along a corridor are generally steady unless there is significant change in nearby land use (such as an airport or a new residential subdivision) or regulatory changes (such as the introduction of new, higher productivity vehicles).

The traffic growth rate along the Barton Highway has been relatively consistent for the past 25 years, reflecting the steady transformation of the areas surrounding the highway from a rural farming catchment to a commuter area of Canberra.

Two different trends in traffic count data have been observed: at the northern and southern ends. The 'linear growth rate' at the northern end (near Yass Valley Way) is 1.9 per cent (**Figure 5-15**); while the growth rate at the southern end (near the ACT border) is about three per cent (**Figure 5-16**).

Figure 5-15 Linear growth rate at the northern end of the Barton Highway

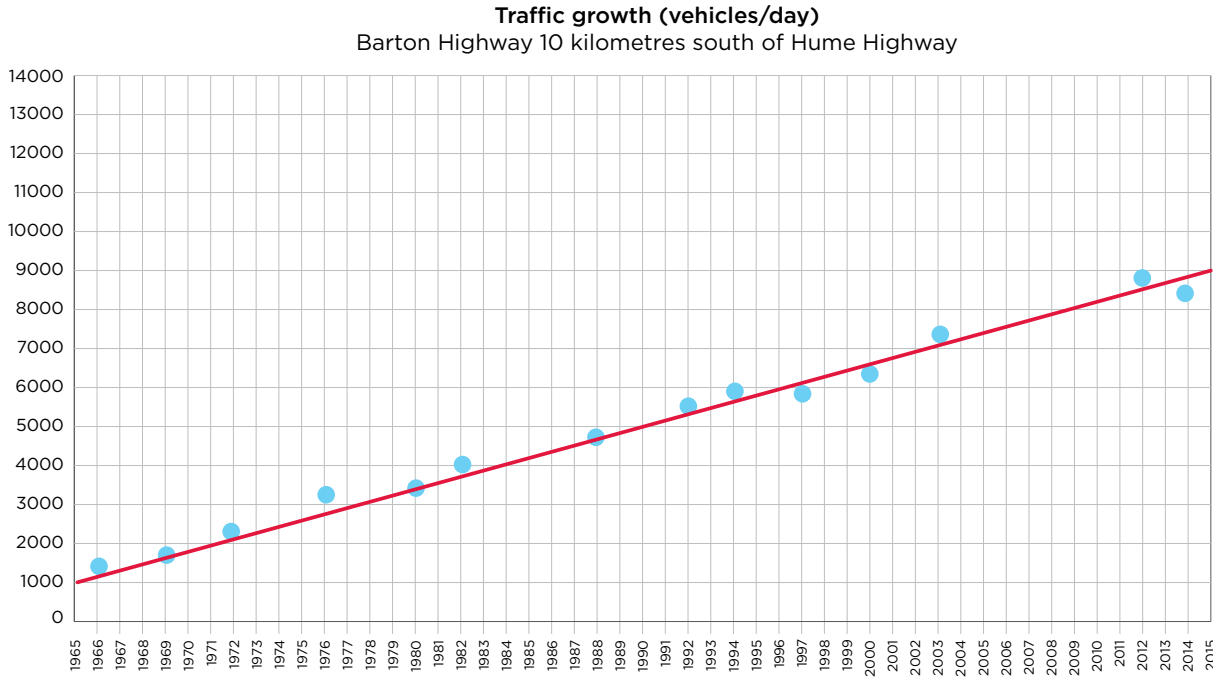
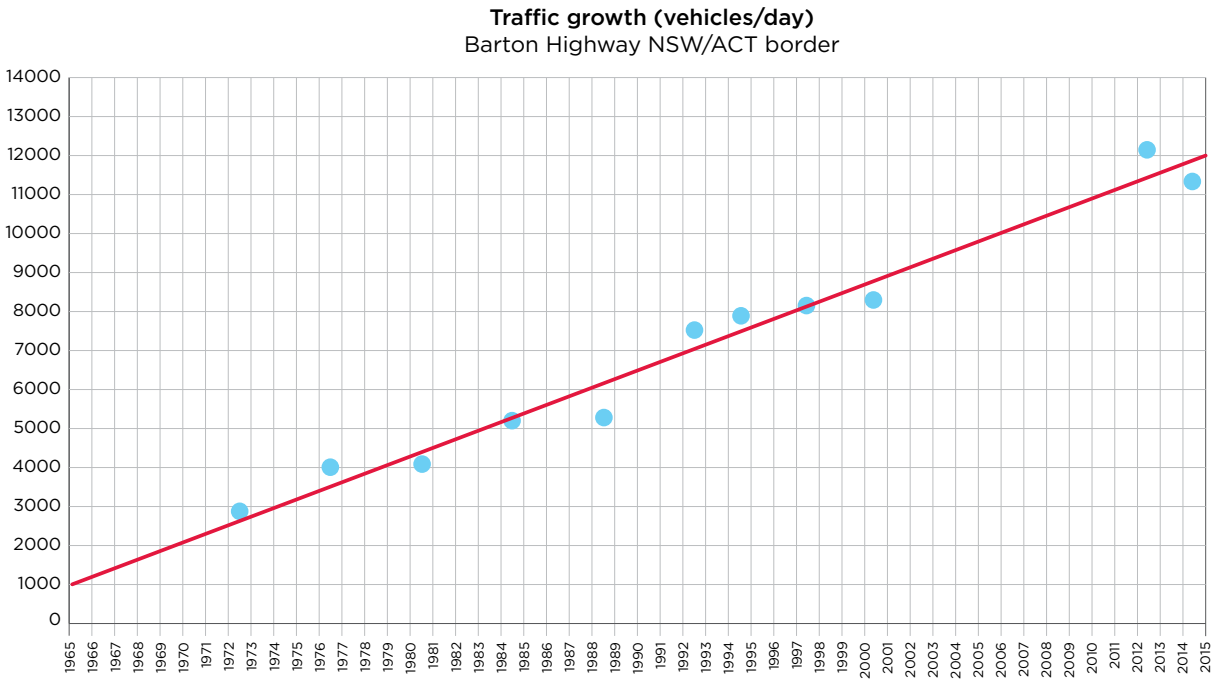


Figure 5-16 Linear growth rate on the Barton Highway at the NSW/ACT border



5.3.3 Number of lanes and level of service

The number of lanes along a route is determined by the demand along the route or a commitment to provide a certain standard of route, generally between inter-regional or interstate locations. Rural Class 4 roads are generally two-way rural highways, with regularly spaced overtaking lanes which reflect traffic volumes and the types of vehicles using the route.

The number of lanes on a Class 4R road can be calculated using the 'level of service' rating method. The level of service is used to determine if the highway capacity is adequate, and is influenced by the number of lanes in each direction on a road, as well as the number and length of overtaking lanes.

The single carriageway section of the Barton Highway corridor has one lane in each direction. The Roads and Maritime Services Network Performance Measures and Network Planning Target[8] for the number of through lanes on a Class 4R road is generally two-lanes, with an increase to four if needed, in order to provide an average level of service C. If the travel demand for a road is forecast to increase to a point where the level of service drops below level of service C, an assessment should be made to determine if it is viable to increase the number of lanes. However, there are several options (such as Intelligent Transport Systems technology or adding overtaking lanes) that should be considered first, in order to improve travel reliability and improve the level of service.

The level of service of a road, as defined by Austroads, is a measure of how easily traffic flows. It assesses the operating condition of a road based on various factors, including traffic volumes, the proportion of heavy vehicles, terrain and frequency of intersections. Levels of service range from 'A' to 'F' with 'A' representing free-flowing traffic and 'F' representing severe congestion. **Table 5-13** defines each level of service on uninterrupted two-lane, two-way roads.

8 Roads and Maritime Services 2010, Network Performance Measures and Network Planning Targets, Sydney, p. 41

Austroads Guide to Traffic Management Part 3: Traffic Studies and Analysis outlines how to calculate the level of service of a two-lane two-way road. This process is based on the *Highway Capacity Manual 2010*[9] which distinguishes between three categories of two-lane highways[10]:

- Class I two-lane highways are generally major intercity routes, primary arterials, daily commuter routes or primary links in state or national highway networks. There is an expectation from motorists to travel at relatively high speeds. These facilities often serve long distance trips or provide connecting links between facilities that serve long distance trips.
- Class II two-lane highways are generally those that function as access routes to Class I facilities, serve as scenic or recreational routes (except primary arterials), or pass through rugged terrain. Motorists do not necessarily expect to travel at high speeds. These facilities often serve relatively short trips, the beginning and ending of longer trips, or trips for which sightseeing plays a significant role.
- Class III two-lane highways are generally those that serve moderately developed areas. They can be sections of Class I and Class II highways that pass through developed areas, where there is a mix between local and through traffic and the density of roadside access points is noticeably higher. They often have reduced speed limits due to the higher activity level.

The Barton Highway is a Class I highway. The percentage of time spent following (with no opportunity to overtake) and the average travel speed determine the level of service. Factors which influence level of service include traffic volumes, the proportion of heavy vehicles, speed limits and overtaking opportunities for the road geometry. Using these inputs, the level of service is calculated using the Traffic on Rural Roads (TRARR) modelling software developed by the Australian Road Research Board.

Table 5-13 Level of service definitions

Level of service	Description[11]
A	Motorists experience high operating speeds on Class I highways and little difficulty in passing. Platoons of three or more vehicles are rare.
B	Passing demand and passing capacity are balanced. On both Class I and Class II highways, the degree of bunching becomes noticeable. Some speed reductions are present on Class I highways.
C	Most vehicles are travelling in platoons. Speeds are noticeably curtailed on all three classes of highway.
D	Bunching increases significantly. Passing demand is high on both Class I and II facilities, but passing capacity approaches zero. A high percentage of vehicles are now travelling in platoons, and the percentage of time spent following (PTSF) is quite noticeable.
E	Demand is approaching capacity. Passing on Class I and 2 highways is virtually impossible, and PTSF is more than 80%. Speeds are seriously curtailed.
F	Exists whenever arrival flow in one or both directions exceeds the capacity of the segment. Operating conditions are unstable, and heavy congestion exists on all classes of two-lane highway.

9 Transportation Research Board 2010, *Highway Capacity Manual: HCM 2010*, TRB, Washington

10 Austroads 2013, Guide to Traffic Management Part 3: Traffic Studies and Analysis, Austroads. Sydney, p. 42

11 Austroads 2013, Guide to Traffic Management Part 3: Traffic Studies and Analysis, Austroads. Sydney, p.46

The level of service for a Class 1 highway is outlined in **Table 5-14**.

Table 5-14 Level of service performance criteria[12]

	Class I highway	
Level of service	% time spent following	Average travel speed (km/h)
A	less than or equal to 35	greater than 90
B	greater than 35–50	greater than 80–90
C	greater than 50–65	greater than 70–80
D	greater than 65–80	greater than 60–70
E	greater than 80	less than or equal to 60

The level of service along the Barton Highway varies from C to E during the day, depending on the number of vehicles using the route.

Results of a TRARR analysis provide guidance as to where new overtaking opportunities might improve the level of service. The Roads and Maritime Services Network Performance Measures and Network Planning Target recommends an overtaking lane should be provided at locations where 65 per cent of time is spent following other vehicles (which means that the level of service is worse than C).

> “As expected, the level of service is worst during the peak periods in the direction of heaviest traffic flow.”

As expected, the level of service is worst during the peak periods in the direction of heaviest traffic flow. Specifically the level of service observations during peak and non-peak periods are:

- E southbound in the morning peak, close to the NSW/ACT border
- E northbound in the afternoon peak, close to the NSW/ACT border
- C southbound in the morning peak, north of Murrumbateman village
- D northbound in the afternoon peak, north of Murrumbateman village
- C northbound during the day, close to the NSW/ACT border
- D southbound during the day, close to the NSW/ACT border
- D northbound during the day, north of Murrumbateman village
- C southbound during the day, north of Murrumbateman village.

Overnight usually sees free flowing conditions with level of service A or B at all locations.

The level of service for future predicted traffic volumes is presented in Chapter 6.

12 Austroads 2013, Guide to Traffic Management Part 3: Traffic Studies and Analysis, Austroads. Sydney, p. 45

Table 5-15 Barton Highway corridor performance – northbound

Corridor section	AM Peak			PM Peak			Day Time		
	% time spent following	Average Speed (km/h)	Level of Service	% time spent following	Average Speed (km/h)	Level of Service	% time spent following	Average Speed (km/h)	Level of Service
Section 2 – Dual carriageway to Hillview Drive	60.5	85.3	C	77.0	80.2	D	67.7	83.0	D
Section 4 – Vallencia Drive to ACT border	53.8	86.4	C	80.5	77.4	E	60.5	85.3	C

Table 5-16 Barton Highway corridor performance – southbound

Corridor section	AM Peak			PM Peak			Day Time		
	% time spent following	Average Speed (km/h)	Level of Service	% time spent following	Average Speed (km/h)	Level of Service	% time spent following	Average Speed (km/h)	Level of Service
Section 2 – Dual carriageway to Hillview Drive	60.8	86.7	C	51.2	88.5	C	51.3	88.3	C
Section 4 – Vallencia Drive to ACT border	85.4	74.3	E	68.5	83.6	D	69.1	82.9	D

The level of service is at its worst during the morning (7.15–8.15am) and evening (5.00–6.00pm) peak hours. The average travel speed along the corridor is lower during the AM peak while the PM peak travel speeds are only slightly less than the travel speeds during the middle of the day.

The proportion of the daily traffic travelling in the morning peak period is 30 per cent. Although a poorer level of service is expected during the AM and PM peak periods, the relatively short duration of this condition indicated that while overtaking opportunities could be improved, travel speeds are still relatively high compared to other similar commuter routes with higher traffic volumes. Peak 'spreading' (road users bringing forward or delaying their travel to avoid the traditional morning and afternoon peak periods) commonly occurs on commuter routes over time.

The results of the TRARR analysis show that additional overtaking lanes in Section 2 (from the existing dual carriageway to Murrumbateman) and in Section 4 (between Murrumbateman and the ACT border) would improve the level of service for peak hour travellers.

5.3.4 Travel speeds

Roads and Maritime Services collects continuous travel speed information from a fleet of courier vehicles using the road network. This data is collected in 15 minute increments to determine travel speed trends. This continuous stream of data reflects the average travel speed along entire sections of the corridor and is more useful for understanding performance than travel speed at point locations.

The average travel speed along the Barton Highway (excluding the section through Murrumbateman where the posted speed is reduced to 50km/h) is between 81km/h and 95km/h except during the AM southbound peak when the travel speed can fall to 62km/h.

Table 5-17 shows the weekday average travel speed, measured using GPS tracked courier vehicles which travel along the highway (excluding travel speed information through Murrumbateman).

Table 5-17 Weekday average travel speed along the Barton Highway

2013 weekday travel speeds along the Barton Highway (excluding travel through Murrumbateman)	Travel time (minutes)	Average speed (posted speed 100 km/h)	Sample size (vehicles)
AM peak period (6.00–9.00am)			
North	18	86	8751
South	19	81	4064
AM peak hour (7.15–8.15am)			
North	18	86	6822
South	25	62	1313
Day time period (9.00am–4.00pm)			
North	17	91	3862
South	17	92	3206
PM peak period (4.00–7.00pm)			
North	17	92	1986
South	18	89	9000
PM peak hour (5.00–6.00pm)			
North	17	95	406
South	17	93	2338

5.3.5 Weekday peak traffic trends

When analysed in blocks of 15 minutes, the traffic survey data suggests:

- AM peak period: 6.00 to 9.00am
  (About 2430 vehicles south of McIntosh Circuit, about 2980 vehicles at ACT border)
- AM peak hour: 7.15 to 8.15am
- PM peak period: 4.00 to 7.00pm
  (About 2700 vehicles south of McIntosh Circuit and about 3370 vehicles at ACT border)
- PM peak hour: 5.00 to 6.00pm.

Figure 5-17 shows the profile of traffic demands during the AM peak period. It is noted that traffic volumes peak between 7.30 and 8.00am, and generally do not spread across the morning period.

Figure 5-17 Traffic profile during AM peak period

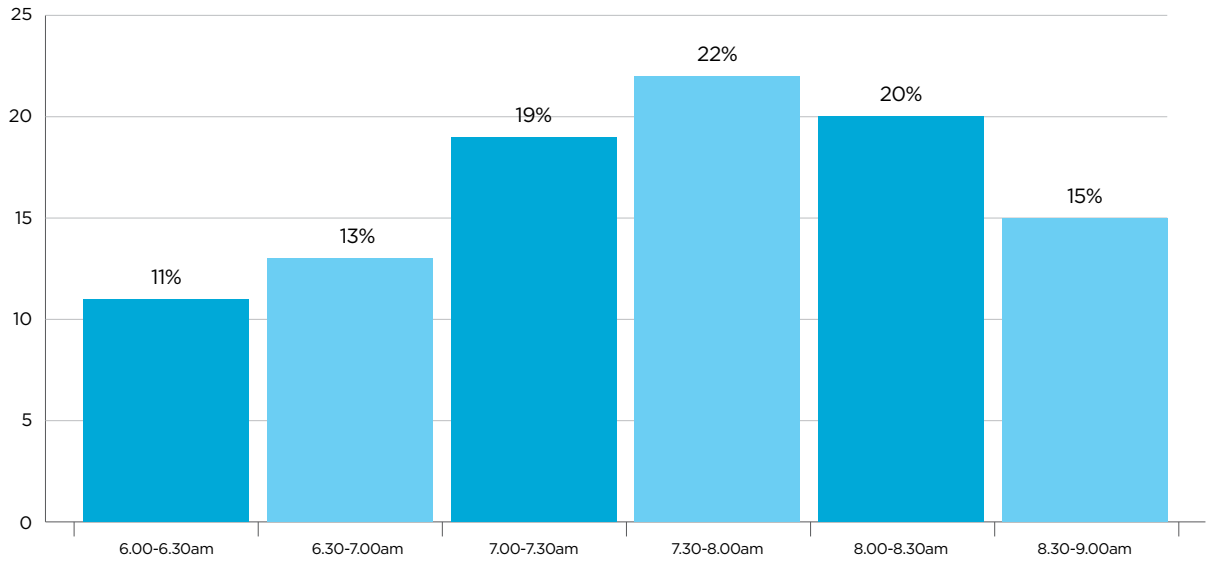
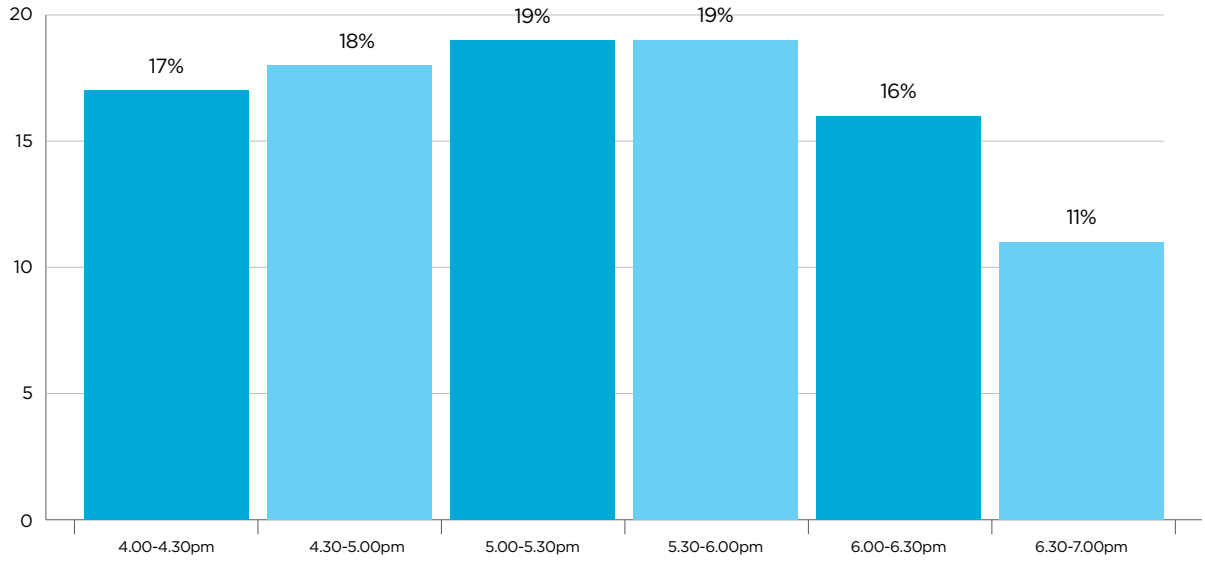


Figure 5-18 shows traffic demands during the PM peak period. Key observations and trends are summarised below (spreading generally occurs between 4.00 and 6.00pm):

- About 35 per cent of total peak period demand occurs between 4.00 and 5.00pm
- About 38 per cent of total peak period demand occurs between 5.00 and 6.00pm
- About 27 per cent of total peak period demand occurs between 6.00 and 7.00pm.

