Queenstown Lakes District Council

Study of Traffic Issues, Cardrona Village

TRAFFIC ASSESSMENT

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August 2007

9008/1
28 August 2007

Queenstown Lakes District Council
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QUEENSTOWN

Attention: Ralph Henderson

Dear Ralph

STUDY OF TRAFFIC ISSUES, CARDRONA VILLAGE

Please find enclosed our updated draft report considering traffic matters in Cardrona Village.

The report describes the current infrastructure and travel patterns through the village, and includes for an analysis of a potential bypass.

It is concluded that the present 70km/h speed limit is appropriate for the current pattern of development, and there is currently a high level of compliance with this. Although there are some minor modifications which could be made to the existing gateway features and lane widths, the treatments represent the most appropriate combination of measures to reduce vehicle speeds.

In respect of the future form of development within the village, the research strongly suggests that permitting the built environment to be located close to the road as possible will assist in reducing vehicle speeds. Any planting between the buildings and the traffic lanes should be undertaken to create discrete groups of bushes and trees, and should not create a continuous line of vegetation. Clustering key development over a short (500m) section of the Cardrona Valley Road may facilitate the implementation of a reduced speed limit on that part of the road in due course.

A preliminary evaluation shows a bypass to Cardrona Village is not currently economically viable unless the present high rate of traffic growth is maintained and a high proportion of traffic presently recorded within the village does not have an origin or destination in the settlement itself. Even then, the calculations suggest that the benefit-cost ratio is not particularly high.

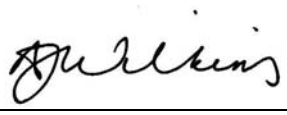
Please do not hesitate to contact me if you require any further information or clarification.

Yours sincerely
TRAFFIC DESIGN GROUP LTD

Andy Carr
ASSOCIATE

QUALITY ASSURANCE STATEMENT

Prepared by:



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Status: Final

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1. INTRODUCTION

The Cardrona 2020 Community Plan (2003) identified traffic safety as a major concern for the Cardrona community. At present, vehicles travelling between Queenstown and Wanaka via the Crown Range are able to travel at speeds up to 70km/h through Cardrona Village, and there is anecdotal evidence of overtaking occurring through the village. Furthermore, volumes of traffic on the road are increasing due to greater travel between Queenstown and Wanaka, and the increasing popularity of the Cardrona skifield.

Concerns have also been expressed that slowing traffic through the village would have significantly detrimental effects upon traffic efficiency and flow, particularly given the large number of buses travelling to the various recreation and tourism activities within Cardrona Valley during winter.

Traffic Design Group was asked by Queenstown Lakes District Council to investigate the effects of slowing traffic, to ascertain the likelihood and potential extent of any adverse implications.

2. DESCRIPTION OF ROADING NETWORK

2.1 Location of Cardrona Village

Cardrona Village lies around 22km to the south of Wanaka and 26km northeast of Frankton. The township is relatively small, but is bisected by the Cardrona Valley Road which provides the most direct link between Queenstown and Wanaka. The area is shown in Figure 1, with Photograph 1 providing an aerial view of the village.

