

Review of the Posted Speed Limit on the Gungahlin Drive Extension



Review of the Posted Speed Limit on the Gungahlin Drive Extension

Prepared for
Roads ACT

Prepared by
AECOM Australia Pty Ltd
Level 2, 60 Marcus Clarke Street, Canberra ACT 2600, Australia
T +61 2 6201 3000 F +61 2 6201 3099 www.aecom.com
ABN 20 093 846 925

14 February 2012

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

© AECOM Australia Pty Ltd (AECOM). All rights reserved.

AECOM has prepared this document for the sole use of the Client and for a specific purpose, each as expressly stated in the document. No other party should rely on this document without the prior written consent of AECOM. AECOM undertakes no duty, nor accepts any responsibility, to any third party who may rely upon or use this document. This document has been prepared based on the Client's description of its requirements and AECOM's experience, having regard to assumptions that AECOM can reasonably be expected to make in accordance with sound professional principles. AECOM may also have relied upon information provided by the Client and other third parties to prepare this document, some of which may not have been verified. Subject to the above conditions, this document may be transmitted, reproduced or disseminated only in its entirety.

Quality Information

Document Review of the Posted Speed Limit on the Gungahlin Drive Extension

Ref

Date 14 February 2012

Prepared by Peter Evans

Reviewed by Rod Weeks, Tom Brimson

Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
	14-Feb-2012	For Information	Marc Blackmore	

Table of Contents

1.0	Introduction	<u>1</u>
2.0	Road Geometry Parameters	<u>2</u>
	2.1 Speed Parameters	<u>2</u>
	2.2 Horizontal Curve Design Speed	<u>2</u>
	2.3 Vertical Stopping Sight Distance	<u>2</u>
	2.4 Sight Distance	<u>3</u>
	2.5 Traffic Lane Width	<u>3</u>
3.0	Other Speed Issues	<u>4</u>
	3.1 Access Arrangement	<u>4</u>
	3.2 Role in Canberra Transport Network	<u>4</u>
	3.3 Adjoining Road Speeds	<u>4</u>
	3.4 Weaving at Glenloch/Lakeside interchange	<u>4</u>
	3.5 Pavements	<u>4</u>
	3.6 Road Furniture	<u>4</u>
	3.7 Current Driver Behaviour	<u>5</u>
4.0	Austrroads Guide to Road Safety Part 3 - Speed Management	<u>6</u>
5.0	Glenloch Interchange	<u>6</u>
6.0	Summary	<u>8</u>

1.0 Introduction

Roads ACT has requested that AECOM undertake a review of the suitability of the posted speed limit for the Gungahlin Drive Extension (GDE) project from the Glenloch Interchange through to the Barton Highway. The current posted speed is 80 km/h but there is a section of the community that believes that this speed limit should be lifted given the nature of the road being a dual carriageway with grade-separated interchanges.

AECOM undertook the current Stage 2 design in 2009. The selected design speed was 100 km/h with the expectation that the posted speed limit would be lower in keeping with Austroads advice "*For urban areas, current practice has been to adopt a design speed 10 km/h higher than the posted speed*". The 2009 PSP report documented the reasons for the design speed and the subsequent design parameters. This was generally consistent with the original SMEC Stage 1 approach.

This report will review the technical road geometry parameters against speed performance using Austroads Guide to Road Design Part 3. This will include:

- Horizontal road geometry.
- Vertical profile.
- Road cross section.

The report will also consider other more subjective but equally important speed factors such as:

- Access arrangements.
- Current driver behaviour.
- Role in Canberra transport network.
- Adjoining road speeds.
- Road furniture.
- Pavements.
- Traffic composition
- Cyclists and other users.
- Traffic volume.

GDE Stage 2 was designed in the first half of 2009, prior to the publication of the current version of Austroads Guide to Road Design (November 2009). However this report will assess the road against the 2010 version and Austroads Guide to Road Safety Part 3 Speed Limits and Speed Management 2008.

2.0 Road Geometry Parameters

2.1 Speed Parameters

Austrroads Guide to Road Design Part 3 (2009) in Section 3 outlines the definitions of the various speed parameters relevant to the design of a road. Of note is that Austrroads advises “For urban areas, current practice has been to adopt a design speed 10 km/h higher than the posted speed limit.”