Figure 5-18 Traffic profile during PM peak period



5.3.6 Overtaking opportunities

Vehicles are currently travelling along the highway with less than four seconds of separation and drivers experience frustration at not being able to overtake as freely as they would like. Providing overtaking lanes and other opportunities to pass slower vehicles improves travel time and level of service. This reduces driver frustration and associated unsafe behaviour, which in turn reduces the risk of road trauma. Overtaking on the opposite side of the road is permitted in NSW on undivided roads where there is a broken centre line alongside the direction of travel.

Table 5-18 Barton Highway sections with overtaking opportunities

Corridor section	% of section WITH overtaking opportunities (including overtaking lanes) Northbound	% of section WITH overtaking opportunities (including overtaking lanes) Southbound
Section 1	100%	Approx. 95%
Section 2	Approx. 40%	Approx. 30%
Section 3	Approx. 30%	Approx. 30%
Section 4	Approx. 55%	Approx. 50%

The decision to create an overtaking lane is influenced by the overall level of service, traffic volumes, percentage of slow vehicles (including light trucks and cars towing a load) and the availability of overtaking opportunities on adjoining sections. Overtaking lanes are an important part of the road network as they allow for safe vehicle passing. Overtaking lanes can improve network efficiency as they allow light vehicles an opportunity to pass slower moving vehicles (such as heavy freight vehicles). Overtaking lanes also reduce vehicles using the opposing lane to overtake, which improves road safety.

> “Overtaking lanes can improve network efficiency as they allow light vehicles an opportunity to pass slower moving vehicles.”

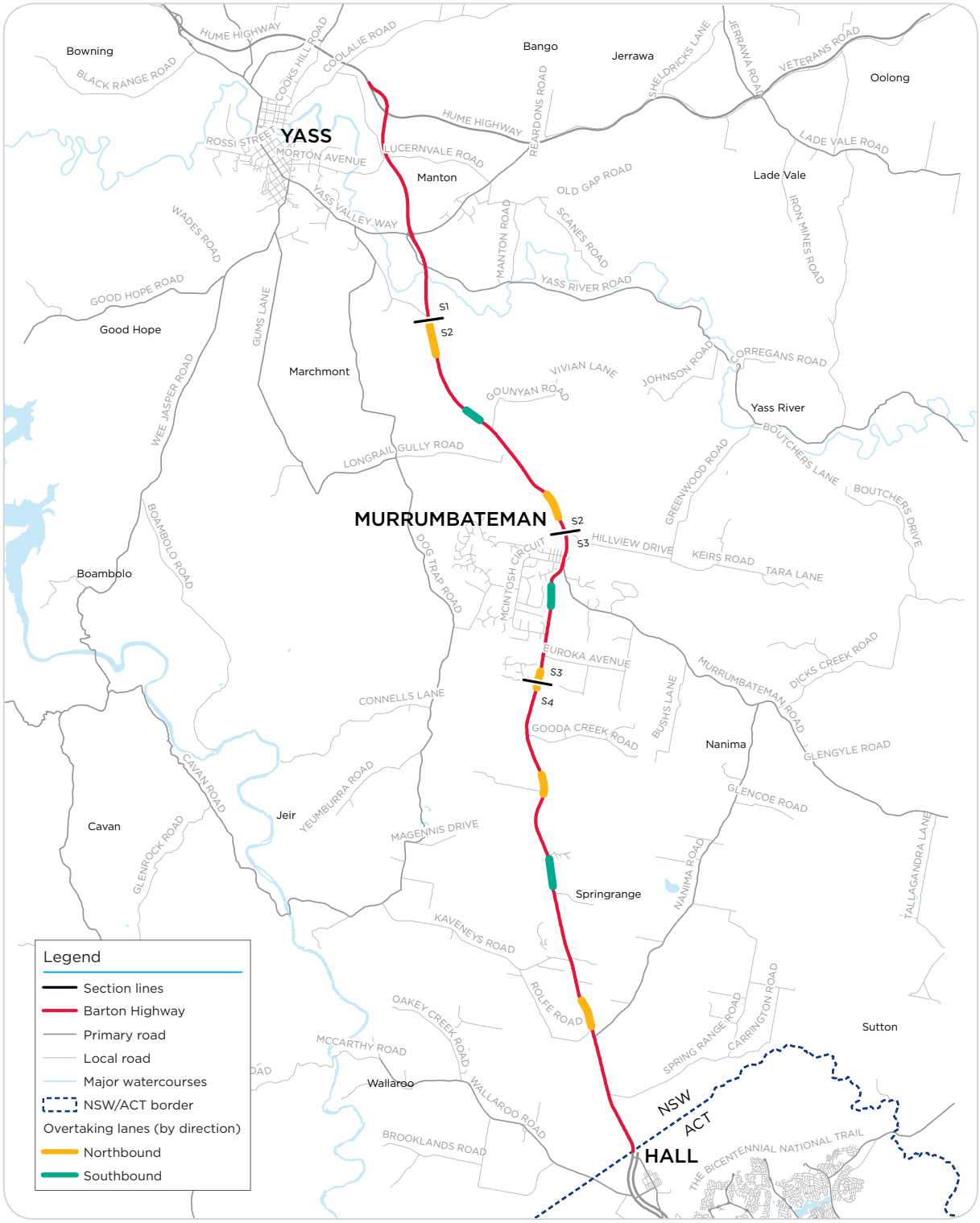
The Barton Highway in NSW is approximately 41 kilometres in length and provides overtaking opportunities in the form of overtaking lanes as well as sections where intermediate sight distance is appropriate for vehicles to pass on the opposing lane. There are currently eight overtaking lanes (five northbound and three southbound) of varying length along the Barton Highway. The location of each overtaking lane is shown in **Figure 5-19**.

Table 5-19 The Barton Highway's overtaking lanes: northbound and southbound

Travel direction	Location services	Length (including tapers)
Northbound	Begins immediately north of Rolfe Road ending about 200m south of Boundary Lane	1000m
	Begins immediately south of Casuarina Lane continuing for about 800m	800m
	Begins immediately south of Vallencia Drive continuing for about 700m	700m
	Begins 600m north of Hillview Drive continuing for about 1km	1000m
	Begins 3.2km north of Gounyan Road continuing to the dual carriageway approaching Yass	1200m
Southbound	Begins about 1.1km north of Gounyan Road ending about 300m north of Gounyan Road	800m
	Begins about 800m south of Murrumbateman Road continuing for about 750m	750m
	Begins about 2.5km south of Casuarina Lane ending just north of Mundays Lane	1000m

Gounyan realignment looking southbound

Figure 5-19 Barton Highway: location of overtaking lanes



5.3.7 Local and through traffic

Origin–destination surveys were carried out in both the AM and PM peak periods (6.00–9.00am and 4.00–7.00pm) to determine the amount of local and through traffic. Survey points were just north of the ACT border as well as just south of Yass Valley Way. **Figure 5-20** and **Figure 5-21** outline the vehicle movements during the morning and afternoon peak periods. The red and orange lines indicate trips starting or finishing within the survey area. The light blue lines indicate trips through the survey area. The dark blue lines indicate trips entering and leaving the same end of the survey area. During both the morning and afternoon peak periods, around 1200–1500 vehicles travel the length of the Barton Highway north or south, and around 1900–2200 vehicles enter and exit the highway between the two survey points. This indicates that for the single carriageway portion of the highway around 35–45 per cent of trips could be considered through traffic and 55–65 per cent begin between the ACT border and Yass Valley Way.

Figure 5-20 AM peak period traffic composition

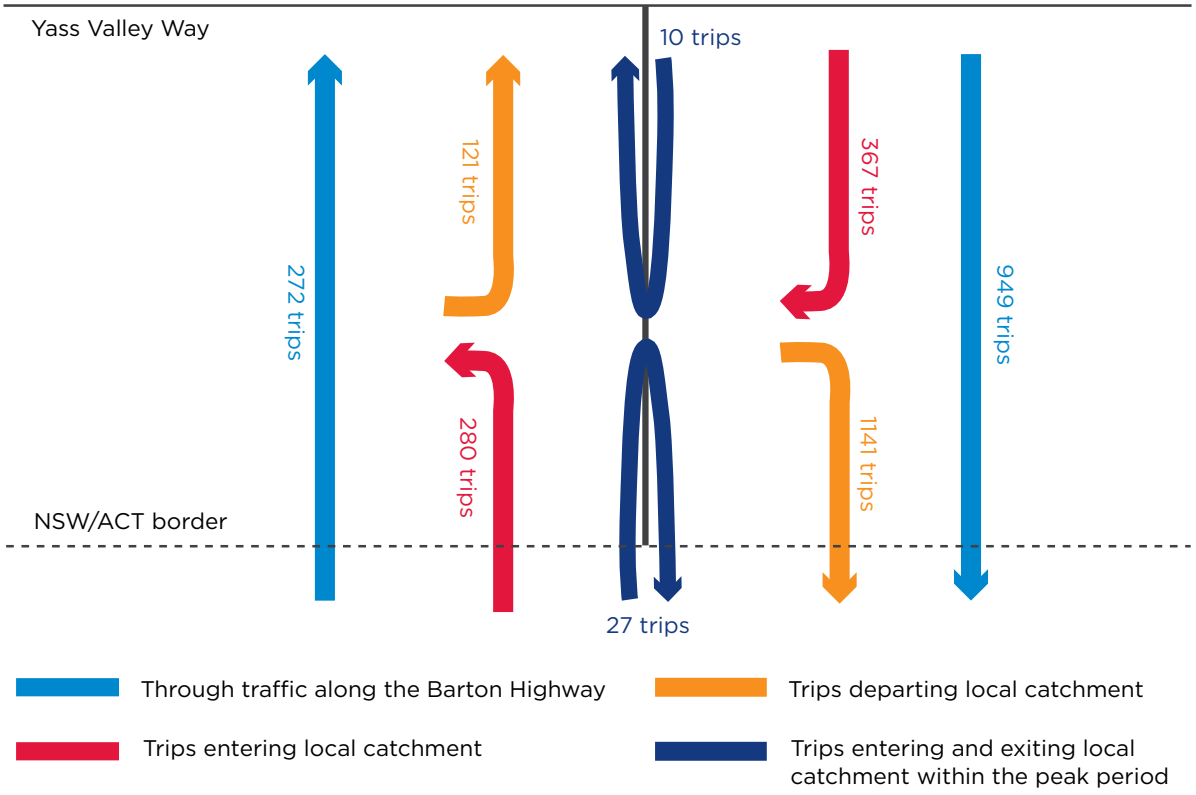
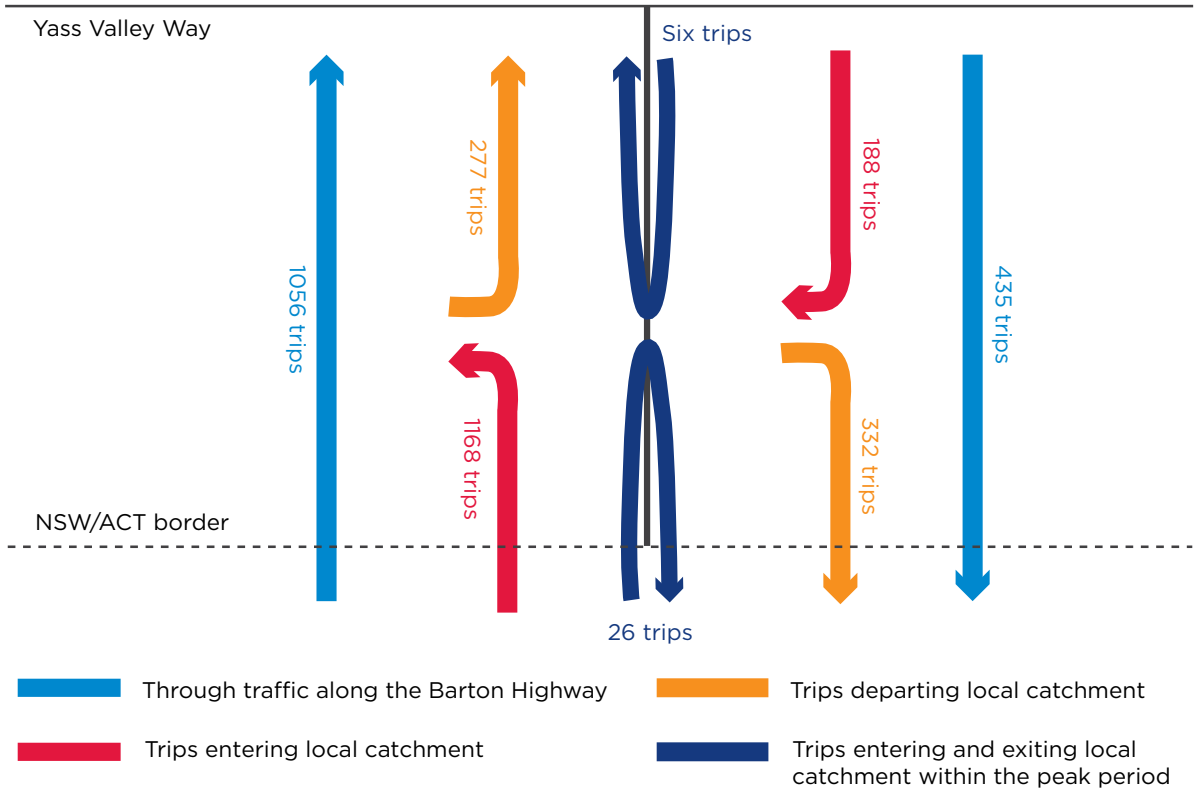


Figure 5-21 PM peak period traffic composition



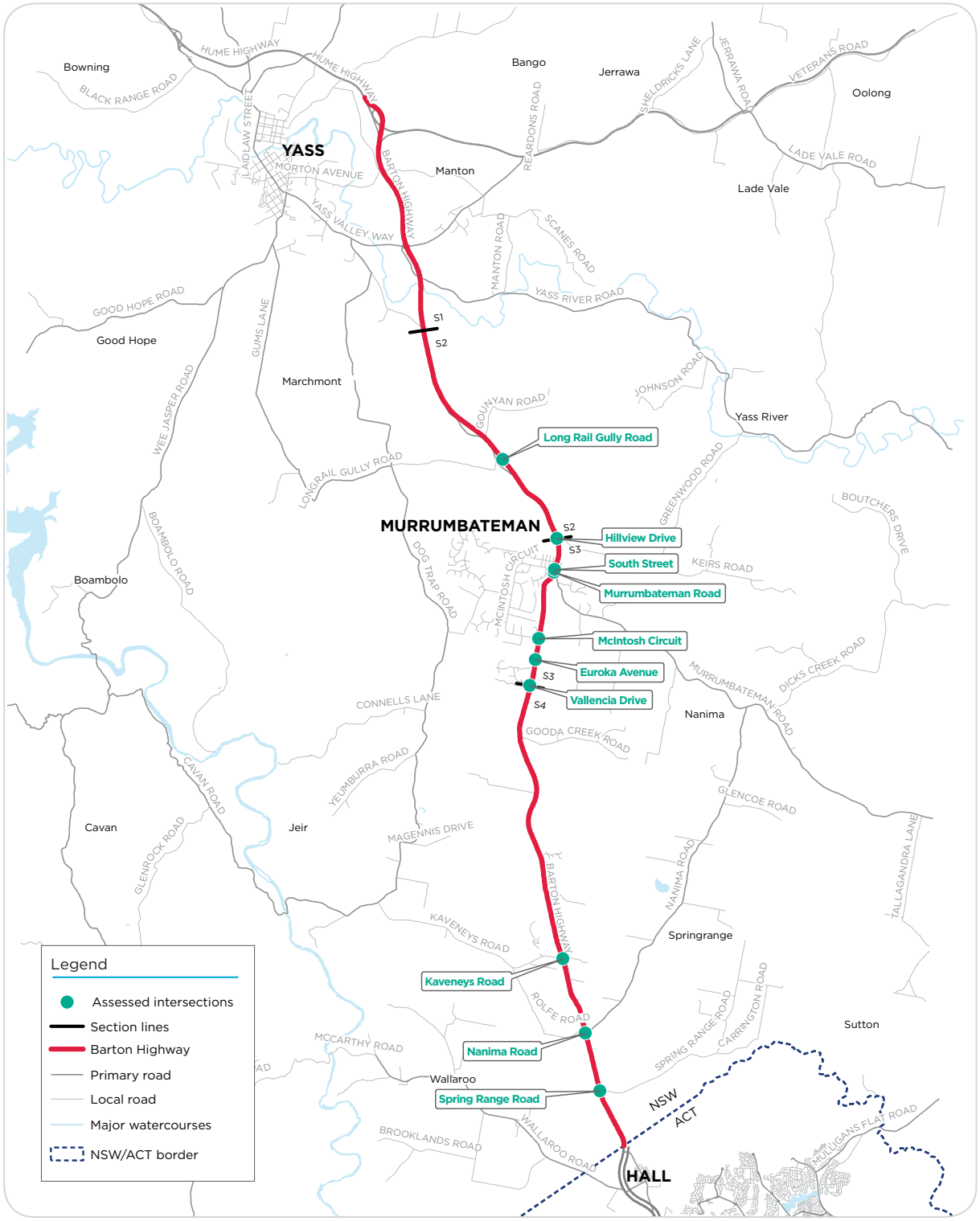
5.3.8 Intersection performance

The operational performance of key intersections along the Barton Highway, using traffic volumes from survey counts in 2014, was assessed using the SIDRA intersection modelling software package. The intersections assessed were:

- Long Rail Gully Road
- Hillview Drive
- South Street
- Murrumbateman Road
- McIntosh Circuit
- Euroka Avenue
- Vallencia Drive
- Kaveneys Road
- Nanima Road
- Spring Range Road.