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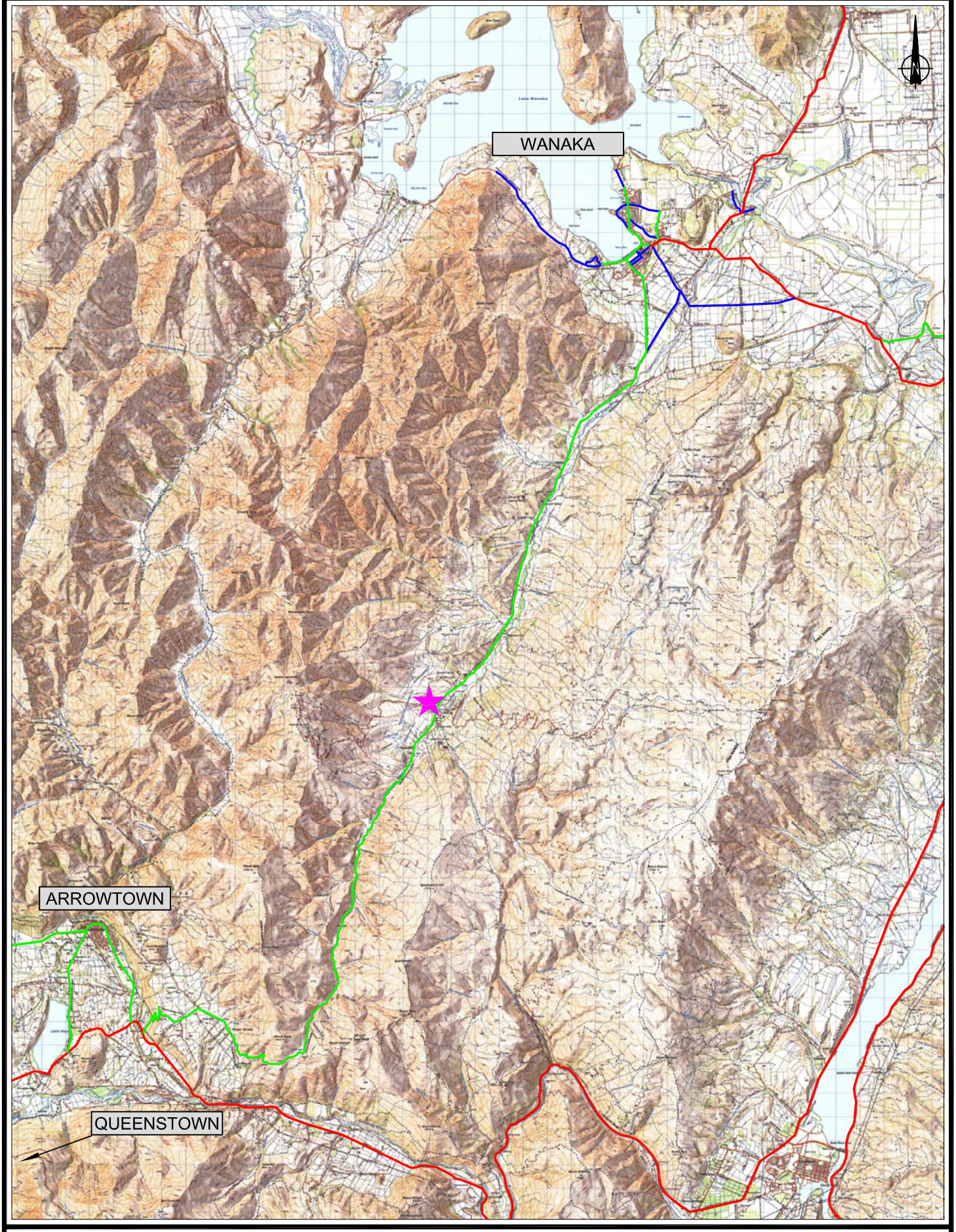

MAJOR ARTERIAL
MINOR ARTERIAL
COLLECTOR ROAD
SITE

SITE LOCATION

1

Photograph 1 : Aerial view of Cardrona Village (looking north), showing the Cardrona Valley Road

2.2 Roading Network

The Crown Range Road (known as Cardrona Valley Road where it passes through Cardrona Village) is defined in the Queenstown Lakes District Plan as an arterial road, meaning that its primary role is to link settlements within the district, in this case Wanaka and the Wakatipu Basin. As such, local access functions are expected to be minimised and through traffic can be expected to form a large proportion of the vehicle flow. While acknowledging this however, the geographic position of the road as it passes through Cardrona Village means that it has inevitably plays a role in accommodating local access and local journeys

The Otago Regional Land Transport Strategy (RLTS) sets out that the Crown Range Road is a "regional corridor", with a role in supporting tourism and freight movements. The RLTS notes that there is likely to be an increasing trend in the use of the road by tourist and other traffic, in part driven by the designation of Wanaka airport as a passenger airport. Consequently, there is mention that the road may require some upgrading to ensure it continues to be suitable for this purpose. The RLTS does not specifically refer to the section of the Crown Range Road through Cardrona Village.

On the immediate approaches to Cardrona Village, Cardrona Valley Road is a rural, two-lane carriageway road with a 100 km/h posted speed limit. The sealed carriageway provides a one traffic lane in each direction separated by a painted centreline and with sealed shoulders varying in width between 0.3m and 0.5m wide.

Within Cardrona Village, the carriageway of the road varies between 6.5m and 7.1m, with a generally flat and straight alignment which affords good forward sight distances to drivers. There are also wide grassed verges bordering much of the road, of up to 5m in places. The verge widths, coupled with the expansive views, and (in places) relatively little development, contribute to a generally rural aspect to the road. The road is however subject to a 70km/h speed limit.

Photograph 2 : Cardrona Valley Road, looking northwards into Cardrona Village

The road is generally marked with a centreline and provides two traffic lanes throughout. There is however a flush median of 1.1m in width over a length of 260m extending for approximately an equal distance either side of the Cardrona Village Hotel.