2.2 Horizontal Curve Design Speed

The following table lists all the horizontal curves along the main alignment together with the relevant cross falls and the associated design speed on both the north bound and south bound carriageways, assuming the ‘desirable’ maximum recommended side friction factors for cars quotes in Austrroads Table 7.4 apply.

Chainage	Radius	South Bound Carriageway		North Bound Carriageway	
		Cross fall	Design Speed (km/h)	Cross fall	Design Speed (km/h)
1300 - 1717	508	5%	104	3%	95
2025 - 2739	1104	3%	145	3%	145
2945 - 3314	625	4%	112	3%	109
3963 - 4820	665	4% - 3.1% *	116 / 111	4 % - 2.8%	116 / 111
5316 - 5657	596	4%	110	4%	110
6384 - 6518	595	4%	110	4%	110
6518 - 6670	800	3%	123	4%	127
6969 - 7074	1251	3%	154	4%	159
7074 - 7483	646	3%	112	4%	114

All horizontal geometry is suitable for design speeds up to 100 km/h except the northbound curve approaching the Barton Highway overpass.

2.3 Vertical Stopping Sight Distance

The vertical crest curve geometry was reviewed against the criteria set out in Austrroads Table 8.7. It assumes that the reaction time is 2.0 seconds for ‘higher speed urban areas’ (see Austrroads table 5.2) and for ‘major highways and freeway situations’ with the driver eye height being 1.15 m and the object height 200 mm.. The estimated safe speed for each crest curve is shown in the following table for the latter road classifications.

Chainage	K Value	Estimated Safe Speed
1060 - 1460	45	80
2630 - 2746	249	130
3627 - 3811	92	95
5940 - 6221	92	95
6562 - 6939	309	>130
6941 - 7348	330	>130

The crest curve over the Barton Highway Overpass (chainage 1060 to 1460) has the lowest safe vertical speed for the road.

The sag curve geometry was reviewed against Austroads Figure 8.7 and the estimated speeds are shown in the following table.

Chainage	K Value	Estimated Speed
1660 - 1840	39	100*
2870 - 3014	435	>130
4049 - 4368	144	>130
4611 - 5035	355	>130

*This curve has street lighting

All sag curves except at chainage 1660 meet the highest criteria of "highway aesthetics". The sag curve at chainage 1660 will still operate safely at 100 km/h because it has street lighting.

2.4 Sight Distance

There are no other road elements that impact on sight distance. The GDE passes over all cross streets except Bandjalong Crescent which is on a straight alignment. Therefore there are no bridge elements that interrupt sight distance. The outside shoulder width is 2.5 m. The median shoulder width is 1.0 m with safety barriers located on the inside of the median curves to avoid sight distance obstructions.

2.5 Traffic Lane Width

The general traffic lane width of the GDE is 3.5 m which meets the Austroads Table 4.4 requirement for urban freeways. The left shoulder width is 2.5 m which is also in the range given in Austroads Table 4.4. The median shoulder width is 1.0 m which is outside the 2.0 to 3.0 m range quoted in Table 4.4. The road was designed under the requirements in the RTA Road Design Guide Table 3.3.2 and complies with this standard.

The left shoulder is a break down and cycle lane and its 2.5 m width meets the requirements for cycle lane operations up to 100 km/h as specified in Austroads Figure 4.18 and 4.19.

3.0 Other Speed Issues

There are other more subjective parameters which none the less have a significant impact on the operating speed of a road. As these parameters cannot fully mathematically define an operating speed, the designer will have to rely on comparisons with other relevant road situations.

3.1 Access Arrangement

Vehicle and cycle access to the GDE is limited and only possible through grade separated interchanges. Pedestrian access is not provided although it is possible for a pedestrian to walk along the shoulder for example after a breakdown. These interchanges provides for high volumes of traffic to safely enter the route. The on-ramps for the redeveloped interchanges at Glenloch and Barton Highway provide vehicles with four seconds of parallel running at 100 km/h before encountering a standard 100 km/h merge taper. The ramps at Belconnen Way and Ginninderra Drive also allow merging at 100 km/h. These are consistent with RTA Road Design Guide.