The location of the intersections assessed is shown in **Figure 5-22**.

Figure 5-22 Location of intersections assessed



Operational Performance Criteria

Three operational criteria are used to determine existing intersection performance:

- Level of service
- Average vehicle delay
- Degree of saturation.

The *Austroads Guide to Traffic Management Part 3: Traffic Studies and Analysis* outlines how to calculate the level of service for intersections. This is summarised in **Table 5-20**, including key indicators.

The 'average vehicle delay' at an intersection provides a measure of its operational performance as shown in **Table 5-21** which relates average vehicle delay to level of service. The average vehicle delay should be taken as a guide only, as longer delays can be tolerated in some locations (such as inner city) and on some roads (such as a minor side street intersecting with a major arterial route).

Another form of operational measurement is to assess the degree of saturation (the level of congestion) of individual intersections. A degree of saturation of less than 0.9 is preferred, with a degree of saturation of up to 0.8 considered satisfactory. Intersections are deemed close to capacity as the degree of saturation approaches 0.9, with queue lengths increasing.

Table 5-20 Intersection performance criteria: level of service

	Type of intersection
Level of service	Give way/stop sign /T junction
A	Good operation
B	Acceptable delays and spare capacity
C	Satisfactory but crash study required
D	Near capacity and crash study required
E	At capacity, requires other control mode
F	Unsatisfactory and requires additional capacity

The Austroads guide identifies the key criteria in assessing the level of service based on average vehicle delays as shown in **Table 5-21**.

Table 5-21 Intersection performance criteria: average vehicle delay

Level of service	Average delay per vehicle (seconds per vehicle)
A	Less than 10
B	10.1 to 15
C	15.1 to 25
D	25.1 to 35
E	35.1 to 50
F	greater than 50

The results of the SIDRA analysis for each intersection based on the above performance criteria are presented in **Table 5-22** below. The results show that all of the intersections generally operate to a satisfactory level under existing conditions and delays, level of service and degree of saturation are all well within industry thresholds.

Table 5-22 Intersection performance results – summary

Scenario	AM Peak				PM Peak			
	DOS*	Delay	Level of service	95th percentile queue (m)	DOS*	Delay	Level of service	95th percentile queue (m)
Long Rail Gully Road	0.019	7.9	A	0.6	0.001	8.8	A	0.0
Hillview Drive	0.073	10.1	B	4.1	0.226	8.3	A	10.4
South Street	0.116	6.7	A	2.3	0.025	6.7	A	0.5
Murrumbateman Road	0.086	8.9	A	5.0	0.311	7.0	A	15.2
McIntosh Circuit	0.376	14.6	B	14.2	0.089	11.5	B	6.2
Euroka Avenue	0.097	17.9	C	10.5	0.324	8.8	A	18.1
Vallencia Drive	0.172	15.9	C	4.5	0.029	11.5	B	0.7
Kaveneys Road**	0.204	24.6	C	6.2	0.004	20.7	C	0.2
Nanima Road	0.177	16.0	C	4.6	0.149	9.1	A	0.0
Spring Range Road	0.110	16.3	C	2.8	0.016	8.2	A	0.1

*DOS = degree of saturation
** Since the analysis carried out for this study, Kaveneys Road has been upgraded and an improved level of service is anticipated.

Figure 5-23 and **Figure 5-24** show the level of service of the 10 key intersections in the AM and PM peaks.

> Another form of operational measurement is to assess the degree of saturation (the level of congestion) of individual intersections.

Figure 5-23 Barton Highway level of service at intersections – AM peak period

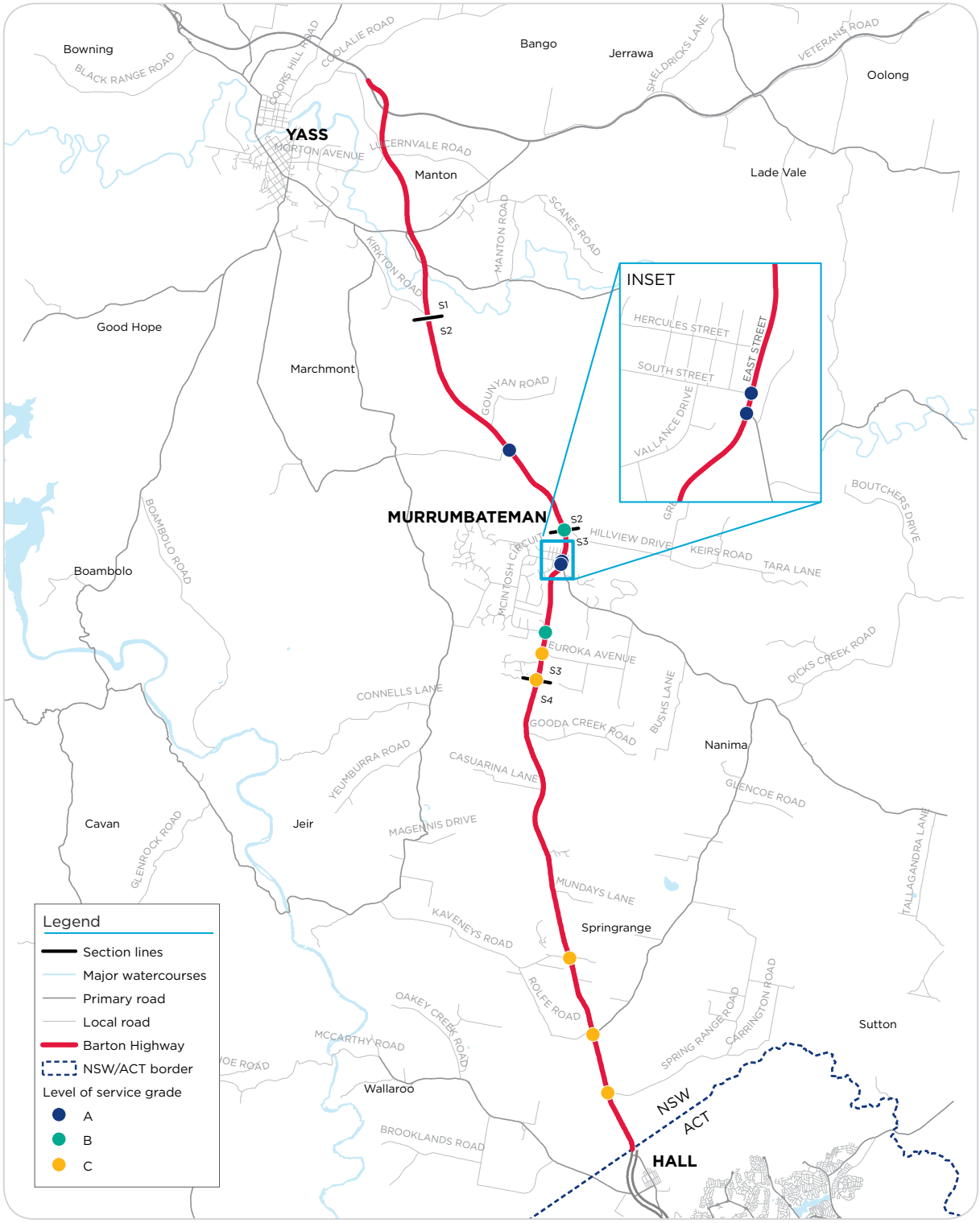
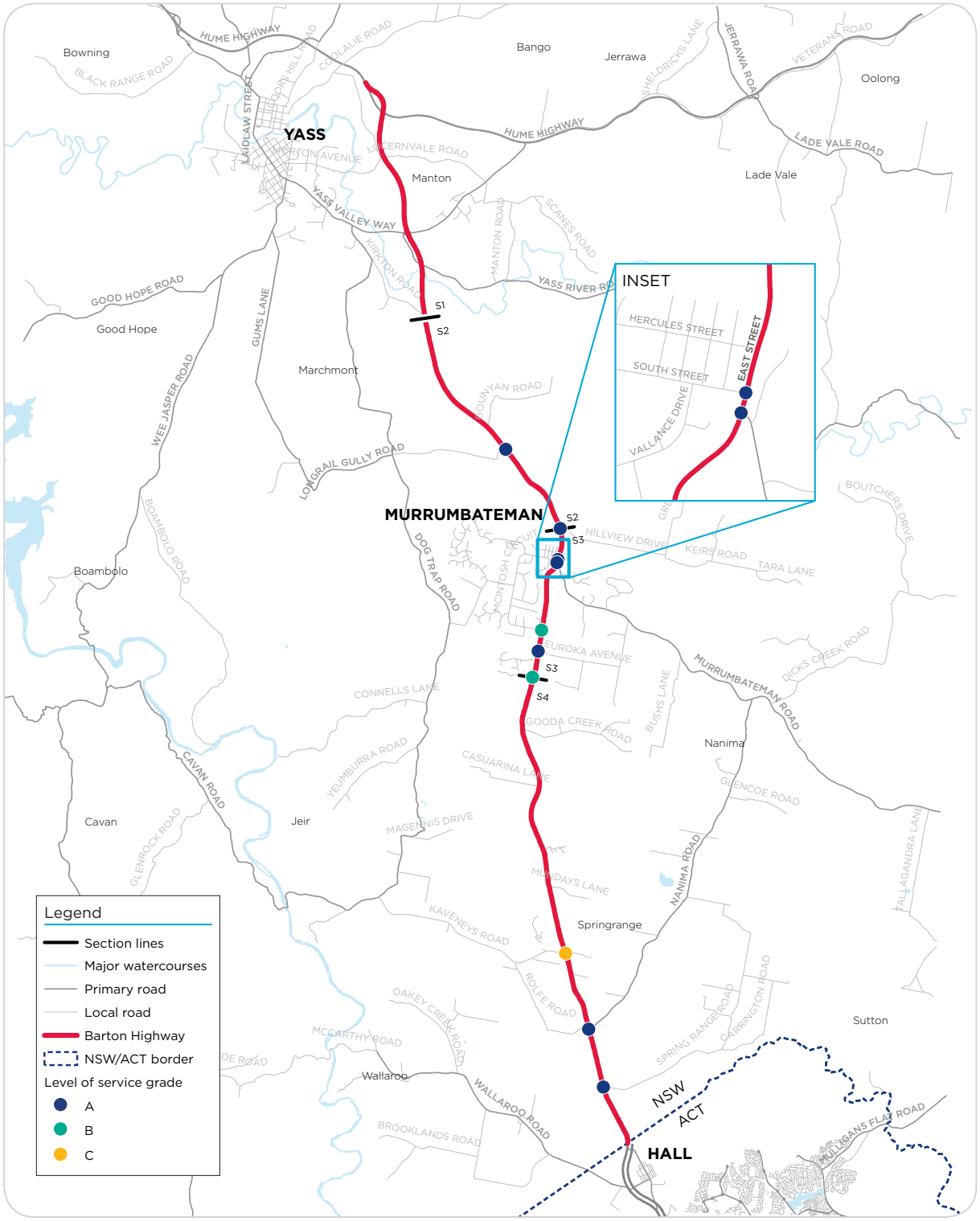


Figure 5-24 Barton Highway level of service at intersections – PM peak period



5.3.9 Incident management

Incidents and planned activities on two-lane roads often result in full or partial closures and require detours, which in rural areas can often be long in distance and time consuming.

The Barton Highway has a peak travel time curfew which restricts the hours when planned works can be carried out, to minimise delays to motorists. The curfew runs from 6.00 to 9.30am and 3.00 to 7.00pm Monday to Friday, except public holidays. Maintenance work along the highway is conducted about twice a week on average, with minor road closures during the duration of works. There are currently 35 long term planned works for 2015 which have been approved and will see a reduced speed limit in place 24/7. Within the past 12 months, speed reductions have been in place along the highway for the majority of the year as a result of major projects.

Between 2009 and 2013, the Barton Highway was partially closed for 39 unplanned incidents – about 65 hours in total, and totally closed for 19 unplanned incidents which totalled 60 hours.

'Traffic incident management' is the delivery of planning and operational tasks by the relevant road authority in response to an unplanned incident. This is achieved through collaboration with emergency services and other key stakeholders and by considering the needs of road users, the road network and infrastructure.

Incident response plans are in place for the Barton Highway to minimise the impact of any road closures and to reduce the risk of secondary incidents. An incident's location determines which incident response plan is implemented at the time. Incident response plans are used to deal with extended disruptions as a result of events such as a vehicle crash, bushfire or flooding.

Incident response plans are designed to support a total closure of the corridor if needed. They define the agreed diversion route and the roles and responsibilities of the agencies involved. These plans also cover temporary signposting to guide motorists along the detour until they reach permanent signs to their destination. The length of detours addressed in the plans range from two to 74 kilometres, with an average of 44 kilometres. The long length of these diversions can increase travel times considerably and encourage motorists to move from the State Road Network to the local road network when the corridor is closed.

To ensure motorists are well informed of incidents and detour routes, Roads and Maritime Services uses static signposting and portable variable message signs in strategic locations to guide motorists and minimise travel time delays.

In collaboration with the ACT Government, Intelligent Transport Systems could be used on the Barton Highway to improve travel decision making for customers which will improve trip reliability, help to better manage incidents, and provide a smoother traffic flow along the highway. Some systems that could be considered include:

- Variable Message Signs (VMS) to inform customers about the travel time variability, road conditions (fog and ice) and road closures.
- Closed Circuit Television (CCTV) to manage the corridor performance during planned and unplanned events.
- Real time traffic monitoring devices gather data on the real time performance of the corridor to provide information to customers via VMS and other technology.
- Internet and mobile phone based applications to provide up-to-date information about traffic conditions.

5.3.10 Regional centres and town bypasses

The need for the highway to bypass Murrumbateman has been assessed using the principles set out in the *NSW Long Term Transport Master Plan*. This included consideration of the road's classification of Class 4R under the Road Network Management Hierarchy.

The approach in the *NSW Long Term Transport Master Plan* aims to provide a bypass on higher order roads running next to significant commercial activity (shops and businesses). The Roads and Maritime Services Network Planning Targets[13] call for consideration of bypasses of urban commercial (Class 6R, 5R and 4R) and urban (Class 6R) areas on major highway classes.

While Murrumbateman village does not constitute a 'significant' commercial activity, it is experiencing a high growth rate resulting in rapid changes to the area's character. Community amenity and connectivity issues need to be considered. A village bypass should be assessed as part of staged duplication planning.

5.3.11 Summary of traffic issues

- The Barton Highway is one of two 'Canberra Connector' road links in the network, along with the Federal Highway. The Barton Highway provides a key connection between Canberra and Melbourne as well as between southern parts of NSW and Canberra.
- The highway is a commuter route during the morning and afternoon peak times, generally consisting of residents in Yass Valley Council LGA travelling to employment in Canberra.
- Traffic volumes along the Barton Highway vary between 8404 vehicles per day close to the Hume Highway with highest volumes at around 11,725 vehicles per day closer to the ACT border.
- The traffic volume through the village of Murrumbateman is approximately 11,000 vehicles per day. The percentage of heavy vehicles as a proportion of total traffic generally decreases on approach to the ACT with heavy vehicles ranging from 8.9 per cent near Yass to 8.0 per cent near the ACT.
- The traffic growth rate along the Barton Highway, with higher traffic growth rates closer to the ACT border, has been fairly consistent for the past 25 years, in line with the areas surrounding the highway changing from a rural farming catchment to a commuter suburb of Canberra.
- The level of service along the route is acceptable with average travel speeds during the morning and afternoon peak periods between 81km/h and 95km/h. The performance of the route deteriorates for a short period during the morning peak hour where average travel speeds for southbound vehicles travelling towards Canberra falls to 62km/h. Outside of peak hours, travel speeds are above 90km/h and approaching 100km/h. Overall, travel speeds and levels of service are acceptable. Improving overtaking opportunities will assist in improving performance along the corridor.
- The importance of incident management will continue to increase, particularly during peak times, with the use of Intelligent Transport Systems and other improvements to allow for better travel decision making for customers along the entire route.
- Roads and Maritime Services will continue to work with Yass Valley Council to use the local road network as a detour route when the Barton Highway is closed for planned and unplanned incidents.

5.4 Road geometry

The assessment of the road geometry was primarily based on geometric data such as cross-fall, lane widths and curve geometry from GIPSICAM digital footage taken in February 2013 and supplied by Roads and Maritime Services.

13 Roads and Maritime Services 2010, Network Performance Measures and Network Planning Targets, p.38

5.4.1 Horizontal and vertical curves

Curves in the roadway can be horizontal or vertical. A horizontal curve is a bend in the road which veers to the left or right. A vertical curve is a change in grade moving either up or down (for example up and down a hill). The curve radius measures the sharpness of a curve.

Single radius curves allow motorists to negotiate the road at a consistent rate. The suitability of a horizontal curve radius (or the size and 'tightness' of a bend) depends on the vehicle speed, super elevation (the level of 'tilt') and friction of the roadway. One important consideration in assessing the curve radius is the sight distance provided when considered with the design speed. Motorists need to be able to navigate through curves efficiently and assess any potential danger on the roadway in enough time to avoid an incident.

The *Austroads Guide to Road Design* and Roads and Maritime Services design supplements are used to determine the minimum horizontal curve radius for the Barton Highway as shown in **Table 5-23**.

Table 5-23 Minimum horizontal curve radius

Speed (km/h)	Minimum horizontal curve radius (m)
50	60
70	165
100	465
110	565

All of the horizontal curves on the Barton Highway meet the *Austroads Guide to Road Design* minimum radius for the relevant speed zone.

The measurement and assessment of road surface friction on horizontal curves is beyond the scope of this study, however, it is recommended as part of any future condition assessment or rehabilitation design scope.

The Road Safety Assessment conducted in September 2013 deemed some vertical curves as medium/high risk due to sight distance constraints. Sight distance can be restricted where a vertical crest curve has a short curve length. This means a slower or stationary object on the road, especially a low lying object such as a branch or animal, may be hidden by a vertical crest which restricts the sight distance a motorist would need to react in time and decelerate to avoid a collision.

Locations with vertical curve issues include:

- Northbound lane between McClungs Creek and Long Rail Gully Road Intersection
- Northbound lane between Vallencia Drive and Euroka Avenue
- Northbound lane between Gooda Creek Road and Vallencia Drive
- Northbound lane between Casuarina Lane and Gooda Creek Road
- Northbound lane between Mundays Lane and Capricorn Park Stud
- Northbound lane between the ACT border and Spring Range Road
- Southbound lane between the end of dual lane merge taper to Gounyan Road intersection
- Southbound lane between Mundays Lane and Kaveneys Road
- Southbound lane between Euroka Avenue and Vallencia Drive.

