17

McLean, Jock

From: Sainsbury, Marcus [Marcus.Sainsbury@aecom.com]
Sent: Friday, 19 August 2011 3:29 PM
To: Carly Porreca
Cc: McLean, Jock; McHugh, Ben; Weeks, Rod; Alan Peggie; Blackmore, Marc
Subject: Parkes Way Widening - EPBC Self Assessment
Attachments: EPBC Act Self-assessment v1-0.pdf

Hi Carly,

Further to Marc Blackmore's previous email, please find attached the EPBC Self Assessment Report for the proposed Parkes Way Widening project.

If you have any questions or comments, please don't hesitate to contact me.

Kind regards, Marcus

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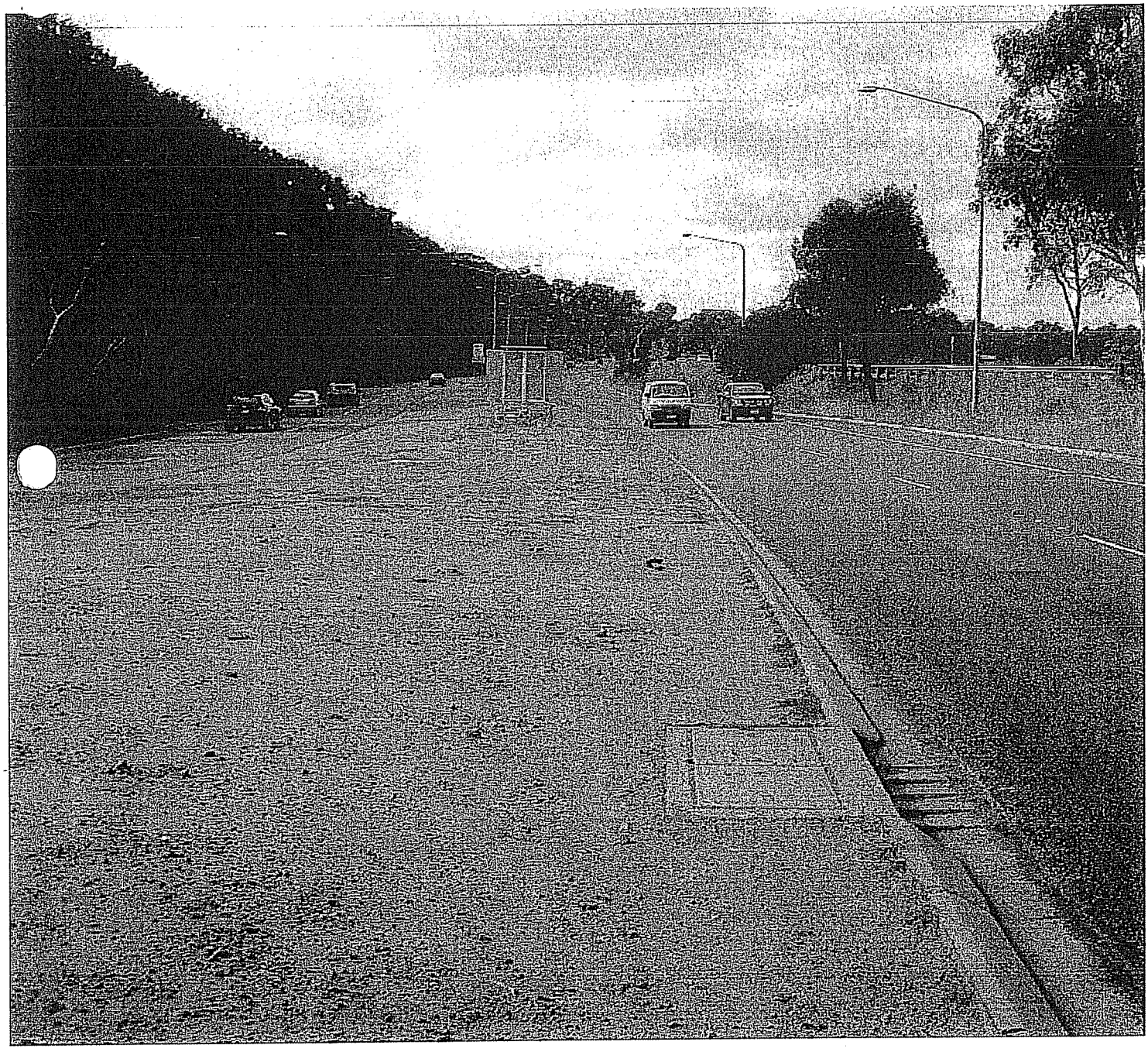
Parkes Way Widening

Environment Protection and Biodiversity Conservation Act 1999 Self-assessment



Parkes Way Widening

Environment Protection and Biodiversity Conservation Act 1999 Self-assessment

Prepared for

Roads ACT

Prepared by

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19 August 2011

60198222

AECOM in Australia and New Zealand is certified to the latest version of ISO9001 and ISO14001.

Quality Information

Document Parkes Way Widening

Ref 60198222

Date 19 August 2011

Prepared by Emma Struys

Reviewed by Marcus Sainsbury

Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
1	17-Aug-2011	For Issue	Marcus Sainsbury Principal Environmental Scientist	

Table of Contents

1.0 Introduction

Roads ACT engaged AECOM Pty Ltd to design, document and superintend upgrade works involving the widening of Parkes Way, Canberra (the Proposal). A self-assessment was conducted to determine if there was any likelihood of the Proposal having a significant impact on matters protected under *the Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This report presents the results of the self-assessment, in accordance with significance criteria set out in the Significant Impact Guidelines 1.1 (DEWHA 2009) and 1.2 (DEWHA, 2010).

This assessment determines whether a referral to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) for a decision by the Commonwealth environment minister on whether further assessment and approval may be needed for the Proposal.

A self-assessment under the EPBC Act was deemed necessary in regards to the following criteria:

- Any person who proposes to take an action which is either situated on Commonwealth land or which may Impact on Commonwealth land.
- Whether the action will have, or is likely to have, a significant impact on a matter of national environmental significance.

The proposal, while not located on Commonwealth land, is adjacent to and 'upstream' from Lake Burley Griffin. Lake Burley Griffin is Commonwealth owned and controlled land. It is therefore subject to the provisions of the EPBC Act. Lake Burley Griffin possesses a broad array of natural and cultural heritage values. This array includes the natural values of the wetlands and aquatic habitat provided by the Lake; historic heritage values relating to the shape and form of the Lake as a designed landscape; its foreshore plantings; designed foreshore parklands; the Lake's role as the setting for the surrounding national institutions; its reflective qualities; lake-based activities and uses; and the relationship to views and vistas of surrounding land, particularly Mount Ainslie, Black Mountain and the Parliament House Vista (land axis).

1.1 Proposal Description

Parkes Way is existing major thoroughfare in Canberra that suffers from peak hour congestion problems. The proposed road widening into the existing median would provide an additional lane each way on Parkes Way between Glenloch Interchange and Edinburgh Avenue and includes widening of the Clunies Ross Street and Sullivans Creek bridges in Acton. The compulsory left-turn lane commencing in the Acton Tunnel would be utilised as a new third lane and a new left turn slip lane to Edinburgh Avenue would be provided

The channelization of the intersection of the entry ramps to Commonwealth Avenue from the Parkes Way and London Circuit is also included in the proposed works.

Given the relatively long section of widening, the Proposal components have been broken down into four consecutive segments based on present road features. The four segments along the Parkes Way include:

- Glenloch Interchange to Black Mountain Peninsula.
- Black Mountain Peninsula to Clunies Ross Street.
- Clunies Ross Street to Acton Tunnel.
- Acton Tunnel to Edinburgh Avenue.

Following widening, the residual median between the Glenloch Interchange and Clunies Ross Street would be 4.2 m wide. A wire rope barrier would be installed in the median and the surface paved to minimise maintenance requirements.

Street lighting between the Glenloch Interchange and Clunies Ross Street would be relocated from the median to the verges. There would be minimum impacts on existing utility services.

Between Clunies Ross Street and Edinburgh Avenue the existing guardrail arrangement would be retained although on a realigned kerb line.

Bridges at Clunies Ross Street and Sullivans Creek would be widened by 2.8 m and 3.7 m respectively. "Super T" girders and new piers would be utilised for the widening at Clunies Ross Street. Whilst at Sullivans Creek the

existing form of the superstructure and substructure would be replicated using pre-stressed beams, widened pile caps and new piers, installed with the assistance of a barge mounted crane to be temporarily located within Sullivans Creek during the construction phase.

1.2 Proposal Justification

Developments either planned or under consideration in the ACT over the next twenty years will likely increase the road network demand in Canberra. A significant proportion of these developments are located close to the centre of the Canberra metropolitan area. Planned future developments will impact the current major transport corridor from the new district of Molonglo to the Canberra Airport/NSW border, known as East West Corridor. The East West Corridor transportation study adopted by Roads ACT, recommended a more detailed investigation into adding an additional lane each way on Parkes Way between Glenloch Interchange and Edinburgh Avenue.

1.3 Matters of National Environmental Significance (NES)

The matters of national environmental significance (NES) protected under the EPBC Act include:

- Listed threatened species and ecological communities.
- Migratory species protected under international agreements.
- RAMSAR wetlands of international importance.
- The Commonwealth marine environment.
- World Heritage properties.
- National Heritage places.
- The Great Barrier Reef Marine Park.
- Nuclear actions.

Sections 2.0 and 3.0 below examine whether the Proposal is likely to impact on any of these matters of NES.

2.0 Environmental Context

2.1 What are the components or features of the environment?

The general features of the environment in the area impacted by the Proposal include Parkes Way aligned east-west between Glenloch interchange and Edinburgh Avenue. Parkes Way runs between Black Mountain Nature Reserve to the north, and Lake Burley Griffin to the south. It is currently a dual carriageway and between the two carriageways is a wide landscaped median. The general features of the environment surrounding the Proposal include the following:

- The dominant landform features at the Proposal site are the Black Mountain and Lake Burley Griffin, with the southern slopes of Black Mountain dropping steeply to the Lake.
- Black Mountain Peninsula (located to the south of the Proposal site) is a landscape feature and popular location for lakeside recreational activities.
- West of the Acton Tunnel Parkes Way passes across a bridge over Sullivans Creek, which flows from north Canberra through the ANU into Lake Burley Griffin.

2.1.1 Matters of NES Ecology

A search utilising the EPBC Act Protective Matters Search Tool was conducted on 9 August 2011. This search provided a general overview of matters of NES and other matters protected by the EPBC Act, within a 1km buffer of the Proposal site. The search results identified there are two threatened ecological communities likely to occur within 1km of the Proposal, including one endangered ecological community (EEC) and one critically endangered ecological community (CEEC). They are:

- Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory (NTG EEC); and

- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Yellow Box Woodland CEEC).

The Yellow Box Woodland CEEC and NTG EEC are also listed under the ACT *Nature Conservation Act 1980* as endangered ecological communities. ACT vegetation mapping indicates that these listed communities are not present along Parkes Way but in Nature Reserve lands adjacent, and outside of the proposal site. Threatened flora and fauna protected under the EPBC Act that may occur within 1km of the Proposal are presented in Table 1 with their status under Commonwealth and ACT legislation.

Table 1. Threatened Species with a potential to occur within a 1km radius of the Proposal.