3.2 Role in Canberra Transport Network

The GDE is part of a western parkway system around the City. This links the main commercial and retail town centres of Gungahlin, Belconnen, Woden and Tuggeranong plus the majority of Canberra's residential suburbs. This route is at the top of the road hierarchy system and can operate as a freeway given that access is only via grade separated interchanges. Similar roads in other cities generally operate at a slightly higher speed to encourage motorists to use them rather than lower order roads which have more conflict points with other users.

3.3 Adjoining Road Speeds

The southern end of the GDE connects directly into the Tuggeranong Parkway which currently has a posted speed of 100 km/h from immediately south of Lakeside interchange until Sulwood Drive in the Tuggeranong Valley.

To the average motorist, the Tuggeranong Parkway between Kambah through to the GDE would appear to be a continuous freeway with dual carriageways and grade separated interchanges but of lower standard than the GDE with the F type median barrier. To the typical driver it may be illogical for the road with the apparent higher design standard to be posted with the lower speed limit. It would be desirable that these sections of the GDE and Tuggeranong Parkway have the same posted speed.

It is noted that both Parkes Way and William Hovell Drive which are continuous with the GDE have 90 km/h posted speeds but all other connecting arterial road to the GDE are controlled with traffic signals have 80 km/h posted speed limit.

3.4 Weaving at Glenloch/Lakeside interchange

AECOM examined possible weaving issues at Glenloch interchange and confirm that the designed merge lane lengths have a minimum parallel travel time of 4 seconds (2009 AUSTRROADS Guide to Road Design) followed by a taper to allow roads users sufficient time to merge. AECOM concluded that an operating speed limit of 90km/h is appropriate.

3.5 Pavements

The Stage 1 bitumen seal wearing coarse has now been replaced with an SMA wearing coarse which is stronger with lower maintenance requirements and better drainage properties. Importantly, it has superior noise reduction properties than dense grade asphalt. This pavement change normally achieves a reduction of 2 to 3 dB(A).

3.6 Road Furniture

The main road furniture consists of street light poles and traffic barriers. Both are specified to operate in speed environments of up to 100 km/h.

AECOM balanced the range of constraints of road furniture such as signage, vehicle barriers and traffic control devices to minimise the overall risk to all road users including maintenance personnel who will service the centre median. Our assessment included:

- At the current 80 km/h posted speed limit and a median at least 5 m wide opposing traffic is outside of the required clear zone.
- For operating speeds between 80 km/h and 100 km/h, the barriers are required to reduce the risk of serious accident from vehicles crossing the median.
- For the traffic negotiating the convex curve at 90 km/h an errant vehicle could strike the barrier and the rope could intrude 300 mm (refer extract below from RTA Road Design Guide Table 6.8) into the oncoming traffic lane. At a travel speed of 100 km/h this intrusion increases to 400 mm. A 400 mm intrusion is considered an occasional frequency for a head on crash, whereas a 300 mm intrusion represents an improbable frequency of an actual collision. Reasons include:
 - The opposed vehicles, as they are driving around the curve, would be unlikely to be driving on or close to the outside curve edge of the lane. Most drivers would slightly cut the corner or stay in the middle of the lane and so should be at least 1.5m away from the barrier thus providing space for 400mm intrusion without impact.
 - The out of control vehicle on the convex curve is more likely to depart tangentially and away from the rope and thus not strike the barrier, and
 - If the vehicle does travel toward the rope it has to cross a 4 m landscape median and this should help attenuate its speed.

Other considerations that influenced the location of the safety barrier include not impacting on sight distance, and the safety of the maintenance personnel maintaining the centre median. Consultation with the maintenance crews concluded that a minimalist approach for median maintenance was appropriate and that this approach required space for a full size slasher to safely operate in the median.

(Extract from RTA table 6.8)

System Type	Dynamic Deflection (m) at Various Speeds		
	80 km/h	90 km/h	100 km/h
Wire rope Safety Barrier (<100m between anchors)	1	1.1	1.2
Wire rope Safety Barrier (>100m between anchors)	1.2	1.3	1.4

3.7 Current Driver Behaviour

AECOM does not possess speed survey data for the completed GDE, but anecdotal comments and observations suggest that the average speed is around 90km/h with 85%ile speeds about 100 km/h. It is recommended that a speed survey be undertaken to establish the actual travel speed distribution.