Future improvements to the horizontal curves between Vallencia Drive and Gooda Creek Road were identified in the Road Safety Assessment in September 2013. Safety hazards identified at this location are:

- Inadequate superelevation on curves (tilting of the roadway along a curve).
- A poorly aligned combination of consecutive left then right curves. Southbound motorists negotiate these curves at high speed following a downhill grade.
- Vehicles driving over centre lines and edge lines.
- Limited sight distance.
- Cluttered driver visibility due to road geometry, a channelised right turn intersection and a tight road corridor with trees and safety barrier.

5.4.2 Grades

Travel efficiency and road safety can be directly influenced by the grade of a road (the 'steepness' of an incline). Sections of road with steep uphill grades over long distances often experience 'platoons' of traffic and perform less efficiently than roads without grade issues. This is particularly relevant for roads with higher traffic volumes and with a high proportion of heavy vehicles.

Single lane roads with steep grades offer limited opportunities for overtaking, which may increase the incidence of crashes due to driver frustration. The impact of steep grades on single lane roads is greater where there is a high volume or high proportion of heavy vehicles, because freight costs increase with fuel consumption and slower speeds.

From an environmental perspective, steeper grades result in higher vehicle emissions and may also affect motorists' ability to see hazards on the road ahead.

The Roads and Maritime Services Network Performance Measures and Planning Targets recommends maximum grades of six per cent for rural Class 4 roads on flat or rolling terrain.

The Barton Highway is situated on relatively flat terrain. Analysis of the available GIPSICAM vertical road geometry data found that 0.3 per cent of the northbound carriageway (approximately 150 metres in Section 3) and 0.07 per cent of the southbound carriageway (approximately 40 metres in Section 4) have grades steeper than the performance targets. In general, grade was not observed to be a significant risk within the study area. The findings of the analysis are presented in **Table 5-24**.

Table 5-24 Barton Highway grades

Direction	Northbound		Southbound	
Corridor section	Less than 6% grade	Less than 6% grade	Less than 6% grade	Less than 6% grade
1 (9.1km)	100%	0%	100%	0%
2 (9.3km)	100%	0%	100%	0%
3 (5.5km)	98%	2%	100%	0%
4 (17.5km)	100%	0%	99.66%	0.34%
Total	**99.7%**	**0.3%**	**99.93%**	**0.07%**

5.4.3 Lane widths

Lane widths influence road capacity, comfort and safety. The desirable lane width on rural roads is 3.5 metres, which allows large vehicles to pass or overtake without needing to move sideways towards the lane's outer edge. Wider lane widths also increase clearance between vehicles so have the potential to reduce the incidence of 'head-on' and run-off-road crashes. Where lane widths are restricted, the ability of heavy vehicles to access a route can also be affected.

A desktop survey of lane widths was carried out using GIPSICAM which is considered to be accurate to within about 100 millimetres. Fifty-four per cent of northbound lanes, 65 per cent of southbound lanes and 100 per cent of bridges and culverts meet the Roads and Maritime Services Network Performance Measures and Planning Targets' lane width guidelines, which recommend that a lane width of 3.5 metres should be maintained for the Barton Highway as it is classified Rural Class 4R. A section by section breakdown is provided in **Table 5-25** and **Table 5-26** for the northbound and southbound carriageways.

The analysis found that around 20 per cent of the northbound and southbound lanes are within 100 millimetres of the recommended 3.5 metre lane width. Allowing for a tolerance of up to 100 millimetres for GIPSICAM based measurements, these lane widths are considered acceptable from a safety and operational perspective.

Road Sections 2, 3 and 4 have a high proportion of lanes in the three metre to 3.5 metre (target) wide range; 26 per cent of northbound and 16 per cent of southbound lanes. When determining precise locations for potential widening or other projects a more accurate assessment would be carried out and the narrowest/high risk sections targeted.

Table 5-25 Barton Highway northbound lane widths

Direction	(%)		
Corridor section	Less than 3.0m	Greater than or equal to 3.0m to 3.5m	Greater than or equal to 3.5m
1 (9.1km)	0%	1%	99%
2 (9.3km)	0%	36%	64%
3 (5.5km)	0%	38%	62%
4 (17.5km)	1%	30%	69%
Total	**Less than 1%**	**26%**	**Greater than 73%**

Table 5-26 Barton Highway southbound lane widths

Direction	(%)		
Corridor section	Less than 3.0m	Greater than or equal to 3.0m to 3.5m	Greater than or equal to 3.5m
1 (9.1km)	0%	1%	99%
2 (9.3km)	3%	11%	86%
3 (5.5km)	0%	28%	72%
4 (17.5km)	0%	16%	84%
Total	**1%**	**16%**	**83%**

5.4.4 Sealed shoulder widths

A shoulder is the portion of road that extends beyond the marked traffic lane. Pavements with sealed shoulders cost more to construct but perform better than those with unsealed shoulders as they improve the pavement structure and reduce moisture levels. Sealed shoulders also deliver road safety benefits as they provide solid level ground which can allow a driver to correct a straying vehicle. A sealed shoulder can assist in reducing the likelihood and severity of a crash.

Roads and Maritime Services Network Performance Measures and Planning Targets recommend a minimum sealed shoulder width of two metres for rural Class 4R roads. Extra shoulder width is recommended on the outside of curves to compensate for a vehicle straying onto the shoulder.

A desktop survey of shoulder widths was carried out using GIPSICAM footage which is considered accurate to within about 100 millimetres.

This showed that 59 per cent of northbound lanes and 52 per cent of southbound lanes meet the shoulder width guidelines. A section by section breakdown is provided in **Table 5-27** and **Table 5-28** for the northbound and southbound carriageways.

In the northbound and southbound lanes 19 per cent and 18 per cent of sealed shoulders are less than 1.5 metres wide. Sealed shoulders less than 1.5 metres wide are mostly located in Section 3 and the northern end of Section 4.

The desktop survey of lane and shoulder widths using GIPSICAM data and photography showed that the road shoulders do not continue across the culvert at Gooda Creek. This creek is narrow at the crossing and is short enough that it is does not require a bridge, so this is considered a local narrowing of the carriageway.

Table 5-27 Barton Highway northbound sealed shoulder widths

Direction	(%)		
Corridor section	Less than 1.5m	Greater than or equal to 1.5m to 2.0m	Greater than or equal to 2.0m
1 (9.1km)	1%	9%	90%
2 (9.3km)	17%	18%	65%
3 (5.5km)	34%	27%	39%
4 (17.5km)	30%	28%	42%
Total length of highway	**19%**	**22%**	**59%**

Table 5-28 Barton Highway southbound sealed shoulder widths

Direction	(%)		
Corridor section	Less than 1.5m	Greater than or equal to 1.5m to 2.0m	Greater than or equal to 2.0m
1 (9.1km)	0%	30%	70%
2 (9.3km)	20%	22%	58%
3 (5.5km)	34%	21%	45%
4 (17.5km)	10%	53%	37%
Total length of highway	**18%**	**30%**	**52%**

Narrow shoulders and clear zones south of Vallencia Drive

Narrow lanes and shoulders south of Nanima Road

Correct width shoulders on Gounyan realignment

5.4.5 Clear zones and road safety barriers

A clear zone is a portion of roadside free of obstructions that is available for drivers to take corrective action in an emergency. The minimum desirable width of a clear zone depends on traffic volumes, traffic speeds and road geometry.

The Roads and Maritime Services Network Performance Measures and Network Planning Targets defines minimum target widths for clear zones as shown in **Table 5-29**.

Table 5-29 Roads and Maritime Services Network Planning Targets

Hierarchy class	Operating speed	Clear zone width (m)
1–4R	Less than 60km/h	3
	60–80km/h	4
	80–110km/h	5
5–6R	All	Use Roads and Maritime Services Road Design Guide section 3

Ideally, clear zones should be designed in accordance with the *Austroads Guide to Road Design*. However, there are many existing roads that were developed prior to implementing minimum requirements for clear zones. Austroads guidelines would see clear zones on both sides of the Barton Highway along its full length – including sections with challenging topography (such as those with cut and fill batter constraints).

Any increase in the width of the corridor's clear zones would improve safety, even if the increase does not meet Austroads guidelines. However, it may mean compromises with environmental objectives, which may result in high expenditure and strict environmental mitigation works being required.

The first step in roadside hazard management is to provide a road environment that reduces the potential for road users to lose control of their vehicle and run off the road. Next is to provide a roadside environment that is free of hazards and is forgiving.

The long term target is to provide roadside clear zones that meet the Roads and Maritime Services Network Performance Measures and Network Planning Targets as a minimum, and then to provide safety barriers where clear zones cannot be built to minimum targets. Safety barriers deflect straying vehicles away from hazards in the clear zone and absorb energy, reducing the severity of collisions.

Barriers must be appropriately selected to suit the site specific requirements of a segment of road (such as the presence of kerbs, road geometry, barrier deflection and existing services). Maintenance requirements are also important in barrier selection.

The Barton Highway has W-beam and wire rope safety barrier systems (and concrete barriers are also part of all bridge structures). **Figure 5-43** provides an overview of the existing barrier systems within the study area. Through onsite investigations and review of the available GIPSICAM footage, there does not appear to be significant damage to the existing safety barrier systems.

This could be partially attributed to the fact that the Barton Highway does not have any substandard horizontal curves and grades are typically less than six per cent. Roads and Maritime Services' comprehensive maintenance program is also a factor in the continuity and integrity of the existing barrier systems.

Hazards within the clear zone are present in all sections of the highway, however Section 4 is the priority area for management, with trees and other hazards identified in the clear zone by both community and technical studies. Mature trees (non-frangible) are prevalent within the Barton Highway clear zone particularly through Sections 3 and 4. Any tree in the clear zone presents a road safety hazard which could be eliminated by removal of the tree or installation of a safety barrier.

W-beam guardrail at Murrumbateman Road intersection

Wire rope guard fence anchor point on Gounyan realignment

W-beam guardrail on a curve south of Murrumbateman

Wire rope guard fence on Gounyan realignment

5.4.6 Guidance and delineation

Guide posts, pavement marking and signage provide visual guidance for drivers by marking the edge and direction of the roadway ahead and by providing destination information to assist with route selection. They are used to make driving safer and more comfortable, particularly at night.

Edge lines are important markings for motorists. In areas with high rates of run-off-road crashes, audio tactile edge lines may be used to audibly alert drivers of departure from their lane, which helps to reduce the risks of vehicles running off the road. Their use needs to be considered as they create noise that can be problematic in some locations.

The Roads and Maritime Services Network Planning Targets recommend that all Class 4R roads have edge lines, provided there is sufficient pavement to have minimum lane widths of 3.0 metres. While the Barton Highway has edge lines, some need to be replaced on parts of the highway that have been resealed or patched, or where the lines are faded or worn.

Signage and pavement markings include:

- Pavement lines, chevrons, symbols etc
- Raised pavement reflectors (cats eyes)
- Audio tactile pavement marking
- Roadside guideposts with reflectors
- Hazard warning/way finding/ information signage
- Lighting.

Sections 2, 3 and 4 of the Barton Highway have worn or missing pavement markings or have 'blacked out' markings beginning to reappear in certain conditions of light and wet road surface. There are also some curves where delineation is lacking. The road safety review identified seven locations in Section 2, and 13 locations in Section 4 at which raised pavement markers, guideposts or chevron alignment markers (CAMs) were missing.

Improving the delineation of the road and of key intersections is recommended for the highway to help customers stay in their travel lane and quickly identify intersections to make early route choices, particularly when driving at night or when the sun is low in the sky. Installing audio tactile line marking is also recommended where possible, particularly at the edges and centre of carriageways along the entire corridor to help drivers to stay inside their lane.

5.4.7 Intersections and sight distance

The Roads and Maritime Services Network Planning Targets identify required intersection treatments based on volumes of through traffic. The minimum intersection treatment relevant to the Barton Highway is a short channelised right turn, with a full length channelised right turn to be provided wherever practical and wherever turning volumes are likely to grow in the future.

The study area of the Barton Highway contains 18 at-grade (level) intersections, and two grade separated interchanges with Yass Valley Way and the Hume Highway, shown by section in **Table 5-30**.

Table 5-30 The Barton Highway – intersection treatments

Corridor section	Basic Right Turn or Basic Left Turn	Auxillary Intersection Treatment	Channelised Intersection Treatment	Total intersections
1	Grade separated interchange			2
2	1	0	3	2
3	5	5	4	7
4	10	2	5	9
Total	**16**	**7**	**12**	**20**

Issues identified at a number of intersections along the highway are generally related to safety and traffic efficiency, these intersections include:

- Mundays Lane intersection – no sight on deceleration to intersection. Bus stop in front of intersection. No protection for right turning vehicles.
- Hillview Drive intersection – no left turn treatment. Cars using unsealed shoulder during left turn.
- Boundary Lane intersection – no sealed approach and no chevron boards.
- South Street intersection – exiting pavement and shoulder width insufficient.
- Casuarina Lane intersection – tight turns coinciding with overtaking lane and narrow shoulders. No right turn protection.

All of the intersections along the highway are T-intersections with lower class roads. Most have turning volumes greater than 30 vehicles per hour in times of high traffic. The most suitable treatment would be to upgrade intersections to at least a short chanellised right turn configuration, with full length channelised right turn treatments where turning queues are expected to be longer. In some locations, vehicles entering the highway with a left turn have difficulty selecting a suitable gap in the traffic flow. Consideration of left turn acceleration lanes should be given at busier intersections. Outside of the Murrumbateman village area, few intersections have street lighting.

Many of the local roads joining the Barton Highway have a relatively small catchment feeding to the highway. Roads such as McIntosh Circuit and Vallencia Drive serve a larger and growing network of rural residential properties. Euroka Avenue, Nanima Road and Spring Range Road serve smaller but not insignificant catchments. Murrumbateman Road forms a regional function and a through route to the Federal Highway and beyond.

Many private properties have direct access to the highway where the speed limit is up to 100km/h. While it is impractical to justify turning lanes for each property along the route, the shoulders could be widened near property entrances to provide greater allowance for vehicles turning right onto the highway or better clearance from through traffic for left turning vehicles. When projects are developed adjacent to properties, options to improve access safety can be discussed with land owners.

Sight distance is defined in the *Austroads Guide to Road Design* as 'the distance measured along the carriageway over which visibility occurs between a driver and an object (single vehicle sight distance); or between two drivers at specific heights above the carriageway in their lane of travel'. For safe and efficient traffic operation on the road, sufficient sight distance is necessary to enable drivers to perceive and react to a hazardous situation. A driver's sight distance should be as long as practicable but it is often restricted by crests (on vertical curves) and obstructions (on horizontal curves).

Sight distance issues along the highway are mostly due to vertical crests, line of sight obstructions on horizontal curves and sight lines from property accesses. At a number of locations in Section 4, notably around Jeir Creek and Capricorn Corner, the community have reported poor visibility along the road. The main contributing factors are a horizontal curve in the road combined with a crest, and the presence of trees. It is also reported that at Jeir Creek the lane markings on the horizontal curve are broken to allow overtaking, which some of the community feel is unsafe at this point.

"While it is impractical to justify turning lanes for each property along the route, the shoulders could be widened near property entrances to provide greater allowance for vehicles turning right onto the highway or better clearance from through traffic for left turning vehicles."


Channelised right turn intersection at Murrumbateman Road


Long Rail Gully Road channelised right turn


Hillview Drive auxiliary right turn

Seagull intersection type at Kaveneys Road

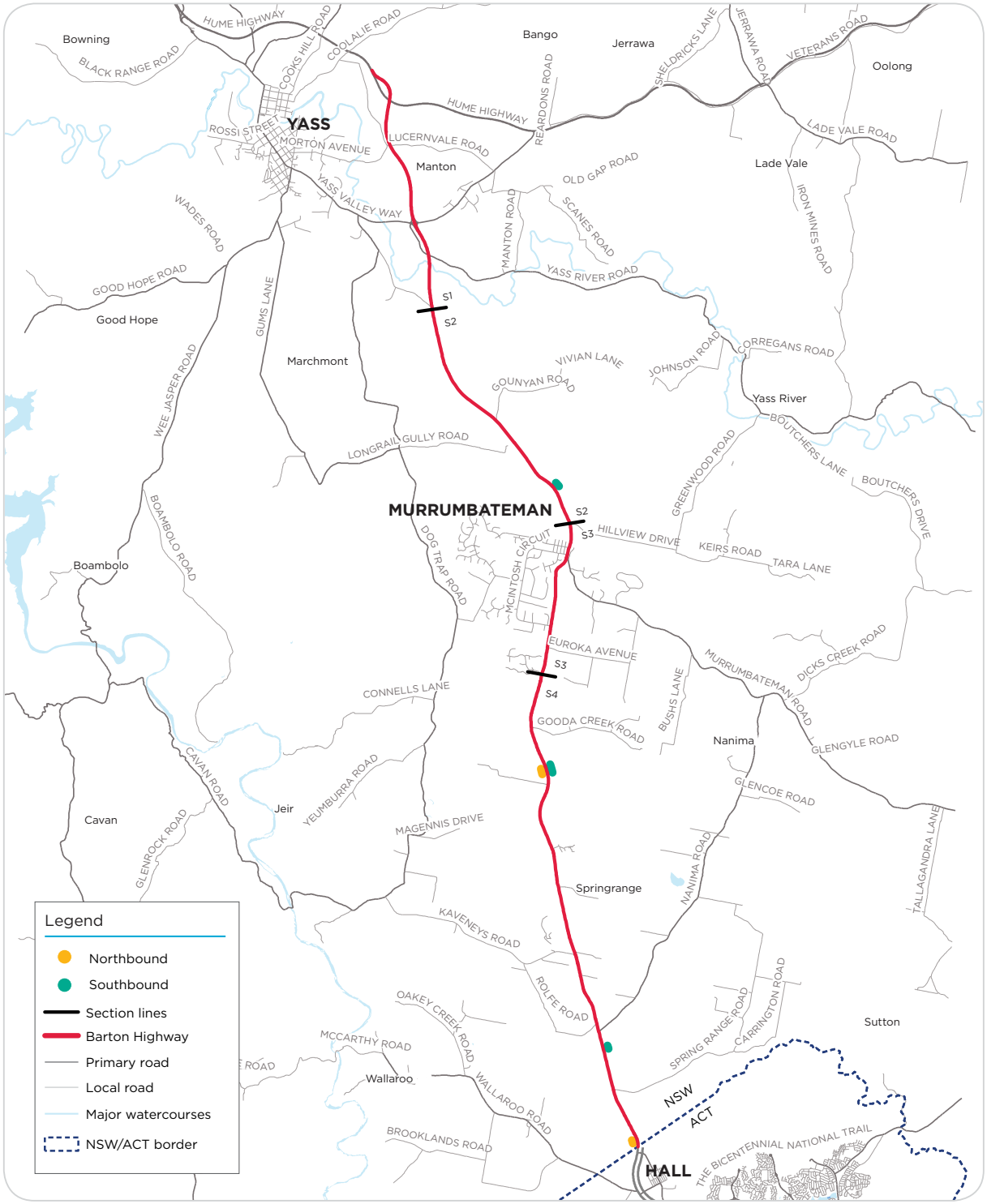
5.4.8 Rest areas

Rest areas are an important part of managing driver fatigue and are part of Roads and Maritime Services' 'stop, revive, survive' campaign. There are three vehicle rest areas along the Barton Highway (for both heavy and light vehicles), two in the northbound direction and one in the southbound direction. There are also two truck parking areas in the southbound direction. Each rest area has deficiencies and it is recommended that a detailed assessment be carried out to identify specific hazards for removal and to determine how the sites could be upgraded.