Threatened Species			
Scientific Name	Common Name(s)	Listed Status in EPBC Act	Listed Under NC Act
BIRDS			
Anthochaera phrygia	Regent Honeyeater	Endangered	-
Lathamus discolor	Swift Parrot	Endangered	-
Polytelis swainsonii	Superb Parrot	Vulnerable	Vulnerable
Rostratula australis	Australian Painted Snipe	Vulnerable	Vulnerable
FISH			
Maccullochella peelii peelii	Murray Cod, Cod, Goodoo	Vulnerable	-
Macquaria australasica	Macquarie Perch	Endangered	Endangered
FROGS			
Litoria castanea	Yellow-spotted Tree Frog, Yellow-spotted Bell Frog	Endangered	-
INSECTS			
Synemon plana	Golden Sun Moth	Critically Endangered	Endangered
MAMMALS			
Dasyurus maculatus maculatus (SE mainland population)	Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (Southeastern mainland population)	Endangered	Vulnerable
PLANTS			
Lepidium ginninderrense	Ginninderra Peppercress	Vulnerable	Endangered
Leucochrysum albicans var. tricolor	Hoary Sunray	Endangered	-
Swainsona recta	Small Purple-pea, Mountain Swainson-pea	Endangered	Endangered
Thesium australe	Austral Toadflax, Toadflax	Vulnerable	-
REPTILES			
Aprasia parapulchella	Pink-tailed Worm-lizard	Vulnerable	Vulnerable
Delma impar	Striped Legless Lizard	Vulnerable	Vulnerable

2.1.2 Matters of NES Heritage

There are sixteen Commonwealth heritage places either listed or nominated within a 1 km radius of the Proposal site protected under the EPBC Act. The sixteen places listed or nominated include:

- John Curtin School of Medical Research ACT - Indicative Place
- Acton Conservation Area ACT - Listed place
- Acton Peninsula Building 1 ACT - Listed place
- Acton Peninsula Building 15 ACT - Listed place
- Acton Peninsula Building 2 ACT - Listed place
- Acton Peninsula Limestone Outcrops ACT - Listed place
- Australian National Botanic Gardens (part) ACT - Listed place
- Canberra School of Art ACT - Listed place
- Canberra School of Music ACT - Listed place
- Institute of Anatomy (former) ACT - Listed place
- Lennox House Complex ACT - Listed place
- Parliament House Vista ACT - Listed place
- R G Menzies Building ANU ACT - Listed place
- Reserve Bank of Australia ACT - Listed place
- University House and Garden ACT - Listed place
- Lake Burley Griffin and Adjacent Lands ACT - Nominated place

In addition, there are three national heritage places listed or nominated under the EPBC Act. The three national heritage places are:

- Australian Academy of Science Building ACT
- Canberra – Central National Area and Inner (Nominated Place)
- Canberra and Surrounding Areas ACT (Nominated Place)

The Australian National Botanic Gardens ACT is listed as a Commonwealth Reserve protected by the EPBC Act as well as the indicative place Black Mountain, Aranda Bushland, O'Connor Ridge and Gossan Hill, ACT. Although these places have been listed within 1 km of the Proposal, the works associated with the Proposal would be consistent with the current visual environment, and not directly impact on any of the values.

2.2 Which components of the environment are likely to be impacted?

As the Proposal does not involve a new alignment of Parkes Way, and is mainly concerned with widening into the existing median area, environmental impacts are likely to be minor and of a temporary nature, occurring only during the construction period.

The existing Parkes Way is characterised by a four lane dual carriageway with a wide median that presents no important habitat for any of the terrestrial species listed in Table 1. However, the addition of two extra lanes may have a cumulative impact in terms of creating a wider barrier to terrestrial fauna movement, especially as Parkes Way runs adjacent to the two lanes of Lady Denman Drive along most of the length of the widening.

Although there is potential habitat for the Murray Cod and the Macquarie Perch within the Sullivans Creek, the area that would likely be affected by the proposal is small in comparison to the known ranges of these species, and given the species are highly mobile, adverse impacts are expected to be minor. Specifically, the widening works on the Sullivan's Creek bridge have the potential to impact on the water quality within the creek, during piling works, on account of mobilising sediments. In addition, while construction occurs, there would likely be temporary impediments to access up Sullivans Creek for aquatic species as well as recreational users such as canoeists, or rowers. These temporary impediments to access would be as a result of barge mounted crane, and the environmental protection measures in place, including erosion and sediment controls, and silt curtains (if required). Notwithstanding, during construction a 13.5 m wide access would be maintained within Sullivans Creek.

2.3 Is the environment sensitive or vulnerable to impacts?

As previously mentioned in Section 2.1, there are a number of flora and fauna species listed as endangered or vulnerable that have the potential to occur within 1km of the Proposal. There are also two threatened ecological communities likely to occur within 1km of the Proposal. The likelihood of these species or communities utilising the area to be affected by the proposal is low, given that the majority of works are located within he existing median of Parkes Way, with some minor works within the Sullivans Creek.

Additionally, the Proposal borders the Lake Burley Griffin heritage listed area, however works would occur within the existing road reserve, and would not directly impact on this heritage nominated area. There is however the potential for indirect impacts on the Lake Burley Griffin area, on account of sediment laden construction runoff. The implementation of appropriate erosion and sediment controls, as indicated in Section 4, would manage these potential impacts.

2.4 What is the history, current use and condition of the environment which is likely to be impacted by the action?

The existing four lane divided carriageway Parkes Way is the dominant land use in the area that would be affected by the Proposal. Road margins, including the median, although vegetated with planted vegetation would suffer edge effects from the operation of Parkes Way, and therefore are characterised as being in poor ecological condition. Sullivans Creek is a small creek which drains both urban and rural land in the north of the ACT before discharging into Lake Burley Griffin. The last two kilometres of the creek passes through the Australian National University where it is a focus of the landscaping of the university grounds.

3.0 Potential Impacts

3.1 What are the components of the action?

The scope of works associated with the Proposal includes the following actions:

- Widening Parkes Way in both directions from the eastern side of the Glenloch Interchange to Clunies Ross Street by using part of the existing median to provide the additional lanes.
- Widening Parkes Way at the Clunies Ross Street twin bridges by construction of extensions to the median side of the bridge decks using super tee girders supported on new piers and extended abutments.
- Widening Parkes Way at the Sullivans Creek bridge by extensions to the median side of the bridge decks by constructing a new cast insitu post tensioned box girder supported on new piers and extended abutments.
- Modifying the Clunies Ross Street ramps to match the road widening works.
- Widening Parkes Way eastbound within the median from the Acton Tunnel to east of the Edinburgh Avenue overpass.
- Modifying the Edinburgh Avenue off-ramp to replace the present compulsory right-turn lane which would form the third lane.
- Adding channelization to the intersection of the on-ramp from Parkes Way to Commonwealth Avenue southbound with the on-ramp from London Circuit to Commonwealth Avenue southbound to improve traffic flow.

The scope of works involves a number of actions which have the potential to impact on the environment. The impacts related to relevant actions have been summarised in Table 2.

Table 2. Impacts related to actions involved with the proposal.

Action	Impact
Widening Parkes Way in both directions from the eastern side of the Glenloch Interchange to Clunies Ross Street.	- Road area expanding into the already highly disturbed median areas of the Parkes Way. - Impacts during construction include potential for erosion and sedimentation.
Widening Parkes Way at the Sullivans Creek bridge by extensions to the median side of the bridge decks.	- Temporary barge installed to support construction works may be an impediment to fauna travelling between Sullivans Creek and Lake Burley Griffin.
Modifying the Clunies Ross Street ramps.	- The ramps would be expanded pushing into the areas of road margin around the ramps. - Temporary soils disturbances may include potential for erosion and sedimentation towards Lake Burley Griffin and Sullivans Creek.

Action	Impact
Widening Parkes Way eastbound within the median from the Acton Tunnel to east of the Edinburgh Avenue overpass.	- Road area expanding into already highly disturbed median of the Parkes Way. - Impacts during construction include potential for erosion and sedimentation.

3.2 What are the predicted adverse impacts associated with the proposed action?

While there are a number of potential impacts associated with the Proposal (as listed in Table 2), these impacts are temporary, during construction and expected to be minor to negligible after mitigation measures have been employed.

3.3 How severe are the potential impacts?

To consider the severity of the potential impacts identified the scale, intensity, duration and frequency should be considered. Similar to a risk assessment, the severity levels of change are graded as severe, moderate or minor as a result of the potential impacts.

Scale

While the scale of the Proposal is quite considerate, altering an approximate 2.2 km stretch of the Parkes Way, the majority of works would be occurring within the median between the east and west bound carriageways. There are some works on the outer median towards Edinburgh Avenue with a slight realignment of a retaining wall. Overall, the scales of impacts are contained to local areas already disturbed by the road and traffic activity and result in a small scale of impacts.

Intensity

The intensity of the Proposal refers to strength and concentration of the impacts that may occur as a result. Considering the Proposal involves modification of road surfaces on the surface (i.e no major excavations underground) and once the proposal is completed, traffic conditions are not expected to increase dramatically, the intensity of the widening works is expected to be low.

Time, duration and frequency

The Proposal's would involve three stages of construction with the bridge works occurring in the first stage. The entire project would be conducted over approximately 15 months, with the bridge works taking most of this period while the road works would take around 6 months. As for the duration of impacts, they may extend beyond the construction time frame depending on the success of rehabilitation. This also would depend on the time of year the project is completed in, as completion in time for spring would facilitate faster regeneration around works. Overall timing, duration and frequency would be short term and although impacts may last longer than construction timing, these potential impacts are still considered short term.

Considering the criteria for the severity had small and localised scale, low intensity and short term duration and frequency, the Proposal is considered to result in minor to negligible potential impacts.

3.4 What is the extent of uncertainty about potential impacts?

The mitigation measures proposed in Section 4 are considered to be industry standard, and are not difficult or complex to successfully implement. Successful implementation of the mitigation measures proposed would ensure that there is a high degree of certainty regarding potential impacts identified.

4.0 Impact Avoidance and Mitigation Measures

Although the impacts have been considered as minor, a number of mitigation measures are proposed to avoid or control any impacts associated with the Proposal. Table 3 displays the potential impacts and mitigation measures during the construction and operational phase of the Proposal.

Table 3. Impacts identified and mitigations to control and avoid them.

Impacts	Mitigations
During construction	
- Possible erosion and sedimentation, as soils are disturbed, affecting local water quality.	- Project specific erosion and sediment control plans would be developed and progressively implemented for the works. - Install silt curtains within Sullivans Creek to ensure bridge works do not adversely impact water quality with the creek. - Re-vegetation of disturbed soils to minimise future erosion as a result of the Proposal. - Spill kits would be available at all times during construction activities.
- Temporary barge installed to support construction works may impede fauna movement between Sullivans Creek and Lake Burley Griffin.	- Maintain a minimum access around the barge within Sullivans Creek of 13.5 m
- The ramps would be expanded pushing into the areas of road margin around the ramps.	- Minimise the disturbance of surrounding vegetation by construction with temporary no-go fencing.
Post Construction	
- Soil disturbances may lead to impacts of sedimentation around the ramps and other road margins (on surfaces sloping towards the Lake Burley Griffin and Sullivans Creek).	- Maintain erosion and sediment controls for as long as necessary to minimise the pollution of nearby water paths. - Progressive rehabilitation of disturbed soils to minimise future erosion as a result of the Proposal.
- Road area expanding into the already highly disturbed median areas of the Parkes Way.	- Revegetation of road margins where possible to rehabilitate the area to pre construction appearance.

5.0 Conclusions of Self-Assessment

Taking the above information into consideration, impacts from the Proposal on matters of NES are expected to be minor to negligible. On this basis, a referral to the Commonwealth Department of Sustainability, Environment, Water and Communities is not required.

6.0 References

- Department of Environment, Water, Heritage and the Arts, (DEWHA, 2010), Action on or impacting upon Commonwealth land, and actions by Commonwealth agencies: Significant impact guidelines 1.2 online, http://www.environment.gov.au/epbc/publications/commonwealth-guidelines.html

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18

13 May 2011

Carly Porreca
National Capital Authority
Treasury Building
King Edward Terrace
PARKES ACT 2400

Dear Carly

Parkes Way Widening - Works Approval Application

Please find attached AECOM's Works Approval submission for the widening of Parkes Way. The following documents are included in the submission:

- Works Approval Design Report – 2 x A4
- Works Approval Drawings – 2 x A3
- Completed Development Approval Form
- Letter of authorization from Tony Gill (Director – Roads ACT) for AECOM to be the Works Approval applicant on behalf of Roads ACT.

A copy of the Temporary Traffic Management and Environmental Management drawings have been forwarded to TaMS for endorsement.

The cost of construction works is estimated to be $21,500,000.00 (excl. GST), which equates to a development approval fee of $13,850.00 (excl. GST). Jock McLean from Procurement Solutions will arrange payment of the fee upon confirmation from NCA.