Photograph 3 : Cardrona Valley Road adjacent to Cardrona Hotel, showing flush median (looking south)

There are two 'gateway' features at the entrance to the village which include kerb build-outs and a narrow flush median. The build-outs are sited within the berm/verge and so the localised lane narrowing (to between 2.8m to 3.1m) is achieved solely by the flush median. The build-outs are vegetated and include an aged wooden cart (as public sculpture) by the side of the traffic lane entering the village. The gateways mark the start and end of the 70km/h speed limit through the village, with large signs showing the speed limits installed on the immediate approaches to the respective gateways.

Photograph 4 : Gateway feature at southern end of village (looking north)

The distance over which the 70km/h speed limit applies is approximately 0.9km.

2.3 Traffic Environment

2.3.1 Traffic Volumes

Over the past few years, various improvements have been made to the quality of the Crown Range Road, particularly the sealing of the whole route between Queenstown and Wanaka in 2001, and the widening of several single lane bridges to the north of Cardrona. These improvements, together with the general growth in activity across the District as a whole have increased the overall usage of this route.

Historic traffic counts from 1992 show an Average Daily Traffic on the Cardrona Valley Road in the vicinity of Soho Street of around 150 vehicles per day. This figure did not significantly increase over the next six years (a traffic volume in the order of 250 vehicles per day was counted in 1998, equivalent to an annual growth of 11%). Between 1998 and 2005, the Average Daily Traffic flows increased to around 1,400 vehicles per day, equivalent to an annual growth in the order of 66%.

A full seven-day automatic traffic count was undertaken on Cardrona Valley Road in the Cardrona Village during February 2007. The hourly patterns are shown in Figure 2.

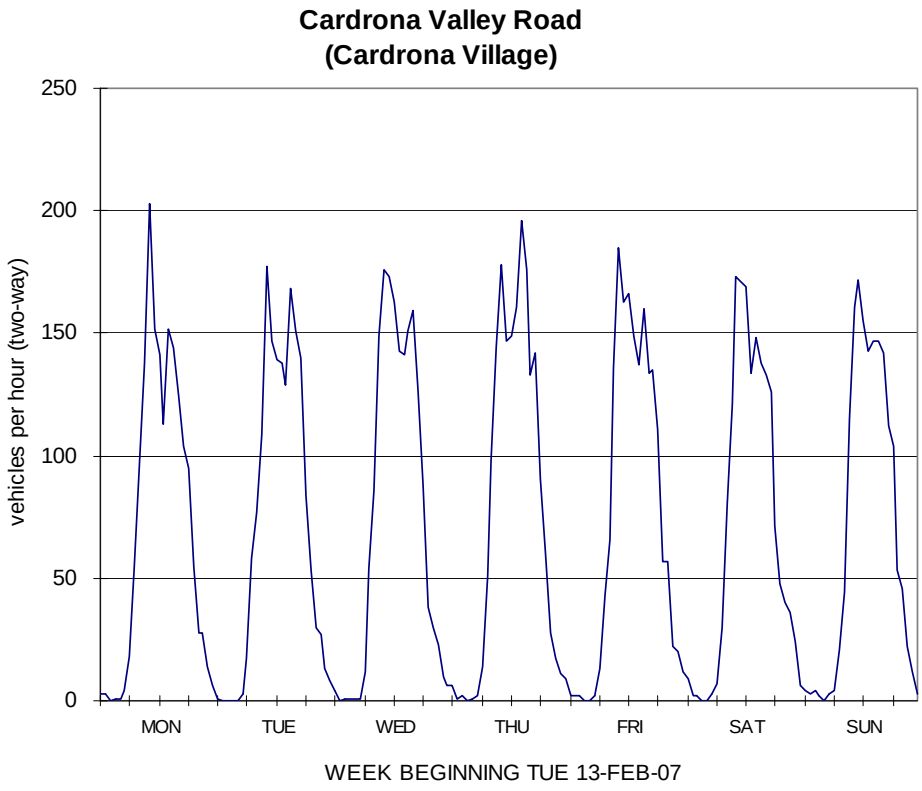

Figure 2 : Hourly traffic volumes on Cardrona Valley Road

The graph shows that the route carried peak two-way volumes of up to 200 vehicles per hour during the late morning. The average seven-day daily volume was recorded as 1,730 vehicles per day an increase of around 11% per annum.

Traffic count data has also been obtained on Cardrona Valley Road at Eastbourne Gates, between February 2006 to August 2006, as shown below.