Under the current strategy for major heavy vehicle rest areas, the Barton Highway is not a designated key freight route that would be targeted for the implementation of new rest areas to fight driver fatigue. This is due to its proximity to the services available in the ACT and rest areas nearby on the Hume Highway.

Key issues for existing rest areas include short deceleration and acceleration lane lengths, a lack of separation from travel lanes which allows vehicles to stop within the clear zone, and inadequate pavement marking. The rest areas have different amenities including shelter, bins and outdoor tables. The locations of the heavy vehicle rest stops are shown on **Figure 5-26**.

Figure 5-25 The Barton Highway rest areas and truck parking areas



5.4.9 Bridges and culverts

A culvert is a pipe or enclosed channel that allows water to flow under a road.

The Barton Highway passes over 119 culverts and 22 bridges. **Table 5-31** shows the bridges (including bridge sized culverts) and culverts in each corridor section.

Table 5-31 Barton Highway – bridges and culverts

Corridor section	Bridges	Culverts
1	13	23
2	1	27
3	1	16
4	7	53

Roads and Maritime Services determines a culvert's assessed risk level (ARL) as part of its asset management processes. This is part of the Culvert Management Framework policy which details how road culverts are monitored, and references the Culvert Inventory Collection Guideline and the Culvert Risk Assessment Guideline. If a culvert fails under extreme conditions, the road surface above the culvert may collapse or be washed away. Culverts with an ARL of two or less are considered 'high risk' while culverts with an ARL of three or more are considered 'low risk'.

Bridge health is measured using the Roads and Maritime Services Bridge Health Index (BHI). The BHI measures a bridge's condition in terms of 'poor', 'fair', 'good' or 'as built'.

The Roads and Maritime Services Network Planning Targets for the rural road network specify that less than 2.5 per cent of all bridges across the route should have a BHI rating of 'poor'[14].

Ongoing inspection and maintenance routines for culverts and bridges on the highway indicate that all are in good operational condition.

5.4.10 Bridge load performance

The Roads and Maritime Services Network Planning Targets state that all bridges on State and Regional roads should be able to carry Higher Mass Limit loads.[15] 'Higher Mass Limits' is a nationally agreed scheme that permits approved heavy vehicles to operate with additional mass on certain types of axle groups, on a restricted road network and subject to specific conditions.[16]

The Australian Government has approved the following axle mass limit increases for vehicles fitted with road friendly suspensions:

- Increase of 0.5 tonnes on tandem axle groups to 17 tonnes
- Increase of 2.5 tonnes on tri-axle groups to 22.5 tonnes
- Increase of 1 tonne on single drive axles on buses to 10 tonnes
- Increase of 1 tonne on six-tyred tandem axles to 14 tonnes
- Increase of 0.7 tonnes on steering axles of long combination vehicle prime movers (such as road trains) fitted with wide single tyres, regardless of suspension type.

Roads and Maritime Services has designated the Barton Highway as a Higher Mass Limit 25/26 metre B-Double Route for its entire length in NSW.

> "Bridge health is measured using the Roads and Maritime Services Bridge Health Index (BHI)."

14 **Roads and Maritime Services 2010,** *Network Performance Measures and Network Planning Targets,* **p. 34**

15 **Roads and Maritime Services 2010,** *Network Performance Measures and Network Planning Targets,* **p. 56**

16 **National Transport Commission 2014, http://www.ntc.gov.au/viewpage.aspx?AreaId=37&DocumentId=1806**

5.4.11 Summary of road design and geometry issues

The following geometric and operational issues currently exist or have the potential to emerge due to forecast population growth and land use density increases:

- Long continuous lengths of single lane carriageway limit the opportunity to pass slower vehicles, which increases travel times and risk taking behaviour, and reduces travel time reliability.
- Some crests limit stopping sight distance. This creates hazards associated with vehicles turning at intersections and driveways. It also affects vehicles overtaking in the opposite travel direction or overtaking stationary objects on the roadway. This can reduce road safety and affects travel speed and travel time reliability.
- Horizontal stopping sight distance is limited by mature vegetation, fences and roadside embankments at various locations. This may reduce road safety and affect travel speed and travel time reliability.
- There are drainage culverts and mature infrangible trees within the clear zone but they don't have safety barriers. This increases the likelihood of a run-off-road crash being a casualty crash. It may also have an impact on driver comfort, with a flow-on effect on travel times and reducing travel time reliability.
- The majority of intersections do not have auxiliary lanes that offer protection and improved access to the main road for turning vehicles.
- Road shoulders along the majority of the highway are under the recommended two metres wide. This limits safety for motorists, cyclists and bus passengers.
- Sight distance at some intersections is affected by the location of bus stops.
- Heavy vehicle rest area facilities are lacking in some facilities, which reduces their appeal to drivers.
- Exit from the Jeir Creek heavy vehicle rest area on the northbound carriageway conflicts with the merge of the overtaking lane.
- Some insufficient signage and delineation.

5.5 Road pavement condition

The pavement condition assessment for the *Barton Highway Improvement Strategy* involved the collection of existing pavement data to identify visible defects, followed by the classification and evaluation of each defect. A desktop review of GIPSICAM footage from February 2013 was carried out, followed by onsite inspections.

Road pavement is a layer of crushed rock which is laid above the ground the road is built on. This rock can be in a natural state, such as gravel, or it can be modified into materials such as concrete or asphalt. The surface of a road experiences very high stress under the tyres of passing vehicles, especially heavy vehicles, and the pavement spreads the tyre load over a wider area and passes the load through to the natural earth.

To understand how pavement is performing along the Barton Highway and to forecast future pavement condition, a number of measures are considered. These include:

- Pavement types and seals
- Pavement age
- Road surface cracking
- Roughness
- Surface friction
- Road smoothness
- Rutting.

5.5.1 Pavement types and seals

Pavements provide structural support for vehicles travelling along a route. Weaker or older pavements may become uneven, rutted or rough, leading to inferior travel conditions.

Rigid concrete pavements on the Hume Highway at Barton exit

Road pavements are classified as either flexible or rigid:

- 'Flexible pavements' are generally made up of a number of layers of gravel and unbound granular materials, with a bitumen surface. Some flexible pavements have cement-bound or asphalt layers, referred to as 'composite pavements'.
- 'Rigid pavements' are Portland-cement concrete pavements. They may or may not be surfaced with asphalt over the concrete base.

The factors that are considered in selecting a pavement type include:

- Anticipated traffic loadings, including heavy vehicle use
- Environmental and construction restrictions
- Material availability, familiarity with construction processes by the local industry and cost.

The Barton Highway is mostly flexible pavement with bituminous spray sealing in Sections 2, 3 and 4 with smaller areas of asphaltic concrete (at intersections and some areas of patching/ rehabilitation). The length of Section 1 is rigid concrete pavement. **Table 5-32** summarises the pavement types along the Barton Highway.

Table 5-32 Pavement types

Corridor Section	Carriageway length (km)	Spray sealed (%)	Concrete (%)
1 – Hume Highway to end of dual carriageway	17.8	0%	100%
2 – End of dual carriageway to Hillview Drive	9.3	100%	0%
3 – Hillview Drive to Vallencia Drive	5.5	100%	0%
4 – Vallencia Drive to ACT border	17.5	100%	0%

5.5.2 Pavement age

Road pavement is designed to provide satisfactory service over a specific period, typically 20 to 30 years for flexible pavements and 40 years for rigid pavements. The age of the pavement is a further indicator of its remaining life. While pavement can continue to operate beyond its design life, it can experience increasing failures and require repairs.

Roads and Maritime Services faces considerable challenges in maintaining and renewing its road infrastructure to make sure it is serviceable and sustainable now and in the future. Increasing traffic and the demand for environmental sustainability contributes to the need for continuing maintenance and rehabilitation of the Barton Highway.

Table 5-33 summarises the age of pavements along the Barton Highway, parts of which have exceeded their design life. Despite this, the majority of pavement is currently serviceable and roughness levels are acceptable due to localised repairs.

Table 5-33 Pavement age*

Corridor Section	Carriageway length (km)	Less than 20 years (%)	More than 20 years (%)
1 – Hume Highway to end of dual carriageway	17.8	0%	100%
2 – End of dual carriageway to Hillview Drive	9.3	45.5%	54.5%
3 – Hillview Drive to Vallencia Drive	5.5	0%	100%
4 – Vallencia Drive to ACT border	17.5	5.5%	94.5%

* Age since pavement was last reconstructed, excluding pavement resurfacing.

5.5.3 Road surface cracking

The road surface plays a dual role: it provides a safe surface for traffic and also acts as a waterproof layer to protect the underlying pavement from moisture that can seriously reduce the strength and durability of the road. The amount of cracking in a road surface does not affect traffic efficiency or road safety, but it is a key performance measure as it contributes directly to the rate of pavement deterioration, which can increase the need for asset maintenance and bring forward the need for pavement replacement.

Granular road pavements are more susceptible to rapid deterioration while manufactured materials (asphalt) and heavier, duty bound pavements are less susceptible. The typical asphalt pavement is less affected by prolonged rainfall and cracking poses less of a risk to pavement durability.

As a guide, the target level of cracking for Class 4R roads is:

- For asphalt roads, at least 67 per cent of road length should have cracking at or below five per cent, and no more than 2.6 per cent of the network should have cracking above 30 per cent.
- For spray sealed surfaces, at least 80.2 per cent of road length should have cracking at or below one per cent, and no more than 4.3 per cent of the road length should have cracking above 10 per cent.

Table 5-34 shows that the level of cracking on asphaltic surfaces on the Barton Highway is within the acceptable limit. In general, the concrete pavement in Section 1 was observed to be in good condition. The percentage of cracking at 5.9 per cent across Section 1 of the Barton Highway is considered negligible.

Table 5-34 Pavement cracking (asphalt concrete)

Corridor Section	Percentage of corridor planning section within cracking category		
	Less than 5%	5-30%	Greater than 30%
1 – Hume Highway to end of dual carriageway	24%	61%	15%
Total highway performance (by length)	**1.4%**	**3.5%**	**1%**

Table 5-35 and **Table 5-36** summarise pavement cracking along spray sealed surfaces, and shows that the spray sealed surfaces exhibit a low level of cracking, though the target of 'at or below one per cent cracking' is not achieved for all sections.

Table 5-35 Pavement cracking (spray sealed)

Corridor Section	Percentage of corridor planning section within cracking category		
	Less than 1%	5-10%	Greater than 10%
2 – End of dual carriageway to Hillview Drive	18%	82%	0%
3 – Hillview Drive to Vallencia Drive	13%	87%	0%
4 – Vallencia Drive to ACT border	15.2%	58.7%	26.2%
Total highway performance (by length)	**0.11%**	**0.94%**	**0.14%**

Table 5-36 Length weighted cracking

Corridor Section	Length (km)	Length weighted cracking (%)
1 – Hume Highway to end of dual carriageway	17.8	5.9%
2 – End of dual carriageway to Hillview Drive	9.3	0.57%
3 – Hillview Drive to Vallencia Drive	5.5	1.07%
4 – Vallencia Drive to ACT border	17.5	0.97%

5.5.4 Roughness

Roughness measures undulations (or 'waves') along a road, and provides an indication of ride comfort. As a roads' roughness increases, the wear and tear on vehicles and the corresponding cost of operating vehicles can increase.

Roads and Maritime Services uses a roughness measure to judge the quality of ride of a pavement surface. The ride quality (or longitudinal profile), of the road surface is measured using vehicle mounted lasers to provide an International Roughness Index.

A smooth and comfortable ride would generally have an International Roughness Index score below 4.2 metres per kilometre.

At least 76.8 per cent of other Class 4R roads have a roughness level below 4.2 metres per kilometre, the Barton Highway's is 98 per cent (**Table 5-37**).

Table 5-37 The Barton Highway – International Roughness Index

Corridor Section	Length (km)	Length weighted roughness greater than 4.2m/km
1 – Hume Highway to end of dual carriageway	17.8	2.1%
2 – End of dual carriageway to Hillview Drive	9.3	2.4%
3 – Hillview Drive to Vallencia Drive	5.5	2.6%
4 – Vallencia Drive to ACT border	17.5	2.3%

Note: The values given in the above table reflect only the northbound carriageway for Sections 2, 3 and 4.

5.5.5 Surface friction

The surface friction of a pavement, known as Sideway-Force Coefficient or SFC, is a key contributor to driving safety and skid resistance. Areas of low surface friction can be made worse by wet or icy conditions.

Sideway-force Coefficient Routine Investigation Machinery (SCRIM) is used to supplement a visual inspection of the pavement. The most recent collection of SCRIM data was October 2013 and is presented in **Table 5-38**. This data indicates that minimal work is needed to improve skid resistance on the Barton Highway.

Table 5-38 The Barton Highway: SCRIM data October 2013

Corridor Section	Length (km)	Average SCRIM SFC value Outer wheel path	Average SCRIM SFC value Inner wheel path	Length weighted SCRIM value (%) Differential
1 – Hume Highway to end of dual carriageway	17.8	70.6	69.9	6.2%
2 – End of dual carriageway to Hillview Drive	9.3	47.2	52.5	11.8%
3 – Hillview Drive to Vallencia Drive	5.5	41.0	46.5	10.4%
4 – Vallencia Drive to ACT border	17.5	46.0	48.4	7.7%

Note: The values given in the above table reflect only the northbound carriageway for Sections 2, 3 and 4.

5.5.6 Rutting

Rutting is when permanent ruts or 'waves' are created in the wheel paths of the road surface. Rutting travels along the length of the road and does not influence roughness. This is a road safety concern due to water ponding, the increased risk of aquaplaning, or ice formation, all of which can lead to skidding.

Rutting is regarded as a key safety issue and is a priority for Roads and Maritime Services' pavement maintenance and rehabilitation programs.

It is important to determine the structural integrity of the pavement and any potential risk to safety caused by rutting.

Rutting can be a sign of structural instability in flexible pavements or excessive plastic deformation in asphalt pavements. The issue can occur in the pavement layer near the road surface, which indicates material instability, so the asphalt will be resurfaced to fix the problem. If the issue is at a deeper pavement level, which indicates material breakdown and loss of bearing strength, the solution is heavy patch or rebuild.

Rut measurements show 11.6 per cent of the Barton Highway currently exhibits 'moderate' rutting above five millimetres (**Table 5-39**). The majority of these areas are on the single carriageway sections of the Barton Highway (Sections 2, 3 and 4). Minimal rutting has been observed on the concrete pavement of Section 1 (dual carriageway).

Table 5-39 Rut depth

Corridor Section	Length (km)	Length weighted rut depth (mm)	Length weighted rutting greater than 5mm (%)
1 – Hume Highway to end of dual carriageway	17.8	3	2.9%
2 – End of dual carriageway to Hillview Drive	9.3	7	15.8%
3 – Hillview Drive to Vallencia Drive	5.5	7	22.3%
4 – Vallencia Drive to ACT border	17.5	6	13.5%

Note: The values given in the above table reflect only the northbound carriageway for Sections 2, 3 and 4.

5.5.7 Summary of pavement issues

The Barton Highway is mostly flexible pavement with bituminous spray sealing in Sections 2, 3 and 4 with smaller areas of asphaltic concrete (at intersections and some areas of patching/ rehabilitation). The length of Section 1 is rigid concrete pavement.

While pavement on parts of the Barton Highway has exceeded its design life, the majority is performing well. The pavement displays structural serviceability and acceptable roughness and:

- Is within the acceptable limit of cracking for the sealed surface, and the concrete pavement in Section 1 is in good condition.
- SCRIM data shows that minimal work is required to improve skid resistance.
- Only a 10 per cent section of the single carriageway (Sections 2, 3 and 4) show moderate rutting. Minimal rutting has been observed on the concrete dual carriageway pavement in Section 1.

5.6 Environment

5.6.1 Preliminary environmental investigation

A preliminary desktop environmental investigation of the Barton Highway duplication corridor was carried out in 2011 to determine the road corridor boundaries for potential duplication. The study considered an area extending 500 metres on either side of the centreline of the corridor. The results of this study are relevant for this Improvement Strategy and will form a basis for further environmental studies for any proposed works. The key findings were:

- Aboriginal heritage – there are a number of Aboriginal heritage sites located within the study corridor. These include scarred trees, artefacts, potential archaeological deposits (PAD) and cultural sites. Following the desktop study and further assessment, a preliminary environmental investigation was conducted at two Aboriginal heritage locations. Discussions between Aboriginal knowledge holders and Roads and Maritime Services were held regarding the two sites. These discussions identified that one site was not of heritage significance, while 'fill only' site management options were identified for the second site.

- Non-Aboriginal heritage – five non-Aboriginal heritage sites were identified within the study corridor. Their respective heritage significance has been determined. The five sites include Dellwood Homestead and Wattle Park Church, both of which are located near the ACT and NSW border.
- Noise – there are areas that may experience noise in excess of legislated noise levels during any duplication works. These will be considered in any proposed works.
- Soil and water – restrictions related to soil and water:
  - Drainage lines running parallel to the study corridor
  - Changes to drainage lines could potentially result in flooding or highway inundation if not properly planned and constructed
  - Ground water bores and farm dams may be impacted
  - There may be areas that require water quality control.
- Ecology – a number of vegetation communities and habitat types of significant ecological value were identified. These include Yellow Box – Blakely's Red Gum Grassy Woodland, Candlebark – Red Stringybark Woodland, derived native grasslands, and granite tor. The vegetation communities and habitats within the study corridor support threatened mammals, birds, reptiles, bats and insects. The ecological values of the vegetation along the corridor will require consideration for any project needing vegetation clearance.
- Visual amenity/landscape – three landscape character zones were identified within the study corridor. Landscape or visual amenity issues are not considered to be restrictions along the corridor.
- Socio-economic considerations – the main socio-economic issue for improvement projects is the impact on the viability of local businesses including farms, wineries, vineyards and tourism establishments. Impacts associated with the acquisition of properties would be further considered during any project development.
- Access – improvement works may affect access to individual properties and around Murrumbateman. Consideration should be given to the maintenance and enhancement of east-west connectivity in the village.
- Contaminated land – during the desktop assessment, a number of sites were identified as having the potential to be contaminated. However, these issues could be addressed through standard management practices and would not be a significant barrier to improvements along the Barton Highway.

5.6.2 Summary of environmental issues

- The previous desktop environmental assessments identified environmental issues which would need to be taken into account when considering improvement works along the Barton Highway.
- Prior to implementation, all infrastructure projects would require an appropriate environmental assessment.
- The main issues relate to Aboriginal heritage, non-Aboriginal heritage, ecology and noise.
- As a general principle, proposals should consider options to avoid impact on the environment. Where impacts cannot be avoided, a justification for the impact should be provided, and appropriate mitigation, management or offset measures must be implemented in consultation with the relevant regulators and stakeholder groups.
- It is noted that there are some trees of ecological value that create a hazard to motorists. Any project at these locations would evaluate the options to remove trees, install safety barriers or to make no change, and a clear case for the preferred solution would be made.