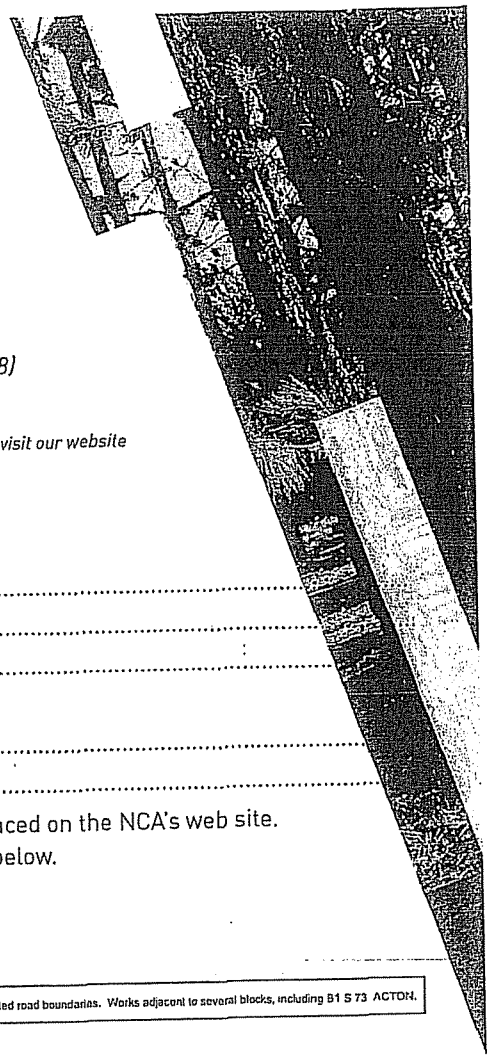
Please contact me at the number noted below should you have any questions regarding the Parkes Way Widening submission.

Yours faithfully

Marc Blackmore
Associate Director - Program Project Management
marc.blackmore@aecom.com

Mobile: 0412 294 845
Direct Dial: +61 2 6201 3023
Direct Fax: +61 2 6201 3099

encl: WA report x 2
WA drawings x 2
Development Approval Form
Letter of authorization
cc: File
J. McLean



Australian Government
National Capital Authority

APPLICATION FOR DEVELOPMENT APPROVAL

(Works Approval under the Australian Capital Territory (Planning and Land Management) Act 1988)

Treasury Building, Parkes ACT 2600 | Telephone 6271 2836 | Fax 6273 4427 | Web www.nationalcapital.gov.au
Do you understand the Development Approval process? ☒ *Yes* ☐ *No If not, please ring 6271 2836 for further information or visit our website*
Note:3 sets of all drawings to be lodged with application.

APPLICANT'S DETAILS

Applicant: AECOM Australia Pty Ltd Contact Person: Marc Blackmore
Postal Address: PO Box 1942 Canberra, ACT 2601
Phone: 6201 3000 Email: marc.blackmore@aecom.com

Invoicing details *(If different)*
Name: Jock McLean
Postal Address: Level 1 North Dame Pattie Menzies House, 16 Challis Street, Dickson ACT 2602

Please note that details of this application, location and the name of the applicant will be placed on the NCA's web site. If you do not wish to have these details published on the NCA's website, please tick the box below.
☐ I do not wish to have details of this application published.

LOCATION ON OF PROPOSED WORKS

Block N/A Section N/A Suburb/District All works located within existing gazetted road boundaries. Works adjacent to several blocks, including B1 S 73 ACTON.

DESCRIPTION OF PROPOSED WORKS

Project Name Parkes Way Widening

Type of Works ☐ Buildings ☐ Landscape ☐ Signs ☐ Demolition
☐ Temporary Works ☒ Other (please specify) Widening of Parkes Way to provide an additional lane in each direction between Glenloch Interchange and Edinburgh Avenue.

Estimated Cost of Works $ 21,500,000.00 (EXCL. GST)

DETAILS OF PROPOSED WORKS (WHERE APPLICABLE)

Site Area
Gross Floor Area
Site Coverage
Car Park Spaces

SETBACKS
Front
Side(s)
Rear

HEIGHT
Storeys

Lease Compliance ☐ Yes ☐ No

NATURE OF SUBMISSION

☒ Sketch Plans ☐ Working Drawings ☐ Amendments ☐ Sample Board

Please list drawing numbers Refer to attached drawing transmittal.

DECLARATION: This application is being lodged by: the lessee or a representative of the lessee with his/her approval

Signature of Submitter: Date: 13/5/11

NCA STAFF TO COMPLETE

Development Approval Application No.:
Fee Calculated: Fee Received/to be invoiced
Signature: Date:

Territory and Municipal Services
ACT GOVERNMENT

Ms Carly Porreca
Senior Town Planner
National Capital Authority
PO Box 373
CANBERRA ACT 2601

Dear Ms Porreca

Parkes Way Widening (Glenloch interchange to Commonwealth Av)

Roads ACT are the Land Managers for Parkes Way.

In my capacity as the Director Roads ACT I authorise Aecom Australia to be the Applicant for a Works Approval Applications. I understand that Marc Blackmore of Aecom Austraila will be their contact person.

Yours sincerely

Tony Gill
Director
Roads ACT

6 April 2011

Locked Bag 2000, CIVIC SQUARE ACT 2608
Canberra Connect: 13 22 81

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Document List No. tml-drg-20-1

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☑ A3	☐ B3	☐ PDF+DWG	☐ By Hand	☐ As Requested	☐ Detail Design
☐ A4	☐ B4	☐ PDF+DGN	☐ Email	☐ For Approval	☐ For Construction
☐ Other	☐ Other	☐ Other	☐ LAN/WAN	☐ Construction	☐ As Built

Distribution Details

Organisation	Address	Attention	Copies
Nantional Capital Authority	Treasury Building, King Edward Terrace, PARKES ACT 2600	Carly Porreca	2

Document Details

Document Number	Rev	Document Title
60198222-DRG-20-GE0001	1	COVER SHEET SHT1
60198222-DRG-20-GE0002	1	DRAWING INDEX AND LOCALITY PLAN SHT1
60198222-DRG-20-GE0003	1	GENERAL NOTES AND LEGEND SHT1
60198222-DRG-20-RD1001	1	SITE PLAN CONTROL MCE01 CH 2536.660 TO CH 2700 SHT1
60198222-DRG-20-RD1002	1	SITE PLAN CONTROL MCE01 CH 2700 TO CH 3040 SHT2
60198222-DRG-20-RD1003	1	SITE PLAN CONTROL MCE01 CH 3040 TO CH 3380 SHT3
60198222-DRG-20-RD1004	1	SITE PLAN CONTROL MCE01 CH 3380 TO CH 3740 SHT4

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Document List No. tml-drg-20-1

Project name: Parks Way Widening

Project Number: 60198222

60198222-DRG-20-RD1005	1	SITE PLAN CONTROL MCE01 CH 3740 TO CH 4080 SHT5
60198222-DRG-20-RD1006	1	SITE PLAN CONTROL MCE01 CH 4080 TO CH 4420 SHT6
60198222-DRG-20-RD1007	1	SITE PLAN CONTROL MCE01 CH 4420TO CH 4760 SHT7
60198222-DRG-20-RD1008	1	SITE PLAN CONTROL MCE01 CH 4760 TO CH 5100 SHT8
60198222-DRG-20-RD1009	1	SITE PLAN CONTROL MCE01 CH 5100 TO CH 5440 SHT9
60198222-DRG-20-RD1010	1	SITE PLAN CONTROL MCE01 CH 5440 TO CH 5780 SHT10
60198222-DRG-20-RD1011	1	SITE PLAN CONTROL MCE01 CH 5780 TO CH 5954.909 SHT11
60198222-DRG-20-RD1012	1	ON RAMP FROM PARKES WAY TO COMMONWEALTH AVENUE SH12
60198222-DRG-20-RD1201	1	LONGITUDINAL SECTION CONTROL MCE01 SHT1
60198222-DRG-20-RD1202	1	LONGITUDINAL SECTION CONTROL MCE01 SHT2
60198222-DRG-20-RD1203	1	LONGITUDINAL SECTION CONTROL MCE01 SHT3
60198222-DRG-20-RD1204	1	LONGITUDINAL SECTION CONTROL MCE01 SHT4
60198222-DRG-20-RD1205	1	LONGITUDINAL SECTION CONTROL MCE01 SHT5
60198222-DRG-20-RD1206	1	LONGITUDINAL SECTION CONTROL MCE01 SHT6
60198222-DRG-20-RD1301	1	LONGITUDINAL SECTION CONTROL MCE02 SHT1
60198222-DRG-20-RD1302	1	LONGITUDINAL SECTION CONTROL MCE02 SHT2
60198222-DRG-20-RD1303	1	LONGITUDINAL SECTION CONTROL MCE02 SHT3
60198222-DRG-20-RD1304	1	LONGITUDINAL SECTION CONTROL MCE02 SHT4
60198222-DRG-20-RD1305	1	LONGITUDINAL SECTION CONTROL MCE02 SHT5
60198222-DRG-20-RD1401	1	TYPICAL CROSS SECTIONS CONTROL MCE01 CH 2600 AND CH 2800 SHT 1
60198222-DRG-20-RD1402	1	TYPICAL CROSS SECTIONS CONTROL MCE01 CH 3300 AND CH 3600 SHT 2
60198222-DRG-20-RD1403	1	TYPICAL CROSS SECTIONS CONTROL MCE01 CH 4050 AND CH 4600 SHT 3
60198222-DRG-20-RD1404	1	TYPICAL CROSS SECTIONS CONTROL MCE01 CH 5340 AND CH 5720 SHT 4

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Document List No. tml-drg-20-1

Project name: Parks Way Widening

Project Number: 60198222

60198222-DRG-20-DR3001	1	DRAINAGE AND SERVICES PLAN CONTROL MCE01 CH 2536.660 TO CH 2680 SHT1
60198222-DRG-20-DR3002	1	DRAINAGE AND SERVICES PLAN CONTROL MCE01 CH 2680 TO CH 2840 SHT2
60198222-DRG-20-DR3003	1	DRAINAGE AND SERVICES PLAN CONTROL MCE01 CH 2840 TO CH 3000 SHT3
60198222-DRG-20-DR3004	1	DRAINAGE AND SERVICES PLAN CONTROL MCE01 CH 3000TO CH 3060 SHT4
60198222-DRG-20-DR3005	1	DRAINAGE AND SERVICES PLAN CONTROL MCE01 CH 3060TO CH 3320 SHT5
60198222-DRG-20-DR3006	1	DRAINAGE AND SERVICES PLAN CONTROL MCE01 CH 3320 TO CH 3480 SHT6
60198222-DRG-20-DR3007	1	DRAINAGE AND SERVICES PLAN CONTROL MCE01 CH 3480 TO CH 3640 SHT7
60198222-DRG-20-DR3008	1	DRAINAGE AND SERVICES PLAN CONTROL MCE01 CH 3640 TO CH 3800 SHT8
60198222-DRG-20-DR3009	1	DRAINAGE AND SERVICES PLAN CONTROL MCE01 CH 3800 TO CH 3960 SHT9
60198222-DRG-20-DR3010	1	DRAINAGE AND SERVICES PLAN CONTROL MCE01 CH 3960 TO CH 4120 SHT10
60198222-DRG-20-DR3011	1	DRAINAGE AND SERVICES PLAN CONTROL MCE01 CH 4120 TO CH 4280 SHT11
60198222-DRG-20-DR3012	1	DRAINAGE AND SERVICES PLAN CONTROL MCE01 CH 4280 TO CH 4440 SHT12
60198222-DRG-20-DR3013	1	DRAINAGE AND SERVICES PLAN CONTROL MCE01 CH 4440 TO CH 4600 SHT13
60198222-DRG-20-DR3014	1	DRAINAGE AND SERVICES PLAN CONTROL MCE01 CH 4600 TO CH 4760 SHT14
60198222-DRG-20-DR3015	1	DRAINAGE AND SERVICES PLAN CONTROL MCE01 CH 4760 TO CH 4920 SHT15
60198222-DRG-20-DR3016	1	DRAINAGE AND SERVICES PLAN CONTROL MCE01 CH 4920 TO CH 5080 SHT16
60198222-DRG-20-DR3017	1	DRAINAGE AND SERVICES PLAN CONTROL MCE01 CH 5080 TO CH 5260 SHT17
60198222-DRG-20-DR3018	1	DRAINAGE AND SERVICES PLAN CONTROL MCE01 CH 5260 TO CH 5400 SHT18
60198222-DRG-20-DR3019	1	DRAINAGE AND SERVICES PLAN CONTROL MCE01 CH 5400 TO CH 5560 SHT19
60198222-DRG-20-DR3020	1	DRAINAGE AND SERVICES PLAN CONTROL MCE01 CH 5560 TO CH 5720 SHT20
60198222-DRG-20-DR3021	1	DRAINAGE AND SERVICES PLAN CONTROL MCE01 CH 5720 TO CH 5880 SHT21
60198222-DRG-20-DR3022	1	DRAINAGE AND SERVICES PLAN CONTROL MCE01 CH 5880 TO CH 5954.909 SHT22
60198222-DRG-20-SL4002	1	LIGHTING PLAN CONTROL MCE01 CH 2700 TO CH 3040 SHT2