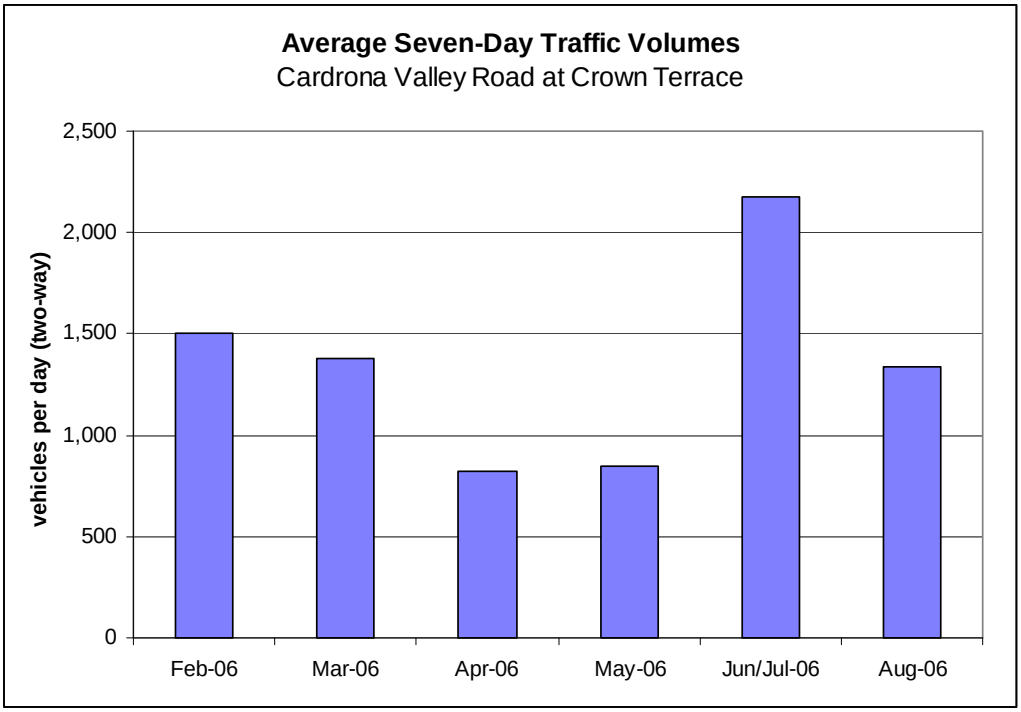

Figure 3 : Seasonal traffic patterns on Cardrona Valley Road

This data highlights that traffic volumes along the route are highly seasonal. The peak period of activity during June/July corresponds to the times when the nearby ski fields are at their busiest, with a peak daily volume of some 2,200 vehicles per day in this period being recorded during the school holiday period.

The AUSTROADS Guide to Traffic Engineering Practice Part 2 ('Roadway Capacity') provides limiting values for the capacity of rural uninterrupted two-lane, two-way roads. Using the February 2007 data suggests that the road provides Level of Service B between 9am to 6pm, defined as "a zone of stable flow (where) drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream".

If the data is factored to approximate to the June/July period, the road is anticipated to continue to provide Level of Service B, but Level of Service C may arise at peak times. This is defined in the AUSTROADS Guide as "also in the zone of stable flow, but most drivers are restricted to some extent in their freedom to select their desired speed. The general level of comfort and convenience declines noticeably at this level."

Overall however, it is considered that the road provides a generally high level of operating service (i.e. free flow speeds with little delay) for the existing road users.

As a result of ongoing development of residential, tourism and commercial opportunities within the area, it is anticipated that there will future traffic growth along the Cardrona Valley Road route. However, the extent of this is difficult to forecast with certainty. Consequently, sensitivity test have been carried out within this report where the extent of traffic growth is critical to any analyses.

2.3.2 Vehicle Speeds

The automatic traffic count undertaken in February of 2007 recorded the speed of every vehicle, and these have been grouped into bands of 10km/h, as shown below.