6 FUTURE CORRIDOR CHANGES

Gounyan realignment looking northbound

6.1 Population and demographics

6.1.1 Population forecasts

Census data from 2006 and 2011 indicated that the population of the Yass Valley Council LGA had grown from 13,130 to 15,020 people, a percentage growth of around 14 per cent over the five year period.

Updated NSW Department of Planning and Environment population projections in 2014[17] differ somewhat from the Census data and quote a 2011 population of 15,600 with a forecast population increase in the LGA to 21,900 by 2031, representing an increase of 40.4 per cent over the 20 year period (**Table 6-1**).

Table 6-1 Predicted population LGA and urban centre demographics

LGA	2011 LGA population	Urban village[18]	Forecast 2031 LGA population	LGA growth rate 2011–2031
Yass Valley Council	15,600	Murrumbateman urban centre 1542 Yass urban centre 5591	21,900	40.4 per cent

The current NSW Department of Planning and Environment population projections suggest an average five year population change of 8.07 per cent, a lower percentage growth in comparison to the 2006–2011 Census period. These future population growth projections in the Yass Valley Council LGA are attributed to:

- Accessibility and commuter distance to Canberra.
- Links between the economy of the Yass Valley Council LGA with the economic drivers of the ACT – which are expected to continue and be an ongoing driver of population.
- Competitive affordability of housing in the Yass Valley Council LGA compared to Canberra, along with the increased appeal of rural living.

6.1.2 Demographic changes and trends

Yass Valley Council is also predicting considerable change in the coming years in terms of its population size and diversity, as well as with the structure and density of its towns and villages, in particular Yass and Murrumbateman. These changes are predicted to be driven by pressure for residential accommodation for people employed locally and for commuters to the ACT. Increased traffic on the Barton Highway is a likely consequence of any population growth.

6.2 Land use changes

The NSW Department of Planning and Environment has prepared the Draft South East and Tablelands Regional Plan[19] to help to plan for NSW's future population needs for housing, jobs, infrastructure and a healthy environment.

6.2.1 Dwelling forecast

The NSW Department of Planning and Environment has released the NSW State and Yass Valley Council LGA dwelling projections for 2011 to 2031 (in five year periods). There is a forecast average growth rate of 7.6 per cent over the period.

Dwelling projections for Yass Valley Council LGA are shown in **Table 6-2**[20].

17 NSW Department of Planning and Environment 2014, 2014 NSW Population Projections data http://www.planning.nsw.gov.au/en-au/deliveringhomes/populationandhouseholdprojections/data.aspx

18 Australian Bureau of Statistics 2011, 2011 Census QuickStats

19 http://www.planning.nsw.gov.au/Plans-for-Your-Area/Regional-Plans/South-East-and-Tablelands/How-to-Get-Involved

20 NSW Department of Planning and Environment 2014, 2014 NSW Household and Dwelling Projections data: http://www.planning.nsw.gov.au/en-au/deliveringhomes/populationandhouseholdprojections/data.aspx

Table 6-2 Dwelling projections for Yass Valley Council LGA

Regional NSW LGAs	2011	2016	2021	2026	2031	Total change	Total % change	Average annual % change
Yass Valley projected dwellings	6450	7200	8000	8750	9500	**3050**		
Projected growth rate (%)		11.6%	11.1%	9.4%	8.6%		**47.3**	**7.6**

6.2.2 Land use changes

Potential for the Yass Valley Council LGA to accommodate additional residential population has been restricted by:

- A lack of suitably zoned land
- An unreliable source of drinking water
- A lack of available zoned village land within Murrumbateman.

Changes to zoning terminology in the *Yass Valley Council Local Environmental Plan 2013* have the potential to bring about changes in land use and populations within the Barton Highway catchment:

Replacement of the *1(d) – Rural Small Holdings zone with zone RU4 – Primary Production (Small Lots)*

- The purpose of the new zone is to reserve land for agricultural production to provide for employment in intensive agriculture and food security. This may result in an increase in traffic.

Replacement of the Rural Residential Zones (Zones 1(c) & 1 (c1)) with the new R5 Large Lot Residential zone.

- This zone is intended to cater for development that provides for residential housing in a rural setting, often adjacent to towns or metropolitan areas. This may result in an increase in traffic.

Local water storage capacity restrictions have been addressed by the recent raising of the Yass Dam wall. The Town and Villages Study 2010[21] projects that the raised dam will secure a yield of approximately 1700ML of water, enough to supply a population of 15,000.

The strategic planning work completed by Yass Valley Council has identified Murrumbateman as a pivotal location for growth within the LGA to 2031. Yass Valley Council commissioned consultants to develop a Master Plan for Murrumbateman[22] to guide the development of the village over the 20 years to 2031. The completed Master Plan is accessible on Yass Valley Council's website.

Essentially, this plan allocates land in and around Murrumbateman for:

- New large lot residential lots, 424 of these over 418 hectares.
- Three-hundred new standard residential lots over 28 hectares.
- Around 7000m^2 of industrial lands, up to 5800m^2 of retail lands and 630m^2 of commercial lands.
- A 16 hectare tourist (winery) precinct.
- A new primary school.
- Public open space.

21 Town and Villages Study 2010 http://www.yassvalley.nsw.gov.au/images/documents/yassvalley/Strategic%20Planning/DOP_endorse_copy.pdf

22 Yass Valley Council, Murrumbateman Masterplan 2012, May 2012 http://www.yassvalley.nsw.gov.au/index.php?option=com_content&view=article&id=1143757:murrumbateman-master-plan&catid=1028&Itemid=2218

6.2.3 Current and projected development

Consultation with the planning division of Yass Valley Council revealed there is potential for:

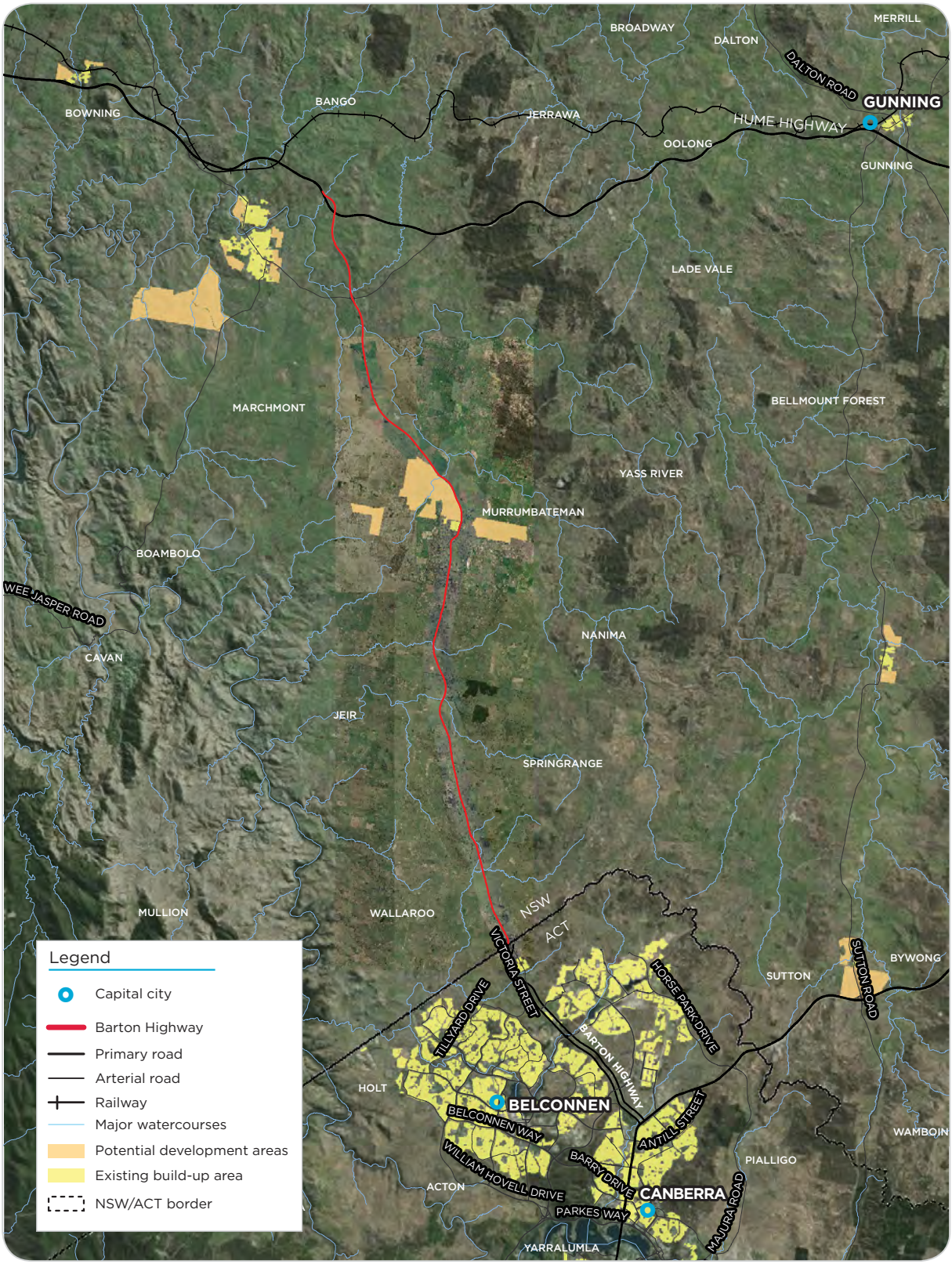
- Land in the Barton Highway catchment to provide up to 1500 new dwelling sites over the next 10 years.
- Land on the periphery of Murrumbateman to provide up to 1300 new dwelling sites over the next 10–30 years.
- Seventy-one hectares of land at Bowning to be developed over the next 15–30 years.
- Development of the South East Livestock Exchange which will provide up to 1.5 million additional head of livestock by 2021, a proportion of which may be transported along the Barton Highway.

Each of these potential residential development sites is illustrated in **Figure 6-1**.

> “There is the potential for land on the periphery of Murrumbateman to provide up to 1300 new dwelling sites over the next 10–30 years.”

From Gounyan Road, looking northbound

Figure 6-1 Current and projected development sites[23]



23 Source: discussion with Yass Valley Council Planning Division

6.3 Traffic growth forecasts

Traffic growth is forecast by considering historical average annual daily traffic (AADT) data as well as significant changes in regulation, land use or industry that could impact the forecast growth rate.

Roads and Maritime Services has been collecting traffic data on the Barton Highway for more than 50 years. During the 1960s and 1970s the Barton Highway provided connections between the ACT and the Hume Highway primarily to provide access for local rural farms and rural industries. However since the 1980s, the route has been transporting increasing commuter traffic from Yass and Murrumbateman to Canberra. Traffic volume growth prior to the 1990s was uniform, but since then it has been considered as two distinct growth rates.

These different traffic growth rates are impacted by Yass at the northern end and a second growth rate takes into account the impact of Murrumbateman village. These two different sets of traffic data are discussed in Section 5.3. They are used as the basis for forecasting future volumes of traffic and also forecasting the level of service.

6.3.1 Traffic forecast

Table 6-3 shows AADT volumes and growth rates (2014 to 2034) and predicted levels of service in 2034, as provided by Roads and Maritime Services, based on growth rates discussed in Section 5.3. This forecasting assumes no major changes to the Barton Highway.

Table 6-3 Average Daily Traffic volumes and growth rates (2014 to 2034)

Corridor Section	2014 AADT	% Growth per annum	Predicted 2034 AADT	Predicted level of service 2034
1 – Hume Highway to end of dual carriageway				
2 – End of dual carriageway to Hillview Drive	8400	1.9	11,600	C
3 – Hillview Drive to Vallencia Drive	10,436	3	16,700	D
4 – Vallencia Drive to ACT border	11,278	3	18,000	D/E

Consultation with Yass Valley Council strategic planners as well as the analysis conducted of future development applications indicates that northbound and southbound heavy vehicle movement along the Barton Highway will increase as a result of the South East Livestock Exchange and the transport of 1.5 million head of livestock by 2021. As a result, heavy vehicle movements will increase which is reflected in the TRARR traffic model of the Barton Highway.

This scenario will add around 20 heavy vehicle movements per day, with the peak hours expected to carry around 10 per cent of the vehicles per day (two heavy vehicles). This is based on 2014 survey data which shows that about 10 per cent of the volume of heavy vehicle traffic is travelling in peak hour. The remaining trips will be spread across the day.

Barton Highway in Murrumbateman, looking southbound

Daytime average traffic volumes in 2034:

If no changes are made to the highway the level of service along a route will deteriorate as traffic volumes increase. Roads and Maritime Services has a target of maintaining level of service along rural corridors. The level of service along the Barton Highway is forecast to decline to below level of service C if traffic volumes grow at the rate of 1.9–3.0 per cent per annum.

Additional overtaking lanes should therefore be progressively provided to align with a plan to progressively upgrade the highway.

6.3.2 Future duplication

Traffic forecasts and performance analysis indicates that, if additional overtaking lanes are progressively installed along the Barton Highway, traffic can be adequately accommodated within the existing lane capacity for many years. Analysis has included forecast population increases and normal background traffic growth to predict the likely future scenario.

It is important that the corridor continues to be monitored and traffic flows assessed so that planning can progress and infrastructure provided to retain an acceptable level of service. Substantial progress has been made to date with the recognition of the duplication corridor in Yass Valley Council's LEP, and the NSW Government has purchased eight kilometres of the remaining 32 kilometre corridor. Any future roadwork along the corridor should complement, or form part of, the future road duplication corridor. This includes purchasing any duplication corridor land as the pavement and clear zone widths are progressively improved. These and other actions form part of the longer term strategy to ensure that this important corridor link provides safe and efficient travel now and into the future.

6.3.3 Intersection performance

Intersection performance is challenging to forecast over a long period. Intersections are assessed on a five yearly basis and recommendations for improvement are based on this assessment. Improvements for intersections are discussed in Chapter 8.

6.4 Staged duplication planning

The Australian and NSW Governments have previously recognised the need for ongoing improvements on the Barton Highway and future duplication when traffic volumes reach numbers where the level of service deteriorates to unacceptable levels. This can be seen in Figure 6.2:

- Reservation and partial purchase of the future corridor. The duplication corridor is included in Yass Valley Council's LEP, and the NSW Government has to date purchased about eight kilometres of the remaining 32 kilometre corridor.
- Construction of sections of road such as the Gounyan Curves realignment and the Capricorn Corner realignment so that they may form part of one carriageway of the future duplicated road.
- Commitment in this strategy supporting overtaking lanes and safety upgrades will form part of, or complement, future duplication works.

More recently the Australian and NSW Governments have also committed to the development of a Strategic Business Case for staged duplication. A business case describes how any projects or programs or capital expenditure will address a service need or opportunity. The business case assists decision makers to determine if the proposed initiative is of value and is achievable compared to the relative merits of alternative proposals. The business case will review all aspects of the strategic concept design, including staging and an assessment of the triggers that would be used to prioritise duplication stages.

At the same time, this strategy also supports investment in the short term to provide a safer road and more efficient travel, particularly during peak periods. These improvement works will form part of or complement the longer term duplication of the highway forming one of the future carriageways with strengthened pavement, appropriate alignment and safe roadside environments.

Traffic forecasts and performance analysis indicates that, if additional overtaking lanes are progressively installed along the Barton Highway and a safer road environment provided, then the highway will be able to provide an efficient and safe travel environment for customers for many years.

It is recognised, however, that factors such as housing growth and commercial development are dynamic, and can change over time at different rates than currently envisaged leading to fluctuations in the growth rates of traffic along a route. For this reason it is important to continue to monitor the performance of the Barton Highway. The NSW Government has committed to the review of Corridor Strategies such as the Barton Highway Improvement Strategy at least every five years.

Figure 6-2 Staged Duplication Planning for the Barton Highway

6.5 Active transport

In regional NSW the provision of good public transport services requires careful planning to take into account long travel distances and dispersed demand.

Regional transport planning will be integrated with land use planning and other NSW Government initiatives such as regional action plans and NSW Department of Planning and Environment regional land use strategies. This will ensure transport services and infrastructure are provided in a timely way, particularly in centres with strong growth. Regional cycling, walking and public transport initiatives are addressed in the Transport for NSW Southern Regional Transport Plan to help reduce the reliance on cars in the region.

The NSW Government focuses on promoting the benefits of active transport, improving customer information, and developing guidelines and resources for local government. This includes improved online resources, such as trip planning, as well as programs to promote cycling and walking as viable transport options.

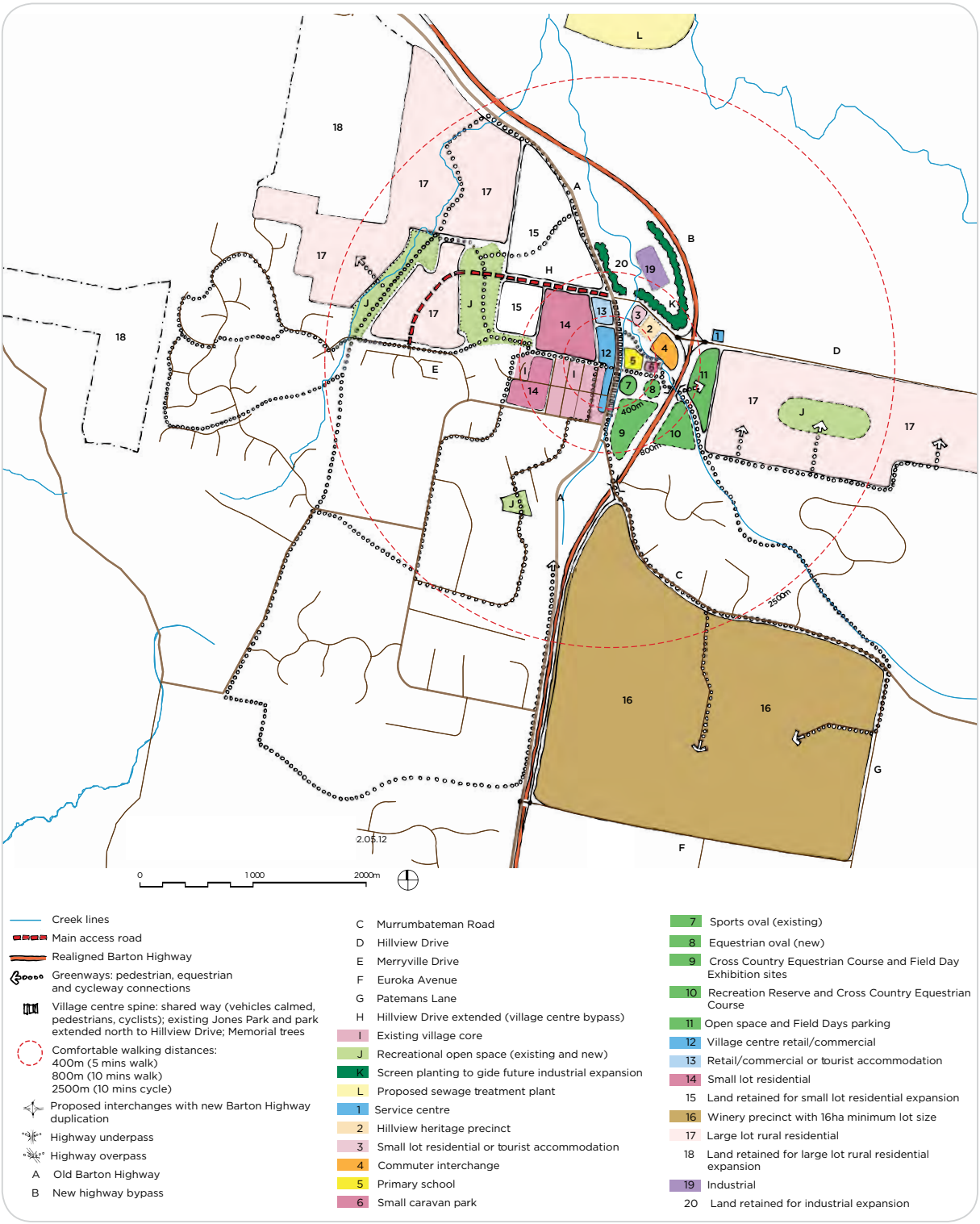
> “As the focus for current and future residential development along the Barton Highway, increased walking activity will be most likely around Murrumbateman village.”