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Project name: Parks Way Widening

Project Number: 60198222

60198222-DRG-20-SL4003	1	LIGHTING PLAN CONTROL MCE01 CH 3040 TO CH 3380 SHT3
60198222-DRG-20-SL4004	1	LIGHTING PLAN CONTROL MCE01 CH 3380TO CH 3740 SHT4
60198222-DRG-20-SL4005	1	LIGHTING PLAN CONTROL MCE01 CH 3740 TO CH 4080 SHT5
60198222-DRG-20-SL4006	1	LIGHTING PLAN CONTROL MCE01 CH 4080 TO CH 4420 SHT6
60198222-DRG-20-SL4021	1	LIGHTING DETAILS SHT1
60198222-DRG-20-TW6001	1	TEMPORARY TRAFFIC MANAGEMENT GENERAL NOTES AND LEGEND SHT1
60198222-DRG-20-TW6011	1	TEMPORARY TRAFFIC MANAGEMENT DETOUR CYCLE PATH SHT2
60198222-DRG-20-TW6012	1	TEMPORARY TRAFFIC MANAGEMENT CONTROL MCE01 CH 2536.660 TO CH 2700 SHT3
60198222-DRG-20-TW6013	1	TEMPORARY TRAFFIC MANAGEMENT CONTROL MCE01 CH 2700 TO CH 3040 SHT4
60198222-DRG-20-TW6014	1	TEMPORARY TRAFFIC MANAGEMENT CONTROL MCE01 CH 3040 TO CH 3380 SHT5
60198222-DRG-20-TW6015	1	TEMPORARY TRAFFIC MANAGEMENT CONTROL MCE01 CH 3380TO CH 3740 SHT6
60198222-DRG-20-TW6016	1	TEMPORARY TRAFFIC MANAGEMENT CONTROL MCE01 CH 3740 TO CH 4080 SHT7
60198222-DRG-20-TW6017	1	TEMPORARY TRAFFIC MANAGEMENT CONTROL MCE01 CH 4080 TO CH 4420 SHT8
60198222-DRG-20-TW6018	1	TEMPORARY TRAFFIC MANAGEMENT CONTROL MCE01 CH 4420TO CH 4760 SHT9
60198222-DRG-20-TW6019	1	TEMPORARY TRAFFIC MANAGEMENT CONTROL MCE01 CH 4760 TO CH 5100 SHT10
60198222-DRG-20-TW6020	1	TEMPORARY TRAFFIC MANAGEMENT CONTROL MCE01 CH 5100 TO CH 5440 SHT11
60198222-DRG-20-TW6021	1	TEMPORARY TRAFFIC MANAGEMENT CONTROL MCE01 CH 5440 TO CH 5780 SHT12
60198222-DRG-20-TW6022	1	TEMPORARY TRAFFIC MANAGEMENT CONTROL MCE01 CH 5780 TO CH 5954.909 SHT13
60198222-DRG-20-EN7001	1	ENVIRONMENTAL MANAGEMENT PLAN GENERAL NOTES AND LEGEND SHT1
60198222-DRG-20-EN7011	1	ENVIRONMENTAL MANAGEMENT PLAN CONTROL MCE01 CH 2536.660 TO CH 2700 SHT1
60198222-DRG-20-EN7012	1	ENVIRONMENTAL MANAGEMENT PLAN CONTROL MCE01 CH 2700 TO CH 3040 SHT2
60198222-DRG-20-EN7013	1	ENVIRONMENTAL MANAGEMENT PLAN CONTROL MCE01 CH 3040 TO CH 3380 SHT3
60198222-DRG-20-EN7014	1	ENVIRONMENTAL MANAGEMENT PLAN CONTROL MCE01 CH 3380TO CH 3740 SHT4

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Document List No. tml-drg-20-1

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Project Number: 60198222

60198222-DRG-20-EN7015	1	ENVIRONMENTAL MANAGEMENT PLAN CONTROL MCE01 CH 3740 TO CH 4080 SHT5
60198222-DRG-20-EN7016	1	ENVIRONMENTAL MANAGEMENT PLAN CONTROL MCE01 CH 4080 TO CH 4420 SHT6
60198222-DRG-20-EN7017	1	ENVIRONMENTAL MANAGEMENT PLAN CONTROL MCE01 CH 4420TO CH 4760 SHT7
60198222-DRG-20-EN7018	1	ENVIRONMENTAL MANAGEMENT PLAN CONTROL MCE01 CH 4760 TO CH 5100 SHT8
60198222-DRG-20-EN7019	1	ENVIRONMENTAL MANAGEMENT PLAN CONTROL MCE01 CH 5100 TO CH 5440 SHT9
60198222-DRG-20-EN7020	1	ENVIRONMENTAL MANAGEMENT PLAN CONTROL MCE01 CH 5440 TO CH 5780 SHT10
60198222-DRG-20-EN7021	1	ENVIRONMENTAL MANAGEMENT PLAN CONTROL MCE01 CH 5780 TO CH 5954.909 SHT11
60198222-DRG-20-EN7101	1	ENVIRONMENTAL MANAGEMENT TYPICAL CROSS SECTIONS CONDITIONS 1, 2 AND 3 SHT1
60198222-DRG-20-EN7102	1	ENVIRONMENTAL MANAGEMENT TYPICAL CROSS SECTIONS CONDITIONS 4 AND 5 SHT2
60198222-DRG-20-RW8001	1	ADJUSTMENTS TO RETAINING WALL No. 11 TOE OF WALL AT PAVEMENT PLAN AND ELEVATION SHT1
60198222-DRG-20-RW8002	1	ADJUSTMENTS TO RETAINING WALL No. 11 TYPICAL CROSS SECTION SHT2
60198222-DRG-20-RW8003	1	ADJUSTMENTS TO RETAINING WALL No. 11 RETAINING WALL BARRIER DETAIL SHT3
60198222-DRG-20-BR9101	1	BRIDGE OVER CLUNIES ROSS STREET PROPOSED WIDENING GENERAL ARRANGEMENT - SHEET 1 SHEET 1 OF 2
60198222-DRG-20-BR9102	1	BRIDGE OVER CLUNIES ROSS STREET PROPOSED WIDENING GENERAL ARRANGEMENT - SHEET 2 SHEET 2 OF 2
60198222-DRG-20-BR9201	1	BRIDGE OVER SULLIVANS CREEK PROPOSED WIDENING GENERAL ARRANGEMENT - SHEET 1 SHEET 1 OF 2
60198222-DRG-20-BR9202	1	BRIDGE OVER SULLIVANS CREEK PROPOSED WIDENING GENERAL ARRANGEMENT - SHEET 2 SHEET 2 OF 2
EL001	1	TITLE PAGE, LOCALITY PLAN AND DRAWING LIST
EL002	1	SITE LAYOUT
EL100	1	LIGHTING LAYOUT - SHEET 1
EL101	1	LIGHTING LAYOUT - SHEET 2
EL102	1	LIGHTING LAYOUT - SHEET 3
EL103	1	LIGHTING LAYOUT - SHEET 4
EL300	1	TYPICAL PLC LIGHTING CONTROL SCHEMATIC

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Project Number: 60198222

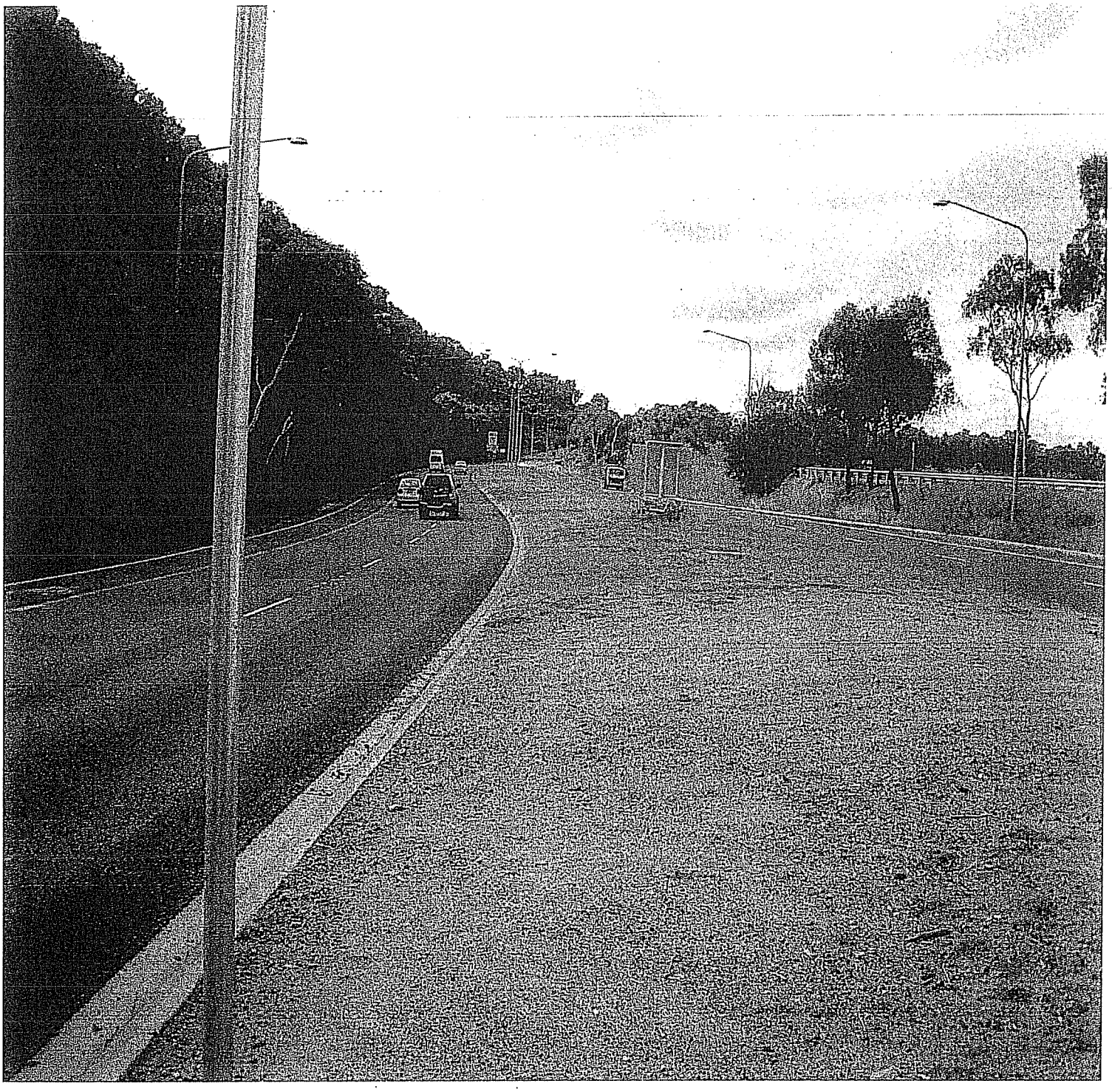
EL301	1	DISTRIBUTION SINGLE LINE DIAGRAM
EL400	1	MAIN SWITCHROOM PLAN AND TYPICAL CABLING ARRANGEMENT
EL401	1	TUNNEL LIGHTING CABLE LADDER GENERAL ARRANGEMENT

AECOM

Parkes Way Widening
Roads ACT
12 May 2011

Works Approval Design Report

Parkes Way Widening (Glenloch Interchange to Edinburgh Avenue)



Works Approval Design Report

Parkes Way Widening (Glenloch Interchange to Edinburgh Avenue)

Prepared for

Roads ACT

Prepared by

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12 May 2011

60198222

AECOM in Australia and New Zealand is certified to the latest version of ISO9001 and ISO14001.