The speed environment indicates that a speed limit higher than 80 km/h is appropriate. The road has been designed for 100km/h and drivers appear to behave accordingly. The designers had an expectation of the posted speed limit being 90 km/h from the Barton Highway interchange through to Lakeside interchange.

4.0 Austroads Guide to Road Safety Part 3 - Speed Management

The modern approach to setting speed limit is based on a safe system approach which is quite different to that of decades ago when speeds were often set at the 85thile driver free speed. The focus of speed management is to reduce the likelihood of serious and fatal road crashes. Lower speeds:

- allow road users more time to assess hazards and avoid a crash
- reduce both the reaction time and vehicle braking distance
- make it less likely that a driver will lose control
- reduce the impact forces in the event of a crash and the crash severity.

Whilst the current speed limit on GDE is 80 /km/h observations show that there is a wide spread of travel speeds. The wider the spread of travel speeds the greater the likelihood of a crash. If the speed limit was to be raised from 80 km/h to 90 km/h the spread of speeds should reduce and consequently the risk of crashes should also reduce.

Further AS 1742.4 indicates that in general a speed limit of 80 km/h is typical of:

- divided roads having provision for safe storage of turning or crossing
- vehicles but with direct access from abutting development; or
- undivided roads having low levels of direct access from abutting development.

Whereas 90 km/h is considered appropriate for:

- on lower standard urban freeways; or
- in limited situations on outer urban arterial roads

(Note higher standard freeways are considered to be freeways with design speeds of 110 km or greater.)

It has therefore been concluded that a speed limit of 90 km/h is consistent with the Australian Standard and Austroads guidelines.

5.0 Glenloch Interchange

The approaches to Glenloch interchange have a range of speed limits installed. It is desirable for road networks to have a consistent and uniform application of speed limits in order to achieve optimum driver compliance.

Traffic movements from east to west through Glenloch experience speed limits of 90km/h on both the approach and departure. These approach and departure speed limits have been in operation for several decades.

Parkes Way westbound to William Hovell Drive connection is signposted at 80 km/h. Although there is adverse cross fall for the reverse entry curve from Parkes Way to William Hovell Drive, the design is suitable for travel speeds of 90km/h. The advisory exit speed from William Hovell Drive to the loop ramp connection to GDE northbound is 55 km/h and is considered appropriate. (Refer attached plan showing current arrangement).

Tuggeranong Parkway has an approach posted speed limit of 100 km/h which reduces to 80 km/h at the Lakeside Interchange. This speed limit then continues to be applied to the GDE. As discussed in the foregoing chapters, AECOM has concluded that it is appropriate to raise the limit on GDE to 90 km/h.

The 80 km/h posted speed at Lakeside Interchange continues along the ramps to William Hovell Drive and Parkes Way. The posted speeds on these ramps could be increased to 90 km/h providing some over grown vegetation is removed (refer attached plan).

The eastbound posted speed limit on William Hovell Drive reduces from 90 km/h to 80 km/h as it enters the Glenloch Interchange and extends for approximately 1.3 km. This is less than the minimum RMS (NSW RTA) recommended length of 2 km. Restricted sight distance and a curve of 200m radius on the approach to Bridge 11 indicate that the safe approach speed is 80 km/h. However the posted speed could be raised to 90 km/h with a signposted advisory speed of 75 km/h supplemented by "slippery when wet" signage and pruning of vegetation

(refer attached plan). The posted speed would then be a consistent 90 km/h from William Hovell Drive to Parkes Way. The connecting ramp to the southbound GDE is signposted with an advisory speed of 55 km/h (refer attached plan).

The GDE southbound to eastbound on Parkes Way eastbound is signposted at 80 km/h speed limit. Eastbound traffic from William Hovell Drive and the northbound to eastbound traffic from the Tuggeranong Parkway both merge on this section of Parkes Way in close proximity. Potential new traffic arrangement of an additional lane eastbound on Parkes Way would allow the speed limit to be raised to 90 km/h (refer attached plan).