6.5.1 Walking

The NSW Government is committed to making walking easier and safer to make it a more appealing choice for customers. As the focus for current and future residential development along the Barton Highway, increased walking activity will be most likely around Murrumbateman village. Future pedestrian infrastructure for the Barton Highway through Murrumbateman could be supported by:

- The NSW Government’s Walking Communities Program which will deliver State funding and contribute to local government initiatives to help boost rates of walking. This includes funding for walking infrastructure within two kilometres of centres and transport interchanges.
- Safe crossing opportunities for cyclists, pedestrians and horse riders at Murrumbateman. This includes pedestrian refuges, and shared walking and cycling paths on corridors along and across the highway.
- The Murrumbateman Masterplan 2031 anticipates the construction of the Barton Highway’s bypass of Murrumbateman and proposes a network of greenways for walking, cycling and horse riding on both sides of the original highway. Part of the Murrumbateman bypass considers two greenway crossings of the highway. These crossings could be grade separated at bridges as indicated on the Murrumbateman 2031 Structure Plan, shown in **Figure 6-3**.
- Accommodating two kilometres of greenway alongside the highway (eastern side), opposite the winery precinct, shown in **Figure 6-3**.

Figure 6-3 Murrumbateman Master Plan 2031 – Structure Plan



6.5.2 Cycling

The *NSW Long Term Transport Master Plan* states an aim to enhance cycling routes in regional centres to increase the number of people who cycle. Increased cycling activity will be most likely to occur around the Murrumbateman village as it is the focus for current and future residential development along the Barton Highway. The Murrumbateman Masterplan 2031 proposes a network of greenways for walking, cycling and horse riding on both sides of the highway.

Future cycling facilities for the Barton Highway through Murrumbateman could be supported by the NSW Government's Connecting Centres Cycling Program, which works with councils and other stakeholders to identify bicycle network gaps and pinch points in the five kilometre catchments that surround regional towns. This program helps councils to complete local cycle networks to regional centres to get more people riding and to provide better information to customers. This could include initiatives such as secure bicycle storage and other appropriate end of trip facilities at public transport points.

The NSW Bicycle Guidelines note that bicycle provisions on rural roads can include sealed shoulders. This provides some separation from high speed traffic, such as the Barton Highway (outside of Murrumbateman) but continuity of the sealed shoulder should be maintained and constraint points including over bridges should be clearly signposted for all users.

Roads and Maritime Services is also committed to providing for all customer markets when planning, designing delivering and operating the road network in NSW. The use of cycling as a transport mode, and the provision of safe and convenient cycling facilities are fundamental to this commitment. Roads and Maritime Services' technical directions include improvements for safe cycling when maintenance or resurfacing work occurs on State roads. This could include pavement line marking and shoulder sealing.

6.6 Public transport

Transport for NSW will continue to improve transport services in towns and work in partnership with local bus operators to introduce a more robust framework for local and regional buses. This will include:

- Working with the bus operators to develop routes and timetables which improve services for customers.
- Developing a service framework that matches routes, coverage, hours of operation and vehicles with specific local needs.

Bus services provide the majority of public transport services for travel within the NSW Southern Region. A new framework for inter-town buses will target improvements designed to:

- Improve the frequency and hours of operation for inter-regional routes.
- Define base service requirements for village to town services including at least morning, afternoon and early evening return trip opportunities.
- Create a connected network of intra-regional services supported by local services within each centre and by connections to smaller villages.

Bus services for school children on the corridor will continue to be provided as these are an essential public transport service in the region.

The NSW Government will also develop and implement regional transport servicing principles to respond to growth and changes in transport demand. The principles provide a strategic framework to support the public transport services provided to regional centres and towns. The NSW Government will work with local transport providers to develop and apply the regional servicing principles to put the customer first and continue to work to broaden the range of services to meet local travel needs.

7 CORRIDOR CHALLENGES

McIntosh Circuit intersection, looking northbound

Hillview Drive intersection, looking southbound

Challenges associated with the Barton Highway are listed in **Table 7-1**. These are the main issues that need to be overcome to maintain or improve the transport roles and services that the Barton Highway provides for the community.

They include challenges already evident and others that are expected to emerge as the result of future changes in land use and demographics. These challenges have been mapped against broader *NSW Long Term Transport Master Plan (LTTMP)* objectives in the table below.

Table 7-1 Corridor challenges

Barton Highway corridor challenges	Where was the issue identified and further detail
LTTMP objectives: Improve liveability/Reduce social disadvantage	
Safety concerns for cyclists/pedestrians/ horse riders crossing the highway in Murrumbateman opposite the showground.	Safety concerns for active transport users crossing the highway in Murrumbateman were identified in the stakeholder and community consultation. An improved crossing between the Murrumbateman village and the showground is desirable.
Insufficient bus seats and shelters at bus stops along the highway.	There are minimal facilities at bus stops for public transport users such as shelters or seats. Nor are there facilities for car parking at bus stops to allow commuters to park and ride or park and wait for passengers leaving the bus.
The mix of users of the Barton Highway includes light vehicles, public transport users, pedestrians, horse riders, cyclists and freight vehicles. The interaction between these different users can cause potential conflict, particularly in Murrumbateman.	Two of the seven fatal crashes on the highway occurred in or near the Murrumbateman village (Section 3) which had the highest crash severity index along the highway. The fatal crashes within the Murrumbateman village were a vehicle collision with a pedestrian, and a head-on collision. In the Murrumbateman village area the crash severity index was higher as a result of four head-on and four rear end casualty crashes. Safety issues could be addressed in Murrumbateman by reducing conflicts between the different road user groups.

Barton Highway corridor challenges	Where was the issue identified and further detail
LTTMP objectives: Support economic growth/productivity Support regional development/accessibility	
Driver frustration at vehicles moving at different speeds along the corridor (including speeding and overtaking in unsuitable locations).	During peak traffic periods the route experiences level of service D and E in the peak direction (southbound in the morning and northbound in the evening). The TRARR traffic model estimates that vehicles are travelling with less than four seconds separation. This is likely to be the cause of motorists reporting frustration at not being able to overtake as freely as they would like during peak periods. The most common issue identified by the survey participants was 'Poor driver behaviour', where some commuters become frustrated with slower vehicles and drive in risky or unsafe ways in attempts to overtake. The need for additional overtaking lanes for Sections 2 and 4 were identified by both community feedback and technical assessments. The community reported that a lack of adequate overtaking lanes was one of the main causes of frustration and conflict between road users travelling at different speeds, and considered that this contributed to poor driver behaviour and crashes. The community most commonly identified locations in Section 4 where driver behaviour was poor and where they most often witnessed unsafe overtaking behaviour. This issue is reflected in the crash analysis and the road geometry deficiency with one fatality during overtaking and three others from vehicles involved in a head-on collision. Drivers also feel frustration at not knowing the current traffic condition along the corridor – both during planned and unplanned incidents/events and adverse weather conditions such as fog, ice or snow.
LTTMP objectives: Improve safety and security	
All vehicles have difficulty turning into and out of the Barton Highway at intersections and private access points when traffic is heavy.	Narrow shoulders and short acceleration or deceleration lanes make turning into and out of road and property access intersections difficult. Both the community and the bus operators identified that buses have difficulty accessing the highway in peak periods, and that the traffic travelling at speed along the highway often has to slow significantly to accommodate slow moving buses accelerating up to cruising speed. The third most common issue reported by all road user groups in the community survey was 'difficult access and egress at intersections'. This was supported by the crash analysis which identified six crashes recorded as a result of turning movements at intersections (includes vehicles waiting to turn). One crash between a light vehicle and a heavy vehicle occurred at the Euroka Avenue intersection as a result of the turning movement with the remaining five occurring between light vehicles at other intersections along the highway. The community identified this as a concern, and the road geometry analysis suggests narrow shoulders on a large proportion of the road, particularly southbound in Section 4, could be a contributing factor.

Barton Highway corridor challenges	Where was the issue identified and further detail
Crashes involving vehicles crossing the opposing travel lane or colliding with vehicles in the opposing travel lane were identified as a significant road safety issue.	Crash analysis has identified that 30 crashes (22 per cent of all crashes) involved a vehicle crossing into or across the opposing direction carriageway, resulting in five of the seven fatal crashes in the crash assessment five year period, and 18 injury crashes.
Waiting bus passengers exposed to vehicle run off as they wait at bus stops on narrow shoulders, close to high speed traffic.	The community identified concerns with safety of bus passengers waiting next to the highway. Fifty to 60 per cent of the southbound shoulders in Sections 3 and 4 are of a substandard width, particularly south of Murrumbateman, where there are minimal areas of local widening near bus stops and no safety provisions to provide refuge for waiting passengers. At several locations south of Murrumbateman village there is no pedestrian access to bus stops along the Barton Highway. The school bus stop on the corner of Gooda Creek Road and the Barton Highway has school children waiting very near to fast moving traffic without any physical barrier. The school bus stop at Kaveneys Road was also identified as a concern.
The access and exit from light and heavy vehicle rest areas does not allow safe merging of slow moving vehicles with high speed traffic.	Some rest areas are located next to curves or at the end of overtaking lanes. This was raised as a safety concern by community feedback, as it impacts sight distance for vehicles entering or exiting the rest area, particularly during peak periods.
The access to and exit from bus stops does not allow safe merging of slow moving vehicles with high speed traffic.	Bus operators involved in the stakeholder engagement identified that the majority of bus stop locations did not have adequate acceleration provisions for re-joining the highway. This is particularly noted for locations used by school bus services, which are often informal. It has also been noted that it is not easy for buses to join the traffic stream from side roads on the Barton Highway where lack of visibility (e.g. Vallencia Drive) or heavy traffic (e.g. Spring Range Road, Euroka Avenue) makes right turn movements by buses difficult. At Vallencia Drive, due to the difficulty involved in turning right onto the Barton Highway, southbound buses are reported to initially turn left onto the highway then turn right into Euroka Avenue, making a 'U-turn' before turning left back onto the highway to travel south.
Vegetation and other exposed hazards obscure road users' vision and are located in the clear zone (e.g. trees, culverts).	Hazards within the clear zone were identified within all sections on the highway; however Section 4 is identified as the priority area for management, with trees and other hazards identified by the community and confirmed by technical studies. Improvements could be made by either removing the hazard or providing a safety barrier between the road and the hazard. Many of the trees in the clear zone have been identified as having high ecological value.

Barton Highway corridor challenges	Where was the issue identified and further detail
Parts of the highway may become slippery in wet or icy conditions.	The pavement can become slippery in wet or icy conditions particularly in Sections 2, 3 and 4. The pavement should be monitored as skid resistance deteriorates so resurfacing can be carried out at the appropriate time.
Accessing the road pavement for routine maintenance.	Accessing the pavement for routine maintenance is challenging due to restrictions on when the road can be closed in daytime hours.
Insufficient/poorly maintained signage and poor delineation.	Community consultation has identified that Sections 2, 3 and 4 of the highway have worn or missing pavement markings or have 'blacked out' markings beginning to reappear in certain conditions of light and wet road surface. There are also some curves where delineation is lacking including: South of the Vallencia Drive intersection Between the Murrumbateman Road and McIntosh Circuit intersections North of Gounyan Road.
The lanes and shoulders are of inconsistent width along the highway, and sections of the highway are below the required standard for a Class 4 rural road.	In sections where higher proportions of the shoulders and lanes are narrower than the recommended target, the highest type of crash is vehicle run-off-road on straight or curve. As identified in the road safety analysis, 50–60 per cent of the southbound shoulders in Sections 3 and 4 are below the target width, particularly south of Murrumbateman.
LTTMP objective: Improve transport integration process	
The different travel needs of both local and commuter traffic users need to be balanced.	Local and commuter travel needs have been considered in detail through community consultation. The different functions of the corridor are also supported by ongoing collaboration on transport issues between the ACT and NSW.

8 TAKING ACTION

Murrumbateman Road intersection, looking northbound

End of duplication, looking southbound

The NSW Government priorities for responding to the Barton Highway corridor challenges set out in Chapter 7 are outlined below. Staged roadwork along the corridor will look to complement any future road duplication, including looking at opportunities to purchase any duplication corridor land.

These projects are divided into short, medium and long term investment priorities as presented in **Table 8-1**, **Table 8-2** and **Table 8-3**. Beyond the long term improvements are detailed in **Table 8-4**. These tables list projects grouped by type of work.

The planning of these potential works will consider where multiple projects can be combined to maximise the financial investment and efficiency. Implementing these actions would improve road safety, offer whole-of-life economic benefits and increase productivity of the Yass Valley Council LGA, the ACT Region and NSW.

The strategy identifies infrastructure (engineered) and operational (non-engineered) initiatives to improve road user safety, reduce travel times and increase reliability along the Barton Highway. A number of improvements identified during the study can be considered as routine maintenance activities such as pavement repairs and line marking, for which an annual budget allocation and program is already in place.

Regular reporting of the status of *Barton Highway Improvement Strategy* actions will be carried out through Roads and Maritime Services and Transport for NSW, to report on progress, to highlight any issues that need to be addressed, and to identify new actions or tasks to ensure that ongoing opportunities along the Barton Highway are being considered.

The Improvement Strategy will be updated at least every five years. Implementation of the final strategy will be a shared responsibility with Federal and NSW governments and Council in collaboration with other State agencies.

Table 8-1 Short term investment priorities (0–5 years)

Short term investment priorities (0–5 years)	
Actions	Strategic response reference
Develop and implement **two new overtaking lanes** along the corridor. One will nominally be a south bound overtaking lane between Nanima Road and Spring Range Road. A second (north bound) overtaking lane will be either between Spring Range Road and the ACT border, or between Mundays Lane and Kaveneys Road. The actual location and direction will be subject to design investigations into the best location based on traffic efficiency, safety, environmental considerations and construction constraints. Both overtaking lanes will utilise the future duplication alignment and provide upgraded pavement.	**Chapter 3.8** Key findings of the community and stakeholder engagement activities **Chapter 5.3** Traffic **Chapter 6.3** Traffic growth forecasts **Chapter 6.4** Staged duplication planning
In collaboration with the ACT Government, improve travel decision making for customers by **installing Intelligent Transport Systems** that will improve trip reliability, better manage incidents, and provide a smoother traffic flow along the highway. These may include real time traffic monitoring devices, Closed Circuit Television (CCTV), and Variable Message Signs (VMS) at strategic locations to inform of changed traffic conditions affecting travel time, variability, road conditions (e.g. fog and ice) and road closures, in a timely manner. Priority locations will be considered as part of the review of incident management plans. In collaboration with the ACT Government, investigate the development of **internet and smart phone based applications** to provide up-to-date information about traffic conditions on the Barton Highway. This will enable customers to make informed choices about the time they begin their journey, or the route they take.	**Chapter 3.8** Key findings of the community and stakeholder engagement activities **Chapter 5.3.7** Incident management
In conjunction with other projects and at specific locations as required, **implement targeted road safety campaigns** to address identified crash types and high risk areas. The road user education campaigns for behavioural change, could include targeted cross border media campaigns, enhanced police presence and targeted operations, and VMS education messaging strategy. Campaigns will include collaboration with relevant stakeholders including Yass Valley Council, and NSW and ACT government agencies.	**Chapter 5.2.6** Crash Types **Chapter 5.2.10** Road user behaviours
Continue **planning for the duplication** of the Barton Highway to ensure that large scale works that require long lead times can be progressed when needed. This means a strategic business case for staged duplication will be prepared to review the strategic concept design and timing as well as implementation staging of works. This will help to ensure that any future roadworks along the highway will complement the duplication corridor, including looking at opportunities to purchase any duplication corridor land as the pavement and clear zone widths are progressively improved.	**Chapter 3.8** Key findings of the community and stakeholder engagement activities **Chapter 6.3.2** Future duplication **Chapter 6.4** Staged duplication planning

Short term investment priorities (0–5 years)	
Actions	Strategic response reference
Develop and design an **upgrade to the curves** between Vallencia Drive and Gooda Creek Road at the north end of Section 4. Proposed works will utilise the reserved duplication corridor to provide a new two-lane road (one lane in each direction) which will ultimately form part of a dual carriageway (two lanes in each direction).	**Chapter 5.4** Road geometry
Upgrade intersections along the Barton Highway to improve safety and enable traffic entering/exiting side roads to do so safely amongst fast moving through traffic on the Barton Highway. This could include, but is not limited to: • Nanima Road • Hillview Drive • Vallencia Drive • Gooda Ck Rd.	**Chapter 3.8** Key findings of the community and stakeholder engagement activities **Chapter 5.2.8** Intersection related crashes **Chapter 5.3.3** Number of lanes and level of service **Chapter 5.3.6** Intersection performance
Progressively **implement recommended clear zones**, particularly in section 4. Methods to be employed may include: • Selective, controlled pruning/removal of vegetation and overhanging or encroaching branches, and removing hazards from the clear zone. • Flattening batters to reduce the chance of vehicles rolling if they leave the road. • Providing adequate safety barriers where hazards cannot be removed.	**Chapter 5.2** Road safety **Chapter 5.4.5** Clear zones and road safety barriers
Continue **bridge and culvert monitoring and maintenance**. Identify any emerging risks and implement management plans for bridges and culverts with an assessed risk level (ARL) rating less than three.	**Chapter 5.2** Road safety **Chapter 5.4.9** Bridges and culverts
In partnership with Council **improve access for cyclists, pedestrians and horse riders within Murrumbateman village** by connecting cyclist and pedestrian networks along the highway. Options that could be considered include: • Use of flashing warning lights • Upgrading or adding median refuges • Installing additional signage on approaches to Murrumbateman village.	**Chapter 4.9** Active transport **Chapter 5.2.11** Vulnerable road users