Quality Information

Document	Works Approval Design Report
	60198222
Ref	j:\60198222_parkes_way_widening\6. draft docs\6.1. reports\nca works approval - may 2011\60198222_parkes-way_wa_rev0.0.docx
Date	12 May 2011
Prepared by	J. Peters
Reviewed by	R. Weeks

Revision History

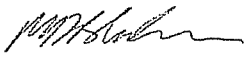
Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
0	11 May 2011	NCA Works Approval	M. Blackmore Project Manager	

Table of Contents

List of Tables

List of Figures

Executive Summary

Parkes Way is an existing road in Canberra that suffers from congestion problems. Roads ACT has engaged AECOM to design, document and superintend upgrade works involving the widening of Parkes Way.

The proposed road widening into the existing median will provide an additional lane each way on Parkes Way between Glenloch Interchange and Edinburgh Avenue and includes widening of the Clunies Ross Street and Sullivans Creek bridges. Through the Acton Tunnel the compulsory left-turn lane is utilised as the 3rd lane and a new left turn slip lane to Edinburgh Avenue is provided.

The channelization of the intersection of the entry ramps to Commonwealth Avenue from the Parkes Way and London Circuit is included in the works.

The design standards selected for the project and adopted in subsequent road design are dictated by the existing design which is generally for an 80 km/h design standard. Bridge widening works will conform to current standards for SM 1600 loadings. The existing structures have been checked for SM 1600 loadings and strengthening is required.

Given the long lengths of widening, this PSP report is broken down into four segments to clearly outline the constraints imposed by the existing geometry along the Parkes Way and subsequent changes resulting from the proposed widening. The four segments along the Parkes Way are as follows:

- Glenloch Interchange to Black Mountain Peninsula
- Black Mountain Peninsula to Clunies Ross Street
- Clunies Ross Street to Acton Tunnel and
- Acton Tunnel to Edinburgh Avenue.

The residual median between the Glenloch Interchange and Clunies Ross Street will be 4.2 m. A wire rope barrier will be installed in the median and the surface paved to minimise maintenance requirements.

Between Clunies Ross Street and Edinburgh Avenue the existing guardrail arrangement will be retained albeit on the realigned kerb line.

Street lighting between the Glenloch Interchange and Clunies Ross Street will be relocated from the median to the verges.

Bridges at Clunies Ross Street and Sullivans Creek will be widened by 2.80 m and 3.7 m respectively. Super T girders and new piers will be utilised for the widening at Clunies Ross Street. Whilst at Sullivans Creek the existing form of the superstructure and substructure will be replicated using pre-stressed beams, widened pile caps and new piers.

There are minimum impacts on existing utility services.

Traffic analyses have been undertaken to determine peak volumes along Parkes Way along with the potential to channelize the Parkes Way entry ramp to Commonwealth Avenue.

The pavement profile adopted for the proposed widening is a flexible pavement with a thin asphaltic concrete surfacing course. The cost estimate has assumed the need for a select fill layer in the pavement profile

The probable cost for the proposed road and bridge widening works is $ 21.5 M.

1.0 Introduction

1.1 Background

The developments either planned or under discussion over the next twenty years will increase the road network demand in Canberra. A significant proportion of these developments are located close to the centre of the Canberra metropolitan area. It will impact the current major transport corridor that extends from the proposed district of Molonglo to the Canberra Airport/NSW border known as East West Corridor. The East West Corridor transportation study under taken by AECOM provides the recommendation for a more detailed investigation for adding an additional lane each way on Parkes Way between Glenloch Interchange and Edinburgh Avenue.

AECOM were engaged by Roads ACT to undertake the design, documentation and superintendence for the upgrade works from Glenloch Interchange to Edinburgh Avenue.

1.2 Works Approval

This works approval (WA) report provides an overview of the design works undertaken by AECOM. It outlines the design objectives and the principles of the Parkes Way widening design. The documentation described within this report and the associated drawings defines the scope and probable construction cost of the works.

1.3 Scope of Works

The scope of works includes the following works:

- Widening Parkes Way in both directions from the eastern side of the Glenloch Interchange to Clunies Ross Street by using part of the existing median to provide the additional lanes.
- Widening Parkes Way at the Clunies Ross Street twin bridges by construction of extensions to the median side of the bridge decks using super tee girders supported on new piers and extended abutments.
- Widening Parkes Way at the Sullivans Creek bridge by extensions to the median side of the bridge decks by constructing a new cast insitu post tensioned box girder supported on new piers and extended abutments.
- Modifying the Clunies Ross Street ramps to match the road widening works.
- Widening Parkes Way eastbound within the median from the Acton Tunnel to east of the Edinburgh Avenue overpass,
- Modifying the Edinburgh Avenue off-ramp to replace the present compulsory right-turn lane which will now form the 3rd lane; and
- Adding channelization to the intersection of the on-ramp from Parkes Way to Commonwealth Avenue southbound with the on-ramp from London Circuit to Commonwealth Avenue southbound to improve traffic flow.

No modifications are proposed to the westbound carriageway on-ramp from Edinburgh Avenue, i.e. the lane from the ramp remains as the added 3rd lane.

1.4 Project Inputs and Assumptions

The (WA) design is based upon available information, including:

Information gathered during site visits

- Location of services (supplied in CAD/ DWF format by service authorities)
- Liaison with services authorities
- Detailed field survey
- Peak hour traffic surveys provided by Roads ACT to establish a SIDRA model of the Parks Way on-ramp to Commonwealth Avenue intersection of the on-ramp for London Circuit to Commonwealth Avenue.
- Liaison with TaMS tree unit and
- Comments on intersection layout from Client.

2.0 Design Standards

2.1 Introduction

The design standards selected for the project and adopted in subsequent road and bridge design comply with the provisions detailed within the standards and guidelines listed below.

2.2 Design Standards

- Design Standards for Urban Infrastructure
- AUSTROADS – Part 3 – Geometric Design
- AUSTROADS – Part 4c - Interchange
- AUSTROADS – Part 14 Bicycles
- RTA – Road Design Guide
- SAA – AS 5100 Bridge Design Code
- ACTEW Water Supply and Sewerage Standards

2.3 Previous Studies

The traffic study underpinning the warrant for the proposed widening of Parkes Way is the East to West Corridor Study which was undertaken in 2009. This study can be referred to for further details.

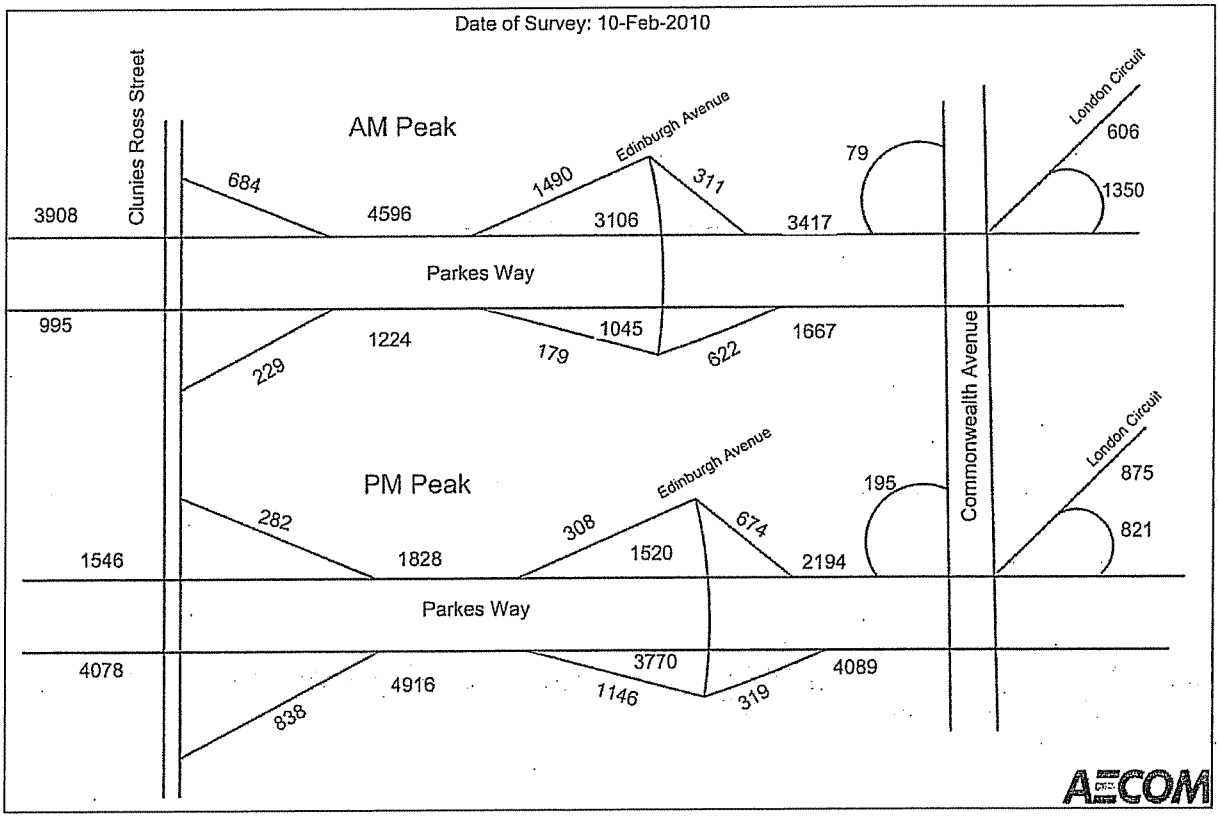
3.0 Road Capacity Analysis

3.1 Introduction

Capacity analyses were undertaken using 2010 and 2021 estimates of traffic volumes. The 2010 volumes were obtained from a recent survey of the section of Parkes Way being considered for widening, as well as the Parkes Way exit-ramp at Commonwealth Avenue and London Circuit East.

The results of the 2010 survey are summarised in Figure 3-1. Estimates of 2021 volumes were derived from the EMME modelling work done as part of the East West Corridor Study.

Figure 3-1: Existing (2010) Peak Hour Traffic Volumes



3.2 Midblock Capacity Analysis

"Level of Service" (LOS) is a measure to determine the operational conditions and efficiency of a roadway or intersection. The definition of LOS generally describes the operating conditions in terms of speed and travel time, freedom to manoeuvre, traffic interruptions, comfort and convenience, and road safety. There are six levels of service, A to F, with LOS A representing optimum operating conditions (free flow) and LOS F the poorest (forced or breakdown in flow).

Midblock capacity analysis was done based on the updated AustRoads, Guide to Traffic Management, Part 3 Traffic Studies and Analysis, 2009 and the Highway Capacity Manual (2000) using calculation methods for basic freeway segments.

Table 3-1 to Table 3-3 summarise the results of the AM peak hour midblock level of service analyses for the section of Parkes Way being considered in this study, for the years 2010 (existing) and 2021 respectively. This indicates that Parkes Way is already congested in the AM peak and will continue to be congested in the future.

Table 3-1 Volume Capacity Ratio – Parkes Way

Road	Section	# lanes	dir of dir 1	V/C Dir 1		V/C Dir 2		Total	
				2010	2021	2010	2021	2010	2021
Parkes Way	Glenloch Int-Clunies Ross	2	east	1.12	1.03	0.28	0.34	1.12	1.03
Parkes Way	Acton Tunnel	3	east	1.31	1.07	0.32	0.38	1.31	1.07
Parkes Way	under Edinburgh Av bridge	2	east	0.89	0.76	0.30	0.38	0.89	0.76

Table 3-2 Midblock LoS - 2010

Road	Section	# lanes	Peak Hr Direct 1	LoS1	Peak Hr Direct 2	LoS2
Parkes Way	Glenloch Int-Clunies Ross	2	3908	F	995	C
Parkes Way	Acton Tunnel	3	4596	F	1107	A-B
Parkes Way	under Edinburgh Av bridge	2	3106	F	1045	C

Table 3-3 Midblock LoS – 2021 (No Works)

Road	Section	# lanes	Peak Hr Direct 1	LoS1	Peak Hr Direct 2	LoS2
Parkes Way	Glenloch Int-Clunies Ross	2	4859	F	1183	D
Parkes Way	Acton Tunnel	3	5316	F	1335	C
Parkes Way	under Edinburgh Av bridge	2	3579	F	1331	D

A key observation from these results is that the capacity of Parkes Way needs to be increased, by widening the road. Table 3-4 shows the midblock level of service with the proposed widening. There is no widening of Acton Tunnel, so it will still exhibit some congestion when Parkes Way is widened.