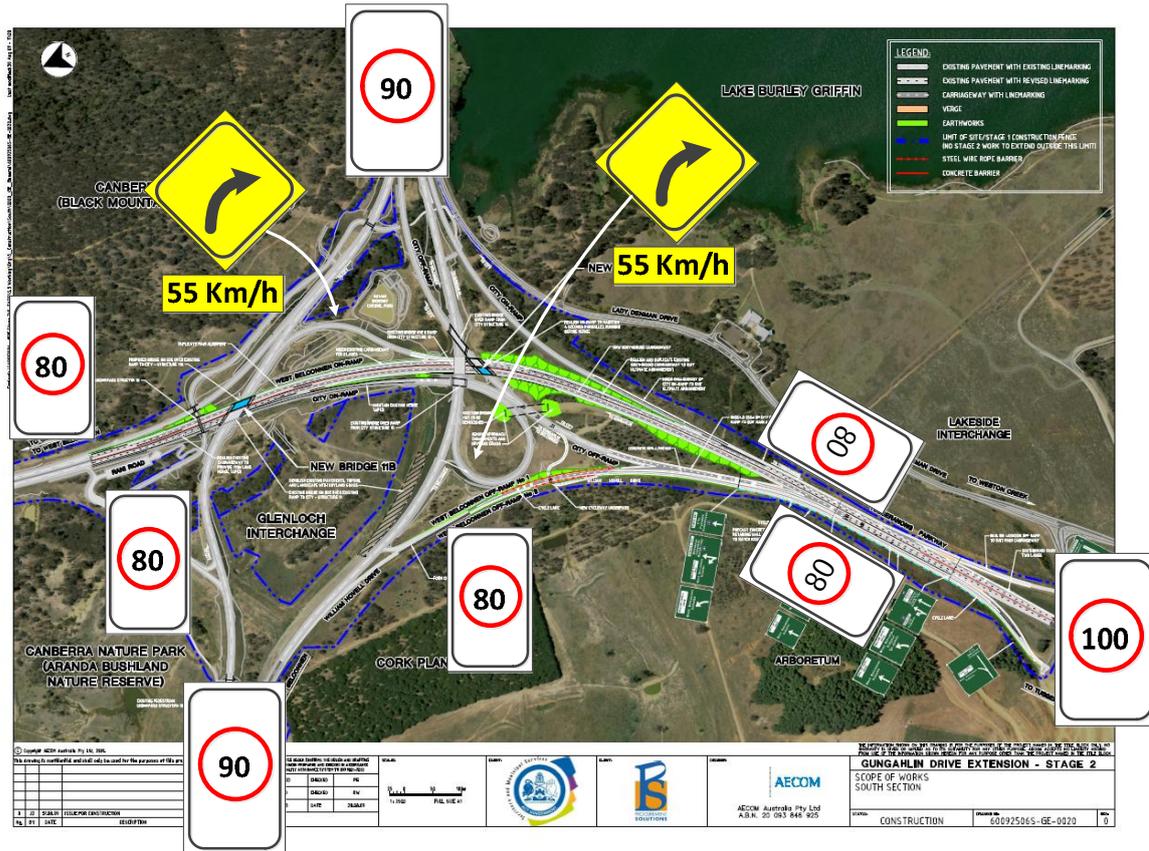


Figure 1 Existing Speed Limits Glenloch Interchange

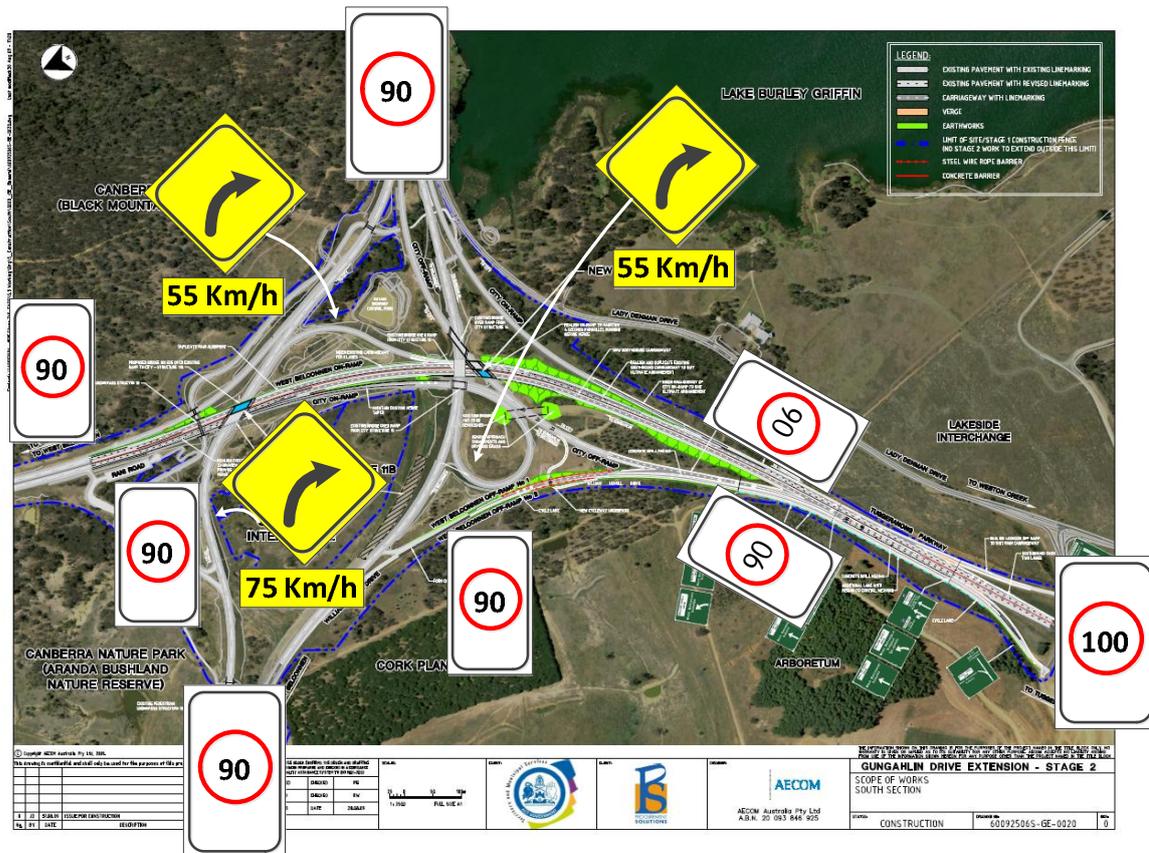


Figure 2 Suggested Speed Limits Glenloch Interchange

6.0 Summary

GDE was designed for conditions of 100km/h and an expected operating speed of 90 km/h and is consistent with NSW RTA Road Design Guide criteria. The design has been assessed against the 2009 AUSTRROADS Guide to Road Design.

The design was found to have suitable road geometry (horizontal and vertical alignment) for travel speeds of up to 100 km/h for the GDE between the southern end of the Barton Highway interchange ramps and Lakeside interchange.

Austrroads guides advise that appropriate and accepted best practice is to set speed limits 10 km/h below the design speed. Further a posted speed limit of 90km/h is consistent with AS 1742.4 and Austrroads Guide to Road Safety Part 3 – Speed Management. AECOM therefore recommend a posted speed limit of 90 km/h from the southern end of the Barton Highway interchange through to Lakeside interchange.

For Glenloch interchange it is desirable for the speed limits to be both consistent and continuous. The road geometry and pavement design will allow the main Tuggeranong Parkway to GDE route to operate at a posted speed of 90 km/h. For consistency the connection from Tuggeranong Parkway to William Hovell Drive could also operate at 90 km/h. The City bound connection ramps from GDE, and Tuggeranong Parkway could be signposted at 90 km/h. The William Hovell City bound connection ramp could also be raised to 90 km/h on the condition that a 75 km/h advisory speed sign and slippery when wet signs are installed and vegetation is pruned. This would be consistent with NSW RMS (RTA) policy on the minimum speed zone length. The outbound connecting ramps from Parkes Way can also remain at 90 km/h.