Short term investment priorities (0–5 years)	
Actions	Strategic response reference
In partnership with Council and bus operators, **improve bus stop locations** to reduce exposure of waiting passengers to passing traffic and weather impacts. Improvements would aim to: • Reduce passengers' exposure to the risk of being struck by passing traffic when waiting for or boarding/alighting a bus. • Improve entry to and exit from bus stops to enable buses to safely leave and re-enter the traffic stream at Rolfe Road, Nanima Rd, Gooda Creek Road and Mundays Lane. • Provide weather protection and/or seating where feasible.	**Chapter 3.6.1** Issues identified by stakeholders **Chapter 5.2.11** Vulnerable road users
Improve road delineation to help motorists stay in their travel lane and quickly identify curves and intersections, particularly in glary or low light conditions and at night. Options include: • In partnership with Council and where appropriate to address an identified issue, consider lighting at intersections. • Ensure all line marking and signage is consistent and to appropriate standards.	**Chapter 5.4.6** Guidance and delineation
Work with other agencies, and particularly Yass Valley Council to **review incident management plans**, and potential detour routes during road closures	**Chapter 3.6.1** Issues identified by the stakeholders **Chapter 5.3.7** Incident management
Monitor the implementation of the final Improvement Strategy every three years internally to inform on progress in implementing the strategy and whether the actions have been achieved, are on track, or need improvement. Review the entire strategy at least every five years.	**Chapter 8** Taking action

Table 8-2 Medium term investment priorities (5–10 years)

Medium term investment priorities (5–10 years)	
Actions	Strategic response reference
Implement an **upgrade to the curves** between Vallencia Drive and Gooda Creek Road at the north end of Section 4. Proposed works will utilise the reserved duplication corridor to provide a new two-lane road (one lane in each direction) which will ultimately form part of a dual carriageway (two lanes in each direction).	**Chapter 5.4** Road geometry
Continue to review and **upgrade intersections** along the Barton Highway.	**Chapter 3.8** Key findings of the community and stakeholder engagement activities **Chapter 5.2.8** Intersection related crashes **Chapter 5.3.3** Number of lanes and level of service **Chapter 5.3.6** Intersection performance
Continue to monitor the level of service along the corridor and manage this by planning and implementing staged improvements to the highway with **additional overtaking lanes**.	**Chapter 6.3** Traffic growth forecasts **Chapter 6.4** Staged duplication planning
Continue to provide the **recommended clear zone** requirements for the corridor.	**Chapter 5.2** Road safety **Chapter 5.4.5** Clear zones and road safety barriers
Continue to **widen narrow lanes** to 3.5 metres **and shoulders** to 2.0 metres along the corridor both northbound and southbound. Especially sections 3 and 4. The needs of cyclists on the shoulders should be considered as part of the shoulder widening planning process.	**Chapter 5.4** Road geometry
Monitor and evaluate Intelligent Transport Systems (variable message signs, variable speed limits and speed activated signs, closed circuit television cameras and real time traffic monitoring devices) implementation to ensure ongoing journey reliability.	**Chapter 3.8** Key findings of the community and stakeholder engagement activities
Investigate improvements for vehicles exiting the **heavy vehicle rest area** on the northbound carriageway north of the ACT border in accordance with the Roads and Maritime Services *Strategy for Major Heavy Vehicle Rest Areas on Key Rural Freight Routes in NSW* (January 2010).	**Chapter 5.4.8** Rest areas

Table 8-3 Long term investment priorities (10–20 years)

Long term investment priorities (10–20 years)	
Actions	Strategic response reference
Continue to **widen narrow lanes** to 3.5 metres **and shoulders** to 2.0 metres both northbound and southbound. Continue to provide the recommended clear zone requirements for the corridor.	**Chapter 5.4** Road geometry
Continue to **review and upgrade intersections** along the Barton Highway as appropriate.	**Chapter 3.8** Key findings of the community and stakeholder engagement activities **Chapter 5.2.8** Intersection related crashes **Chapter 5.3.3** Number of lanes and level of service **Chapter 5.3.6** Intersection performance
Continue to **monitor and manage the level of service** along the corridor by planning and implementing overtaking lanes as required.	**Chapter 3.8** Key findings of the community and stakeholder engagement activities **Chapter 5.3** Traffic **Chapter 6.3** Traffic growth forecasts **Chapter 6.4** Staged duplication planning

Table 8-4 Beyond the long term investment priorities (+20 years)

Beyond the long term investment priorities (+20 years)	
Actions	Strategic response reference
Continue to monitor traffic growth along the corridor. If the travel demand means that an acceptable level of service is being exceeded for a large proportion of traffic over extended portions of the day, then an increase in the number of lanes available should be assessed along with measures to manage travel demand. Sections with the highest traffic volumes would be targeted for partial duplication, however emerging safety issues would also be a strong influence.	**Chapter 6.4** Staged duplication planning

APPENDIX

Appendix 1: Barton Highway Terms of Reference

ATTACHEMENT A:
BARTON HIGHWAY IMPROVEMENT STRATEGY
Terms of Reference

Purpose:

Transport for NSW and Roads and Maritime Services, on behalf of the NSW and Australian Governments, are to prepare an Improvement Strategy for the Barton Highway. The strategy will guide the ongoing development of the road corridor within the corridor boundaries determined in 2011 for a future duplication of the Barton Highway. Although current projections indicate that the full duplication of the Barton Highway is not expected to be financially viable until at least 2038, it is appropriate that planning for the ongoing development, maintenance and management of the corridor progresses now for the future.

The Corridor Strategy will address the strategic framework described in the NSW Long Term Transport Master Plan (LTTMP). It will align with the LTTMP objectives and challenges and develop corridor specific objective and vision statements.

The strategy will assess the existing road performance, determine corridor challenges and develop appropriate investment priorities to address these challenges over the longer term. Transport solution or investment priorities will be identified for short (0-5 years), medium (5-10 years) and long (10 year +) timeframes. Assessment of short term investment priorities will include consideration of options for staged improvements to the highway including provision of overtaking opportunities, road shoulder widening, intersection upgrades and safety improvements.

Background:

Due to the rapid expansion of residential lifestyle and urban residential land use in the Yass Valley Shire that is serving as satellite suburbs of Canberra, there is a strategic requirement to plan the development and management of the Barton Highway from the Hume Highway to the ACT within the corridor boundaries for the future duplication.

The strategic road corridor boundaries for the Barton Highway duplication corridor were approved on 28 April 2011 and provided to Yass Valley Council for inclusion in their Local Environmental Plan. The report:

- *Barton Highway duplication – Preferred road corridor boundaries report*, prepared by Manidis Roberts for Roads and Maritime Services in November 2011

provides an overview of investigations and consultation undertaken to determine the road corridor boundaries, and documents the process of evaluation and the evaluation outcomes. This document is supported by the:

- *Preliminary Environmental Investigation* prepared by Aurecon Australian for Roads and Maritime Services in April 2010

and uses data and guidance from the safety analysis of the highway carried out in the:

- *Barton Highway safety review* prepared by the RTA in February 2008.

Appendix 1: Barton Highway Terms of Reference cont'd

In April 2012 strategic estimates were carried out based on the strategic duplication concepts developed for determining the corridor boundaries. This was followed by:

- *Barton Highway Duplication – Economic Evaluation Report,* produced by SKM for Roads and Maritime Services in November 2013.

The findings from this last study indicate that the duplication is not warranted in the short to medium term on purely economic grounds. However, the other studies and associated community consultation for the determining of the duplication corridor boundaries indicate that land use, demographic, social and environmental issues need further investigation to provide an appropriate context to the ongoing development of the Barton Highway Corridor.

The Australian and NSW Governments made a funding announcement in late December 2013 of $300,000 towards the completion of a Barton Highway Improvement Strategy as a staged masterplan, which will build on previous work that has identified a corridor for duplication of the road.

Approach:

The Barton Highway Improvement Strategy will be developed through further investigation of the land use, transport and traffic demands on the road corridor into the future, as well as extensive consultation with local communities and stakeholders about the future development of the Barton Highway corridor. Community consultation will form part of the study process.

The Barton Highway Improvement Strategy will consider the road as a whole while considering the unique characteristics of four sections:

- Dual carriageway from Hume Highway to the commencement of the single carriageway at Kirkton Road near the Yass River.
- End of existing dual carriageway to Murrumbateman.
- Murrumbateman village precinct.
- Murrumbateman village to the existing dual carriageway in the ACT.

Roles and Responsibilities:

Refer to the governance structure in Schedule 1.

Tasks:

The following will be carried out as part of developing the *Corridor Strategy*:

a) Identify the short (0-5 years), medium (5-10 years) and long term (10 year +) transport needs and corridor objectives for the Barton Highway duplication corridor between now and any future duplication taking into account expected future transport requirements and land use changes.

b) Through technical investigations, community consultation and economic analysis, identify opportunities for road safety, traffic efficiency, and asset management for social and economic benefit along the Barton Highway duplication corridor.

c) Identify corridor development opportunities and projects that align with the duplication corridor and maximise the benefit of any future investment on the Barton Highway duplication.

d) Provide recommendations on candidate projects and assign priority or intervention levels for these projects to be progressed.

Outputs:

Outputs of the investigations for the Improvement Strategy will include a list of investment priorities and the intervention levels for these to occur.

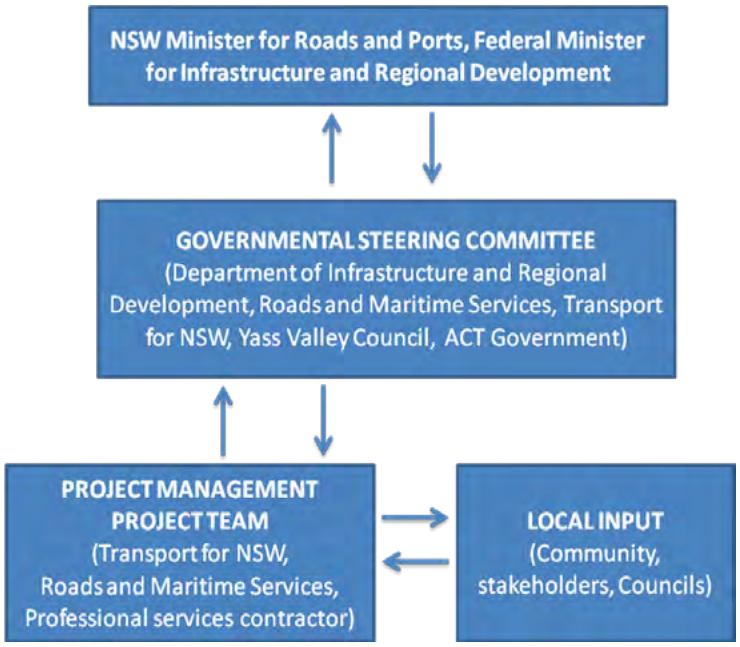
The Corridor Strategy will include:

- Outline of the study methodology.
- Summary of findings from relevant past studies pertaining to the Barton Highway duplication corridor.
- Description of corridor-specific objectives that support the NSW Long Term Transport Master Plan, Regional Transport Plan (and other State and national plans).
- Summary of current and future challenges in meeting these corridor-specific objectives.
- Assessment of all aspects of the current performance of the highway compared to a set of *Network Performance Measures and Planning Targets* developed by Roads and Maritime Services in 2010.
- Summary of factors that will influence traffic growth and traffic demand on the Barton Highway including forecast of traffic growth along the route (20 year horizon).
- Identified investment priorities for the development, maintenance and management of the Barton Highway duplication corridor.
- Recommended timeframes or intervention levels for further project development.

Timeframe:

Completion of a draft *Improvement Strategy* for Steering Committee consideration is required within 26 weeks of commissioning a contractor to assist in the study.

Appendix 1: Barton Highway Terms of Reference cont'd



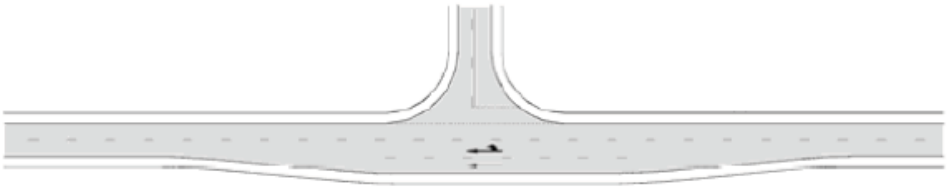
Role	Members	Responsibility/input
Governmental Steering Committee	• Department of Infrastructure and Regional Development • Roads and Maritime Services • Transport for NSW • Yass Valley Council • ACT Government	Review progress in accordance with Terms of Reference and provide guidance as required. Ensure Ministers and Councils are kept informed.
Project Manager, Project Team	• Transport for NSW • Roads and Maritime Services • Professional Services Contractor	Project management, liaise with stakeholders, and undertake project studies. Provide secretariat to Governmental Steering Committee. Manage contractors. Oversee community consultation.
Local input	• Community, stakeholders, Yass Valley Council	The Barton Highway Improvement Strategy will be developed through consultation with local communities and stakeholders about the future development of the road. It is anticipated that once a draft strategy is developed, stakeholders will be invited to make comments over a four week period. This feedback will be considered as part of the preparation of the final document.

Appendix 2: Terms of Reference outputs

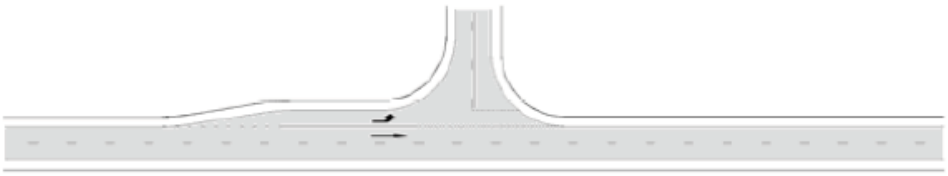
Terms of Reference Outputs	Improvement strategy chapter reference
Outline of the study methodology	Chapter 2.1
Summary of findings from relevant past studies pertaining to the Barton Highway duplication corridor	Chapter 2.4
Description of corridor-specific objectives that support the NSW Long Term Transport Master Plan, Regional Transport Plan (and other State and national plans)	Chapters 2.6 and 2.7
Summary of current and future challenges in meeting these corridor-specific objectives	Chapters 4.2-4.8 Chapters 6.1-6.5
Assessment of all aspects of the current performance of the highway compared to a set of Network Performance Measures and Planning Targets developed by the RMS in 2010	Chapter 5
Summary of factors that will influence traffic growth and traffic demand on the Barton Highway including forecast of traffic growth along the route (20 year horizon)	Chapters 6.1-6.3
Identified investment priorities for the development, maintenance and management of the Barton Highway duplication corridor	Chapters 7 and 8
Recommended timeframes or intervention levels for further project development	Chapter 8

GLOSSARY

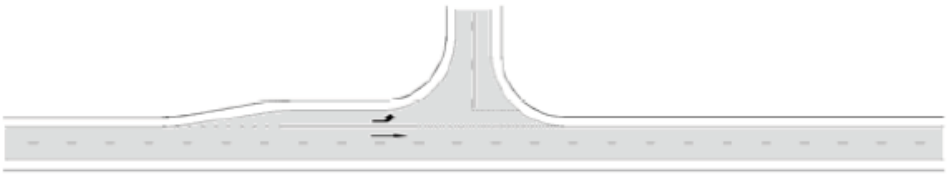
Term	Definition
Active transport	The movement of people by cycling, walking or on horseback.
Auxiliary lane	A portion of the carriageway adjoining through traffic lanes, used for speed change or for other purposes supplementary to through traffic movement.
AUR, AUL	Auxiliary intersection treatment right and left



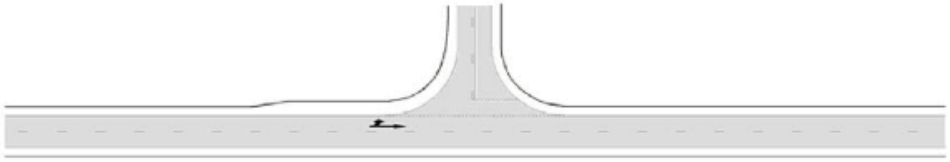
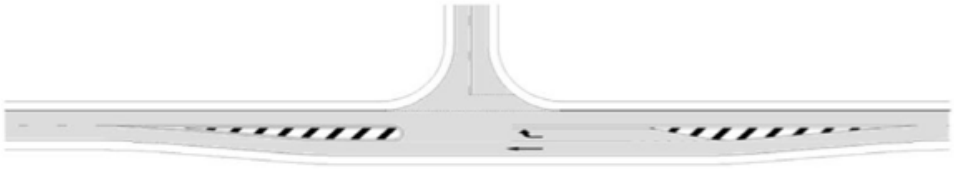
Auxiliary Right Turn (AUR) on the Major Road (Two-Lane, Two-Way Road).
This turn type not as safe as a channelised treatment at unsignalised intersections.



Auxiliary Left Turn (AUL) on the Major Road.
CHL treatment is preferred at unsignalised intersections to ensure a clear line of sight for vehicles turning from the minor road.



Auxiliary Left Turn (AUL) on the Minor Road.
This type is undesirable at unsignalised intersections because it is not as safe as a single lane approach. CHL treatment preferred.

Term	Definition
BAR, BAL	Basic intersection treatment right and left.  Basic Right Turn (BAR) on the Major Road (Two-Lane, Two-Way Road).  Basic Left Turn (BAL) on the Major Road.
Carriageway	That portion of a road or bridge devoted particularly to the use of vehicles, that is between guide posts, kerbs, or barriers where these are provided, inclusive of shoulders and auxiliary lanes.
CHR, CHL	Channelised intersection treatment right and left.  Channelised Right Turn (CHR) on the Major Road.  Channelised Left Turn (CHL) on the Major Road.  Channelised Right Turn (CHL) on the Minor Road.

Term	Definition
CHR (s) & CHL(s)	Short channelised intersection treatment, the channelised portion of the intersection is shorter than a CHR.
Culvert	One or more adjacent pipes or enclosed channels for conveying water, a watercourse or stream below under the surface of a road. Culverts minimise flooding by minimising water building up alongside the road and overtopping the road surface (causing flooding) to escape.
General access vehicle	A vehicle that has unlimited access to the road network, limits being 2.5m wide, 4.3m high, 12.5m long for rigid vehicles and 19m long for single combinations and conforming axle groups.
Higher Mass Limit route	Higher Mass Limits is a nationally agreed scheme that permits approved heavy vehicles to operate with additional mass on certain types of axle groups, on a restricted road network and subject to specified conditions. Details are specific to each vehicle type, see **ntc.gov.au**
Platoon	A closely spaced group of vehicles on a carriageway, moving or stopped and ready to move, with relatively large spaces ahead and behind.
Road smoothness	A surface condition in which the aggregate is worn and the texture depth is minimal.
Roadloc chainage	The name given to the linear referencing system used by Roads and Maritime Services.
Roughness	The consequence of irregularities in the longitudinal profile of a road with respect to the intended profile.
Rutting	The longitudinal vertical deformation of a pavement surface in a wheel path, measured relative to a straight edge placed at right angles to the traffic flow and across the wheel path.
Shoulder	The portion of a carriageway beyond the traffic lanes and contiguous and flush with the surface of the pavement.
Through lane	A lane provided for the use of vehicles proceeding straight ahead.
TRARR	Traffic on Rural Roads (TRARR) is a micro-simulation model of traffic flow on two-lane roads used to investigate overtaking lane projects in particular.
Verge	The section of the road formation that joins the shoulder with the batter.

Australian Government

BUILDING OUR FUTURE

NSW GOVERNMENT

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