Table 3-4 Midblock LoS – 2021 (With Widening)

Road	Section	# lanes	Peak Hr Direct 1	LoS1	Peak Hr Direct 2	LoS2
Parkes Way	Glenloch Int-Clunies Ross	3	4859	D	1183	A-B
Parkes Way	Acton Tunnel	3	5019	D	1335	C
Parkes Way	under Edinburgh Av bridge	3	3579	C	1331	C

3.3 Merge and Weaving

An analysis of the capacity of freeway ramps and weaving areas on Parkes Way was undertaken using procedures in the Highway Capacity Manual. The capacity of the ramps is determined from the worst level of service provided by either:

- The ramp proper
- The merge/diverge area to/from the ramp
- The section of freeway adjacent to the ramp

The results of the AM peak hour analyses of freeway ramps are summarised in Table 3-5 and Table 3-6, for the years 2010 and 2021 respectively. This analysis identified capacity problems eastbound on Parkes Way in the weaving section between the on-ramp from Clunies Ross Street and the off-ramp to Edinburgh Avenue in the AM peak. Similar problems may exist in the reverse direction in the PM peak on the Lawson Crescent off ramp onto Parkes Way (westbound).

Table 3-5 Level of Service – Existing Weaving Sections on Parkes Way

Parkes Way Eastbound (Clunies Ross Street ON ramp – Edinburgh Avenue OFF ramp)	Parkes Way Westbound (Lawson Crescent ON ramp and Lady Denman Drive OFF ramp)

2010	2021	2010	2021
F	F	A	B

Future analysis of the Clunies Ross Street ON ramp onto Parkes Way (EB) was also undertaken for the future as a merge instead of continuous lane. The results from that analysis are shown in Table 3-6. It shows that traffic from Clunies Ross Street will still have difficulty merging with eastbound Parkes Way traffic in the AM peak, although this traffic would not need to perform a weaving movement. There would be further congestion through Acton Tunnel and at the merge east of Edinburgh Avenue.

Table 3-6 Level of Service – Future Merge Segments on Parkes Way (with widening)

Parkes Way Eastbound (Clunies Ross Street ON ramp)	
2010	2021
E	E

3.4 Parkes Way to Commonwealth Avenue Entry Ramp

3.4.1 Options for Ramp

A SIDRA analysis of the Parkes Way off ramp onto Commonwealth Avenue was also undertaken as a part of this study, to help determine the design and impact of signal metering at the ramp junction with London Circuit East. The results from the analysis for the existing conditions are shown in Table 3-7, based on the give-way arrangement shown in Figure 3-2.

Figure 3-2 Intersection - Parkes Way OFF ramp / London Circuit OFF ramp

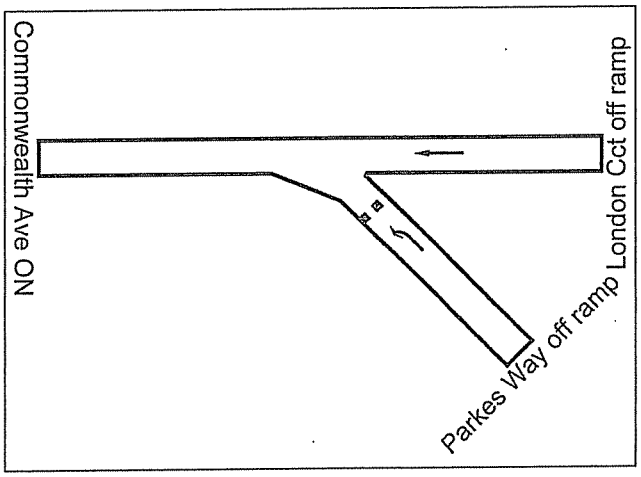


Table 3-7 SIDRA Results - Parkes Way OFF ramp / London Circuit OFF ramp GIVEWAY

Approach	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)
Parkes Way off ramp	1.106	117.3	F	788
London Cct off ramp	0.327	0.0	A	0
Total	1.106	80.9		788

The results from SIDRA analysis demonstrate the current situation at the intersection in the morning peak, in which the queuing on Parkes Way ramp extents up to 800 metres on Parkes Way therefore blocking the traffic coming from Commonwealth Avenue off ramp on to Parkes Way.

The full analysis of the intersection alternative treatments is discussed in Section 7.0.

4.0 Existing Condition Analysis and Proposed Widening Constraints and Opportunities

The project has been divided into four sections for the purpose of analysing the design standards adopted when the road was designed and built in the late 1970s and the impacts the widening has on the existing road and associated infrastructure.

4.1 Glenloch Interchange to Black Mountain Peninsula

4.1.1 Existing Conditions

4.1.1.1 Horizontal Geometry

This section across the Black Mountain escarpment has a combination of curve radii beginning with 635 m (westbound) and 530 m (eastbound) left-hand curves at the west end and then two right-hand compound curves of 1800 m and 1020 m radius respectively.

In the eastbound direction the two right-hand curves have a 3% adverse cross fall which has created safety issues in the past during winter due to ice forming as a result of heavy dew or frost, or following rainfall. The road in this location does not receive the full benefit of early sun due to its low elevation and the shading created by Black Mountain; hence the icy conditions remain during the peak hours. The condition is further exacerbated by the 0.5% longitudinal gradient on the road.

The situation has been alleviated by a bituminous seal over the earlier asphaltic concrete surface to create a greater texture depth in the surface as a method of improving skid resistance.

4.1.1.2 Vertical Geometry

The crest vertical curves at the Glenloch Interchange end of the work provide the following design speeds.

i) Eastbound

The crest vertical curve at the start of the widening proposed where the existing 3 lanes merge into 2 lanes has a stopping sight distance equivalent to 80 km/h for cars and 85 km/h for trucks.

ii) Westbound

The crest vertical curve at the end of the widening proposed where the existing 2 lanes continue to William Hovell Drive and the exit lane to the Tuggeranong Parkway commences, has a stopping sight distance equivalent to approximately 80 km/h for cars and 85 km/h for trucks.

The existing diverge taper for the Tuggeranong Parkway exit ramp commences on the crest of the vertical curve and is difficult to detect for approaching traffic.

iii) Longitudinal Grading

A gradient of 0.5% connects the western end of the escarpment to a low point located prior to the rising grade of 5.7% to the Black Mountain Peninsula.

4.1.1.3 Cross Section

The existing cross section within this section is generally as follows for the eastbound and westbound carriageways:

- 2 x 2.7 m wide traffic lanes
- m wide shoulder

The median separating the carriageways is 10.4 m wide measured face to face of the mountable kerb and gutter.

The Lady Denman Drive roadway embankment lies beyond the 3.0 m shoulder on the westbound carriageway and the steep Black Mountain escarpment within the Nature Park abuts the shoulder of the eastbound carriageway.

4.1.1.4 Geometric Deficiencies

Deficiencies in the present design relate to:

Adverse cross fall on the eastbound carriageway pavement. AUSTROADS recommends the following speed/curve radii relationships for curves with adverse cross fall.

- 80 km/h: 1250 m
- 90 km/h: 1700 m
- 100 km/h: 2250 m

Of these compound curves the 1800 m radius meets a 90 km/h design speed. The second portion of the compound curve is only suitable for an 80 km/h design speed.

Vertical curves on the east side of the Glenloch Interchange at the limit of the proposed widening work.

Provided that the posted speed does not change to 90 km/h (eastbound) until after the merge between Belconnen and Tuggeranong traffic the AUSTROADS design criteria is met.

Similarly for westbound traffic the 80 km/h posted speed should remain prior to the crest vertical curve approaching the Glenloch Interchange for AUSTROADS Guidelines to be met.

4.1.2 Proposed Works

4.1.2.1 Carriageway Widening to Form 3 Lanes

The widening of the carriageway to accommodate the extra lane will occur in the median due to the constraints identified in Section 4.1.2.2.

By narrowing the existing 3.7 m wide lanes from 3.7 m to 3.5 m the resulting widening into the median is 3.1 m for each carriageway with a residual median width of 4.2 m.

The narrowed median will be flanked by semi-mountable kerbs which do not require any offsets from the edge of traffic lane to the kerb face for design speeds up to 100 km/h.

4.1.2.2 Median Form

The narrowed median will require:

- Stabilised decomposed granite gravel paving to eliminate maintenance requirements in this relatively narrow strip and problematic safety issues for maintenance personnel that would be associated with a vegetation solution.
- Wire rope barriers over the total length. A post spacing of 2.5 m can be adopted given the 2.1 m clearance to the traffic lane which is acceptable for speeds up to 100 km/h.
- Relocation of the existing street lighting columns to the verges.

4.1.2.3 Line Marking

The carriageways will require remarking to account for the narrowing of the lanes to 3.5 m. This will affect the present lane line separating the existing two lanes.

4.1.2.4 Street Lighting

The existing twin arm street lights will need to be relocated to the verges as single arm columns.

Give the steep sloping areas of the Black Mountain escarpment generally 1.5 (H) to 1 (V) and the 1(H) in 1(V) batter on the Lady Denman Drive embankment the new light columns will need bases scalloped into the aforementioned batters.

Street light electrical cables will require installation at the edge of the existing paved shoulder requiring the reinstatement of trenches and pavement finishes. On the Black Mountain side the existing concrete formed high-capacity table drain will need to be cut through and reinstated following the installation of the cabling.

4.1.2.5 Stormwater Drainage

In this section the majority of the stormwater drainage sumps are located at the edge of the shoulder and hence are not affected by the works.

Notwithstanding there are several sumps on the median edge of the westbound carriageway which will need to be relocated to the new median kerb line together with their collector pipes.

The existing pavement edge sumps and collector pipe -work which are connected to transverse drainage lines discharging into Lake Burley Griffin are not affected by the works.

No new connections to Lake Burley Griffin are proposed or required.

No subsoil drains have been identified in the existing pavement. A study of the Works-Executed drawings also confirms this observation. New subsoils drains will be installed at the interface between the new and existing pavements.

The capacity and spacing of the existing sumps are acceptable for the widened road.

However, the potential for aquaplaning due to additional water flowing across the carriageway from the additional paved area will be verified in the final design phase. It will also be important to maintain a skid resistant surface on the areas in the shadow of the Black Mountain escarpment where ice has a tendency to occur on the adverse crossfall of the road following rain in the winter months.

4.2 Black Mountain Peninsula to Clunies Ross Street

4.2.1 Existing Conditions

4.2.1.1 Horizontal Geometry

The horizontal curves leading up onto the Black Mountain Peninsula and around to Clunies Ross Street consist of a 310 m radius left-hand curve followed by a 420 m radius right-hand curve. Both of these curves have 3% superelevation.

These radius curves equate to 75 km/h and 83 km/h design speeds respectively adopting the linear distribution of 'f' (friction) for 'e' (superelevation) of 5% maximum.

4.2.1.2 Vertical Geometry

The crest vertical curve at Black Mountain Peninsula has a stopping sight distances equivalent to approximately 80 km/h for cars and 85 km/h for trucks whilst the crest curve approaching Clunies Ross Street has stopping sight distance equivalent to approximately 90 km/h for cars and 95 km/h for trucks.

The gradients in this section range from 5.7% on the eastern approach to the Black Mountain Peninsula to 1.95% approaching the vertical curve near Clunies Ross Street.

A sag vertical curve is located at about the midpoint of this section.

4.2.1.3 Cross section

The cross section is generally as noted in Section 4.1.1.3 the exception being the interface with Lady Denman Drive which changes from being above Parkes Way to below Parkes Way with steep batters approaching slopes of 2 (Hl) and 1 (V) at the narrowest point. A narrow verge flanked by G4 type guardrail separates the westbound carriageway from the road embankment batters.

4.2.1.4 Geometric Deficiencies

The geometric deficiencies in this section relate to the:

- Posted speed limit of 90 km/h being in excess of the AUSTROADS guidelines for the Black Mountain Peninsula crest vertical curve and
- Posted speed limit of 90 km/h being in excess of the AUSTROADS guidelines for both horizontal curves.

4.2.2 Proposed Works

4.2.2.1 Carriageway Widening to Form 3 Lanes

The work is identical to that outline in Section 4.1.2.1.

4.2.2.2 Median Form

The work is identical to that outline in Section 4.1.2.2.

It should be noted that the installation of the wire rope barrier in the median in this Section will limit stopping sight distances as follows

i) Eastbound

- 310 m radius curve: 100 m (equivalent to 75 km/h design speed; cars and 68 km/h design speed; trucks)
- 420 m radius curve: 115 m (equivalent to 80 km/h design speed; cars and 70km/h design speed; trucks)

Offsetting the wire rope barrier to the 1.5 m minimum from the kerb line marginally increases the sight distance (+5%).

4.2.2.3 Line Marking

The work is identical to that outline in Section4.1.2.3.

4.2.2.4 Street Lighting

The work is generally similar to that outlined in Section 4.1.2.4, the exception being the lighting columns on the westbound carriageway verge will need to be located behind the guardrail.

4.2.2.5 Stormwater Drainage

The work is generally similar to that outlined in Section 4.1.2.5, the exception being:

- There are a greater number of sumps located at the median edge of the carriageway which will require relocation along with the connecting pipe network and
- Issues associated with icing are not applicable in this section.

4.3 Clunies Ross Street to Acton Tunnel

4.3.1 Existing Conditions

4.3.1.1 Horizontal Geometry

Between Clunies Ross Street and the Acton Tunnel horizontal curves vary from 400 m to 550 m (at the Acton Tunnel) in radius.

Both of these curves have superelevation of 3%.

These radii and superelevation equate to design speeds of 85 km/h and 88 km/h adopting the linear distribution of 'f' (friction) for 'e' (superelevation) of 5% maximum.

4.3.1.2 Vertical Geometry

The vertical geometry in this section commences with a -2.25% gradient at Clunies Ross Street reducing to 0.7% at Sullivans Creek. This latter grading continues through the Acton Tunnel.

Apart from the sag vertical curve west of Sullivans Creek there are no other vertical curves in this Section.

4.3.1.3 Cross Section

The carriageway widens from 2 lanes to 3 lanes on the east side of Sullivans Creek which is a result of the entry ramp from Clunies Ross Street joining the eastbound carriageway.

On the westbound carriageway a 3rd add-on lane commences at the Edinburgh Avenue interchange entry ramp and continues through to Clunies Ross Street where it becomes a compulsory exit ramp to Clunies Ross Street.

Both carriageways in the 3 lane section are configured as follows:

- 3 x 3.7 m wide traffic lanes
- 3.0 m wide left-hand shoulder
- 1.2 m wide right-hand shoulder

Within the 2 lane section between Clunies Ross Street and Sullivans Creek the configuration is:

- 2 x 3.7 m wide traffic lanes
- 3.0 m wide left-hand shoulder
- 1.2 m wide right-hand shoulder

The ramps to and from Clunies Ross Street have:

- 3.7 m wide traffic lane
- 1.8 m wide shoulder

The median width varies in this section commencing with 10. 2 m at Clunies Ross Street; 15.4 m (and varies) at Sullivans Creek; and 4.8 m at the approach to the Acton Tunnel.

4.3.1.4 Geometric Deficiencies

Apart from the horizontal curves as noted in Section 4.3.1.1 being less than the posted speed limit there are no other deficiencies in this section.

4.3.2 Proposed Works

4.3.2.1 Carriageway Widening to Form 3 Lanes

The widening to 3 lanes will occur in the median between Clunies Ross Street and Sullivans Creek.

Beyond Sullivans Creek on the eastbound carriageway the widening in the median will taper and merge into the existing median width approximately 250 m west of Acton Tunnel.

On the westbound carriageway the widening also joins the existing median opposite that of the eastbound carriageway.

The widening described above together with the existing 3 lanes formed by the on-ramp commencing at Clunies Ross Street (eastbound) and Edinburgh Avenue (westbound) enables the 3 lanes between Clunies Ross Street and the Acton Tunnel to be formed, i.e. the existing compulsory left-turn lanes will form the 3rd lane.

The entry and exit ramps at Clunies Ross Street will be reconfigured to join/depart the main carriageways respectively as ramps with merging/diverging tapers rather than the present exit and entry lanes.

The ramp merge/diverge tapers are designed for 100 km/h design speed on Parkes Way and are largely formed by linear line markings and chevrons rather than new kerb lines.

The 1.2 m wide sealed shoulder will be maintained on the right-hand side of each carriageway as required by the location of the barrier kerb and guardrail.

4.3.2.2 Median Form

The existing median is flanked by barrier kerbs with G4 guardrail aligning with the kerb face.

The kerb and guardrail will be removed and the additional pavement extended by 2.0 m into the variable width median.

It is intended that the barrier kerb and guard rail be reinstated on the new edge of the median given the need to join with the existing guardrail flanking the 4.8 m wide median at the approaches to the Acton Tunnel.

Part of the vegetation in the median will need to be removed and replaced with a stabilised decomposed granite paved surface, to remove the need for regular access for mowing the grass.

4.3.2.3 Line Marking

The line marking will require adjustment to suit the new configured lane and merge/diverge arrangements, new lane lines, and edge lines on both shoulders.

4.3.2.4 Street Lighting

The existing street lighting is located on the verges and hence will not require relocation.

4.3.2.5 Stormwater Drainage

In areas of superelevation where the sumps are located on the median edge the sumps and connecting pipe systems will require relocation to within the median.

As in Sections 4.1 and 4.2 the drainage flow paths with the widened pavement will need to be verified as the design develops to ensure conditions with a build-up of water film on the pavement surface does not result in the creation of aquaplaning conditions.

4.4 Acton Tunnel to Edinburgh Avenue

4.4.1 Existing Conditions

4.4.1.1 Horizontal Geometry

The horizontal curve in the tunnel is a 550 m radius left-hand curve with superelevation of 3%. This radius, when evaluated with AUSTROADS Guidelines equates to a design speed of 88 km/h adopting the linear distribution of 'f' (friction) for 'e' (superelevation) of 5% maximum.

The horizontal stopping sight distance on the westbound carriageway is controlled by the central wall of the tunnel. The available distance is 115 m which equates to a design speed of approximately 80 km/h for cars and 70 km/h for trucks.

On the eastbound carriageway the shoulder increases the sight distances to 130 m which equates to a design speed of approximately 90 km/h for cars and 80 km/h for trucks.

East of the tunnel the 550 m radius left-hand curve connects to a 450 m radius right-hand curve which has 3% superelevation and an equivalent design speed of 85 km/h adopting the aforementioned parameters.

The bridge pier at Edinburgh Avenue is the limiting factor for sight lines. A 115 m stopping sight distance is available which effectively limits speeds to approximately 80 km/h for cars and 70 km/h for trucks.

4.4.1.2 Vertical Geometry

The vertical geometry in this section consists of generally flat grades of 0.5% or less.

These gradients do not impose any restrictions on sight lines.

4.4.1.3 Cross Section

Within Acton Tunnel the cross section of each carriageway is:

- 3 x 3.7 m wide traffic lanes, one lane being the Edinburgh Avenue exit ramp
- 3.0 m wide left-hand shoulder and
- 1.2 m wide right-hand shoulder.

East of the tunnel the cross section is the same, however; at the exit ramp gore the right-hand shoulder decreases from 1.2 m to 0.6 m in width at the end of the G4 guardrail and barrier kerb.

Beyond the exit ramp gore the cross section configuration is:

- 2 x 3.7 m wide lanes
- m wide left-hand shoulder and
- 0.6 m wide right-hand shoulder.

The ramps to and from Edinburgh Avenue are configured as follows:

a) Exit ramp

- 4.3 m wide traffic lane, 2.5 m wide left-hand shoulder and
- 0.6 m wide right-hand shoulder.

b) Entry ramp

- 3.7 m (minimum) wide traffic lane at the ramp gore area widening to two lanes 7.4 m wide at the ramp commencement at Edinburgh Avenue and
- 1.8 m wide left-hand shoulder.

The median width varies from 4.8 m wide at the Acton Tunnel portal to 12.0 m at the Edinburgh Avenue overbridge.

Both edges of the median are flanked by G4 type guardrail and barrier kerbs up to the point where the median begins to widen from 4.8 m. The barrier kerb is replaced by a semi-mountable kerb east of this point which is generally coincident with the entry/exit ramp gore areas.

4.4.1.4 Geometric deficiencies

As stated in Section 6.1.1 the deficiencies are limited to restrictions imposed by the horizontal alignment and flanking guardrails and the walls of the Acton Tunnel.

4.4.2 Proposed works

4.4.2.1 Carriageway widening to form 3 lanes

i) Eastbound

The widening to 3 lanes is achieved as follows:

- Tunnel section

  The existing compulsory left-turn lane to Edinburgh Avenue becomes the 3rd lane.

- East of tunnel

A new 3.5 m wide left-turn slip lane is commenced approximately 80 m east of the tunnel portal. The lane width tapers from the full 3.5 m at this location to zero width at the point of connection to the existing construction over a distance of approximately 70 m.

A new 4m high (exposed face) retaining wall will be required to replace the existing wall which needs to be demolished as a result of the pavement widening. This wall will have a stone pitched face to match the appearance of the existing walls.

Between the Edinburgh Avenue exit ramp gore and approximately 350 m east of Edinburgh Avenue overbridge widening of approximately 3.5m into the median is required to achieve the 3rd lane and to provide stopping sight distance for cars travelling in the median lane.

The 3.5 m of widening for the additional lane is partly achieved by narrowing the existing 3.7 m wide traffic lanes to 3.5 m and the shoulder from 3.0 m to 2.5 m gaining an extra 0.9 m of width on the existing pavement.

To provide the aforementioned sight line requirements there is a need to provide a right-hand shoulder to the median lane to allow sight lines past the guardrail protecting the Edinburgh Avenue overpass. This shoulder varies in width from 1.2 m to 2.1 m.

Hence the overall widening into the median will vary between 3.8 m and 4.7 m to provide the traffic lane and shoulder for sight lines.

The variable width right-hand shoulder will be an extension of the existing 1.2 m wide shoulder occurring near the Edinburgh Avenue exit ramp (replacing the existing 0.6 m shoulder) to a point approximately 150 m past the Edinburgh Avenue overpass where the right-hand shoulder presently terminates.

ii) Westbound

The existing westbound add-lane from the Edinburgh Avenue entry ramp will be maintained thus forming the 3rd lane east of this location.

Due to the constraints of the existing Acton Tunnel it is only possible to achieve an 80 km/h design speed on the merge taper for a reconfigured entry ramp joining 3 lanes developed east of the Edinburgh Avenue overbridge.

Given the resultant sub-standard merge arrangement and the volume of traffic (1,146 vehicles/hour) entering Parkes Way from Edinburgh Avenue, a decision was made in consultation with Roads ACT to maintain the present lane-add arrangement with only 2 lanes east of the entry ramp gore.

4.4.2.2 Median form

The median width (eastbound) will be reduced in width by 3.5 m east of the Edinburgh Avenue exit ramp gore area. The new median edge will be flanked by kerbs up to and beyond the Edinburgh Avenue overbridge pier, with G4 type guardrail flanking the kerbs to provide protection for the bridge pier.

The guardrail extends approximately 150 m beyond the overbridge. It is also proposed to extend the G4 guardrail on the eastbound carriageway median to link with the eastbound carriageway guardrail east of the Edinburgh Avenue overpass.

The grassed median will be maintained beyond the extent of the guardrail.

The required clear zone is 9.0 m and as a consequence a barrier is required where the residual median width is less than this dimension. This occurs between the Edinburgh Avenue exit ramp gore and a location approximately 100 m east of the Edinburgh Avenue overbridge.

Within the area of the guardrail stabilised decomposed granite gravel paving is proposed.

4.4.2.3 Line Marking

The line marking will require adjustment to suit the new configured lane and merge/diverge arrangements, new lane lines, and edge lines on both shoulders.

4.4.2.4 Street Lighting

The existing street lighting is located on the verges and hence will not require relocation.

4.4.2.5 Stormwater Drainage

In areas of superelevation where the sumps are located on the median edge the sumps and connecting pipe systems will require relocation to within the median.

As in Sections 4.1 and 4.2 the drainage flow paths with the widened pavement will be verified in the final design phase to ensure any build-up of water film on the pavement surface does not result in the creation of aquaplaning conditions.

5.0 Bridge Widening

5.1 Background

In order the facilitate the widening of Parkes Way the bridges crossing Clunies Ross Street and Sullivans Creek require widening into the median. There are two options for the widening of the Clunies Ross Street bridge a single RTA standard super tee girder and concrete deck slab or a cast insitu prestressed single box girder. Sullivans Creek bridge is to be widened using cast insitu prestressed box girders. Both structures will be supported by new and independent abutments and piers to minimise interaction with the existing structure.

To minimise the impacts on the aesthetic appearance of the new structure to traffic along Clunies Ross Street (underneath the bridge), the existing and new piers will be clad in metal sheeting all around to smoothly blend and give the appearance of one large pier. As there is virtually no traffic travelling underneath the Sullivans Creek Bridge similar measures have been deemed unnecessary for Sullivans Creek Bridge.

5.2 Design Inputs

The following information has used in the design input:

- Work-as-executed drawings for Clunies Ross Street bridge.
- Work-as-executed drawings for Sullivans Creek bridge and
- AS 5100.

5.3 Proposed Concept Design

5.3.1 Clunies Ross Street Bridge

5.3.1.1 Existing Structure

The existing Clunies Ross Street Bridge consists of a set of twin bridges each with a shoulder and two lanes of traffic. The existing twin bridges consist of 3 span twin cell box girder superstructure supported on rectangular piers. The piers are supported by on a pilecap and driven steel H piles. The girder was constructed insitu on falsework and post tensioned. The abutment consists of a spill through, headstock beam supported on driven steel H piles.

The hand railing on the left-hand shoulder side of the bridge will be required to be upgraded to meet cycle lane requirements.

5.3.1.2 Bridge Widening

The Clunies Ross Street twin bridges are to be widening by 2.8 m to accommodate the additional traffic lane. The widening will take the form of a precast 1200 mm deep supertee girder and insitu deck. The supertee girders will be precast and prestressed in the casting yard. The supertee girders will be lifted into place and temporally supported on falsework. Continuity will be achieved by casting a small diaphragm between the ends of the beams. The continuous supertee girder will be supported on pot bearings. The new deck over the girder will be cast in a sequence to minimise the hogging moments over the piers. The edge of the existing cantilever will be broken back to exposure the reinforcement. The new deck will be tied into the exposed reinforcement of the existing cantilever girder using a stitch pour arrangement. Load restrictions / traffic management will be required during the casting and curing of the stitch pour. A medium performance concrete and steel railing barrier is provided on the edge of the deck widening.

The cast insitu piers for the widening have been proportioned to match the existing piers. The piers will be finished in an exposed aggregate rope finish to provide a uniform and consistent appearance. The abutment extensions are detailed to match the existing bridge with the stone pitching batter protection to be reinstated. The substructure is supported on driven steel H piles.

5.3.1.3 Bridge Strengthening

The load rating report identified the following deficiencies under SM1600 design loadings:

- External web of the girder hogging and sagging, live load rating 0.6
- Internal web of the girder hogging and sagging adequate
- Shear and torsion, not rated due to illegible drawings
- Deck slab cantilever live load rating 0.88

The low load rating results apply to the outer webs of the twin cell box girder. The proposed widening changes the behaviour of the bridge superstructure, significantly reducing the torsion in the twin cell box girder. Legible versions of the web reinforcement drawings have been located enabling the shear and torsion capacity of the webs to be determined. The revised SM1600 load rating of the existing box girder for the widened structures is as follows:

External web of girder hogging and sagging, live load rating 1.03 and 0.92 respectively

Internal web of girder hogging and sagging, live load rating 1.05 and 0.90 respectively

External web of girder (widening side) hogging and sagging, live load rating 1.05 and 0.95 respectively

Shear and torsion, external webs live load rating 1.05

Shear and torsion, internal web, live load rating 0.80 (web crushing)

Deck cantilever unchanged 0.8

Deck slab between girder and supertee, live load rating hogging, 1.03, sagging 0.75

The preliminary checks have shown there is adequate shear and torsion capacity in the external girder webs for the widened superstructure, however the internal web is below capacity due to web crushing limitations. A design concrete strength of the box girder is shown as on the drawings as 30MPa. A 10% increase in concrete strength would be sufficient to demonstrate that the internal web has adequate shear strength. It is recommended 3 concrete core samples are taken from the bridge to determine the actual concrete strength.

A number of options have been considered to strengthen the bridge superstructure. Options considered include:

Carbon fibre

External prestress

Concrete deck overlay

Carbon Fibre Strengthening

The carbon fibre strengthening solutions involves epoxy gluing carbon fibre laminates or fabric to the surfaces of the girders and can be used to increase the moment capacity and shear capacity of the section provided adequate anchorage of the carbon fibres can be achieved. The ACI guidelines recommends carbon fibre strengthening be limited to 25% of the required LL capacity at the ultimate limit state (i.e. 75% of the live is to be resisted by the unstrengthened structure). In combination with the widening, the Clunies Ross Street box girders are within this requirement. Strengthening for sagging moments can be achieved by fixing the carbon fibres to underside of the bottom flange over the midspan region of the girders. Strengthening for hogging moments at the piers is not required however if required during the detailed design can be achieved by fixing the carbon fibres to the underside of the cantilever deck slab. As the shear capacity of the internal web is limited by web crushing, carbon fibres will not help to increase the shear capacity of the internal web.

Carbon fibre strengthening works for the main box girder can be constructed from the underside of the superstructure with little impact on the Parkes Way traffic, a reduction in vertical clearance over Clunies Ross Street will be required during the strengthening works to provide access to the underside of box girder. Traffic restrictions (speed and/or load) on the deck may be required for short periods while the epoxy gains strength. The carbon fibre strengthening has minimal impacts on the aesthetics of the bridge. The carbon fibre laminated can be rendered to provide a smooth finish and coated to match the colour of the existing concrete.

To strengthen the cantilever it will be necessary to install carbon fibre laminates or rods into transverse saw cuts in the deck surface. The carbon fibre will need to be placed sufficiently below the surface to minimise the heat exposure from the reinstatement of the asphalt surfacing. This work will be undertaken from the deck surface and will have impacts on the Parkes Way traffic.

External Prestress Strengthening

The external prestress strengthening solution involves the use of external post tensioning cables. The location of the tendons would be within the box girders due to difficulties of anchoring the tendons external to the box section. To anchor and deviate the tendons anchor blocks are required to be constructed. To construct the anchors it is necessary to break out sections of the deck and to scabble the inside surface of the box. Depending on the magnitude of the forces a positive anchorage between the scabbled surface and the anchor block may be required. Positive anchors could take the form of epoxy fixed bars or transverse stressing. The Clunies Ross Street girders have a full depth diaphragm across the end of the deck requiring the anchor block to be constructed behind the diaphragm. This complicates the construction of an anchor block and reinstatement of the approach slab. At the piers there is an internal post tensioned diaphragm, avoiding the post tensioning at this location will limit the available position for the tendon. It will be necessary accurately locate the reinforcement and tendon prior to coring a hole through the diaphragm for the tendon. The vertical component of the tendons would address the shear capacity issues of internal web. External tendon strengthening of the box does not address the cantilever / slab capacity deficiencies, carbon fibre strengthening will still be required for these elements.

Although space within the box is limited it is considered feasible to construct the deviators and install the tendons within the box. The construction of the deviators and anchors within the box requires significant localised breakouts of the deck slab, approach slab and abutment upstand wall. The external post tension option has significant staging and traffic management issues during the construction phase. External post tensioning strengthening within the box would have no impact on the appearance of the bridge.

Concrete Overlay Strengthening

Overlaying the bridge deck has been investigated as an option to strengthen the superstructure of Clunies Ross Street bridge. The methods involves removing the asphalt surfacing, preparing the deck surface and installing starter bars into the deck followed by the construction of a reinforced concrete deck. The deck slab acts compositely with the existing superstructure, increasing the depth of the superstructure to provide the required structural capacity. For Clunies Ross Street a deck overlay thickness of approximately 200-250 mm would be required to satisfy ultimate strength requirements. This would provide the required moment and shear capacity for SM1600 loading for the box and address the moment deficiencies in the cantilever and slab. The additional dead load in combination with the SM1600 design loading on the piers increases the load on the pier piles beyond the nominated pile capacity stated on the drawings. The barrier on the cantilever would need to be replaced to accommodate the additional deck thickness. The concrete overlay option has significant staging and traffic management issues during the construction phase, traffic restrictions / exclusions would be required during placement and curing of the deck concrete.

Substructure

The bearings of the existing bridge consist of proprietary pot bearings. The design loading on the pier bearings exceed the rated bearing load shown on the drawing. Therefore it will be necessary to replace the bearing with a larger capacity pot bearing. The initial assessment has shown the pier diaphragm has adequate shear and moment capacity for the widened structure with the increased bearing reaction.

The capacity of the existing piles will be assessed in detail during the detailed design. The initial assessment of the abutment and pier piles has shown the serviceability pile loads are within the capacity stated on the drawings. The borehole information from the existing bridge will be used for the assessment of the existing and proposed driven steel H piles.

An alternative solution to strengthening the cantilever is to limit traffic access to the cantilever. The current arrangement has a 3.3 m wide cycleway running over the external cantilever. The cycleway could be raised relative to the traffic lanes eliminating the need to strengthen the cantilever for M1600 design, there would also be a potential reduction in amount of carbon fibre strengthening required for the external web of the main box. The

option seems viable on the eastbound bridge however on the westbound bridge the cycleway provides the surface drainage path for stormwater. An internally drained path could be constructed on top of the existing cantilever surface.

Recommendations

The carbon fibre strengthening of the Clunies Ross Street superstructure is the preferred option for the strengthening. This option has the least impact on the Parkes Way traffic and minimal impact on the Clunies Ross Street traffic. The strengthening solution has a minimal impact on the aesthetics of the existing bridge. Concrete cores to determine the actual concrete strength are required to confirm the web shear crushing capacity of the internal web. To minimise the amount of carbon fibre strengthening required consideration should be given to the option of raising the cycleway.

5.3.2 Sullivans Creek Bridge

5.3.2.1 Existing Structure

The existing Sullivans Creek Bridge consists of a set of twin bridges, one for eastbound traffic, and one for westbound traffic. Each bridge is of prestressed cast in-situ box girder construction, with six girders for the eastbound carriageway and five girders for the westbound direction. The bridges are supported by concrete abutments founded with driven steel H piles and by two tapered reinforced concrete piers located approximately at third points. The tapered piers come down onto a common pile cap which is supported by steel piles driven into the creek bed below.

5.3.2.2 Bridge Widening

The Sullivans Creek twin bridges are to be widening by 3.8m to accommodate the additional traffic. The existing twin bridges consist of 3 span continuous post tensioned multi box girder superstructure supported on multiple tapered piers and a common pilecap. The beams were erected in segments with wet joints and post tensioned as simply supported trough girder. The girders at the piers were filled with a reinforced concrete plug to make the girders continuous and finished with a composite insitu deck.

The widening will take the form of a precast custom trough girder to match the existing beams and an insitu deck. The trough girders will be precast and post tensioned in the casting yard. The trough girder will be lifted into place and placed on elastomeric bearings. Continuity will be achieved using a reinforced concrete plug, similar to the existing the bridge. The new deck over the girder will be cast in a sequence to minimise the hogging moments over the piers. The deck will be tied into the edge of the existing using a stitch pour arrangement. Load restrictions/ traffic management will be required during the casting and curing of the stitch pour. A medium performance concrete and steel railing barrier is provided on the edge of the deck widening.

The cast insitu piers and abutments are detailed to match the existing bridge. The substructure is supported on driven steel H piles.

The widening mimics the aesthetics of the existing bridge.

5.3.2.3 Bridge Strengthening

The load rating report identified the following deficiencies under SM1600 design loadings

- Girder hogging and sagging, live load rating 0.61 and 0.38 respectively
- Shear and torsion, live load rating 0.62
- Approach slab live load rating 0.77
- Deck slab live load rating 0.90

The load rating results generally apply to the edge girder of the bridge on the opposite side of the pedestrian walkway. The proposed widening changes the critical edge girder to an internal girder, this improves the SM1600 load rating of the girders as follows