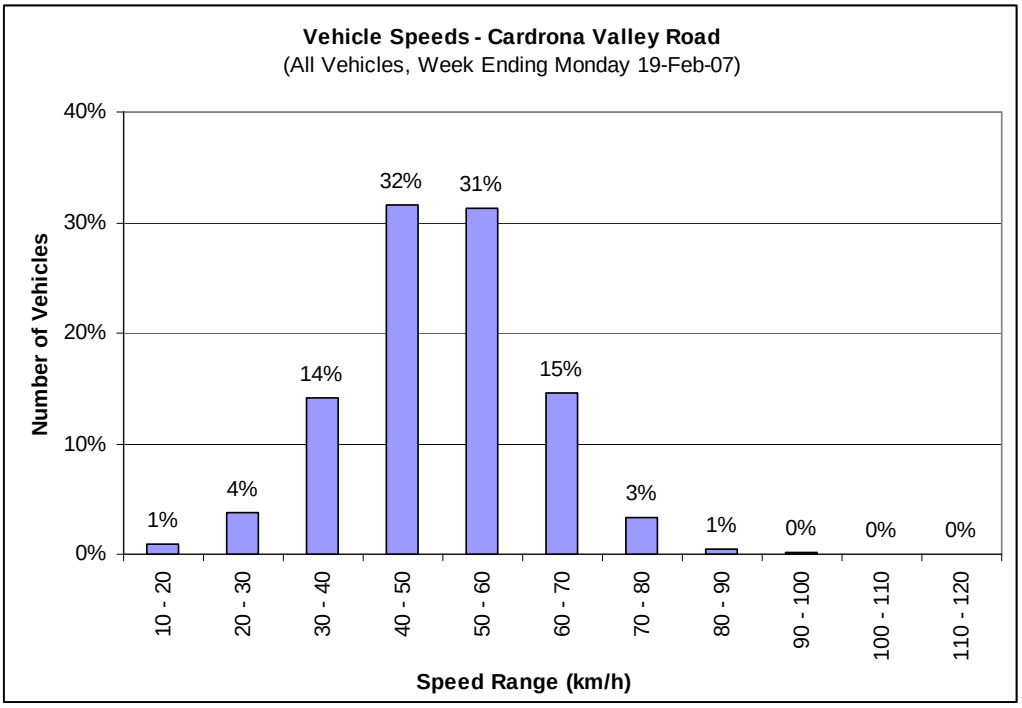

Figure 4 : Vehicle speeds

The data illustrates that the majority of vehicles (63%) were travelling between 40km/h and 60km/h through the Cardrona Village. Only 4% of all vehicles were recorded travelling above the posted speed limit of 70km/h, suggesting generally good compliance with the maximum legal speed limit.

3. ROAD SAFETY

A search of the Land Transport New Zealand Crash Analysis System (CAS) was undertaken for Cardrona Valley Road in Cardrona Village for the most recent five-year period 2002 to 2006 inclusive.

Two crashes were reported in the study area, neither of which resulted in any injuries. The first, during December 2001, occurred when a vehicle pulled over to the left before turning right off Cardrona Valley Road and was struck by a following vehicle. The second, in January 2004 was a single-vehicle loss of control crash with alcohol and driver fatigue indicated as contributing factors.

Overall this accident history is considered to be moderate but the lack of crashes in the study area makes drawing conclusions about underlying safety issues difficult.

Anecdotal evidence suggests there are perceived safety issues relating to vehicle speeds and overtaking behaviour. However these do not appear in the recorded crashes.

4. CARDRONA COMMUNITY PLAN

During 2003 the Queenstown Lakes District Council facilitated a community-based strategic planning exercise with the Cardona community. The result of a workshop with members of the community was the Cardrona Community Plan published in December 2003. The purpose of the plan is to provide a vision, strategic goals and priorities for the Cardrona Community over the next 10 to 20 years.

Of particular relevance from a transportation perspective are the following Key Community Outcomes:

- To create defined entranceways into the Cardrona Townships with appropriate signage, subtle lighting and landscaping.
- To increase traffic safety by lowering the speed limit to 50km/h through the township and 70km/h near the approaches to the ski fields, and to create slipways or similar in order for traffic to turn safely into these areas.
- To create and maintain walkways and reserve area adjacent to the Cardrona River and between and around the towns for enjoyment of residents and visitors.

The community has expressed concerns about traffic safety issues due to the speed at which some vehicles move through the township. However, concerns have also been subsequently raised about the effects upon traffic efficiency and flow of reducing the traffic speeds through the village. There have also been questions about whether a bypass would protect the function of the road and assist safety through the village.

5. ECONOMIC ANALYSIS OF POTENTIAL ROAD OPTIONS

A simple economic evaluation has been undertaken to provide an indication of the costs associated with reducing the posted speed limit through the Cardrona Village and a possible bypass to the village. The analysis has focussed upon travel time and vehicle operating costs. The costs of accident and 'intangibles' have not been taken into account at this stage, as this would require a more in-depth analysis (and as described subsequently, it is not anticipated that they will have a significant effect upon the conclusions drawn).

5.1 Reducing the Speed Limit

Three options have been considered in this assessment:

- The 'existing' option of retaining the current speed limit in its present form and at its current location;
- Option 1, which involves reducing the present 70km/h speed limit to 50km/h; and
- Option 2, which involves reducing the present 70km/h speed limit to 50km, but allows for short 70km/h 'transition' zones between the 50km/h area and the 100km/h approaches.

These are shown graphically below.

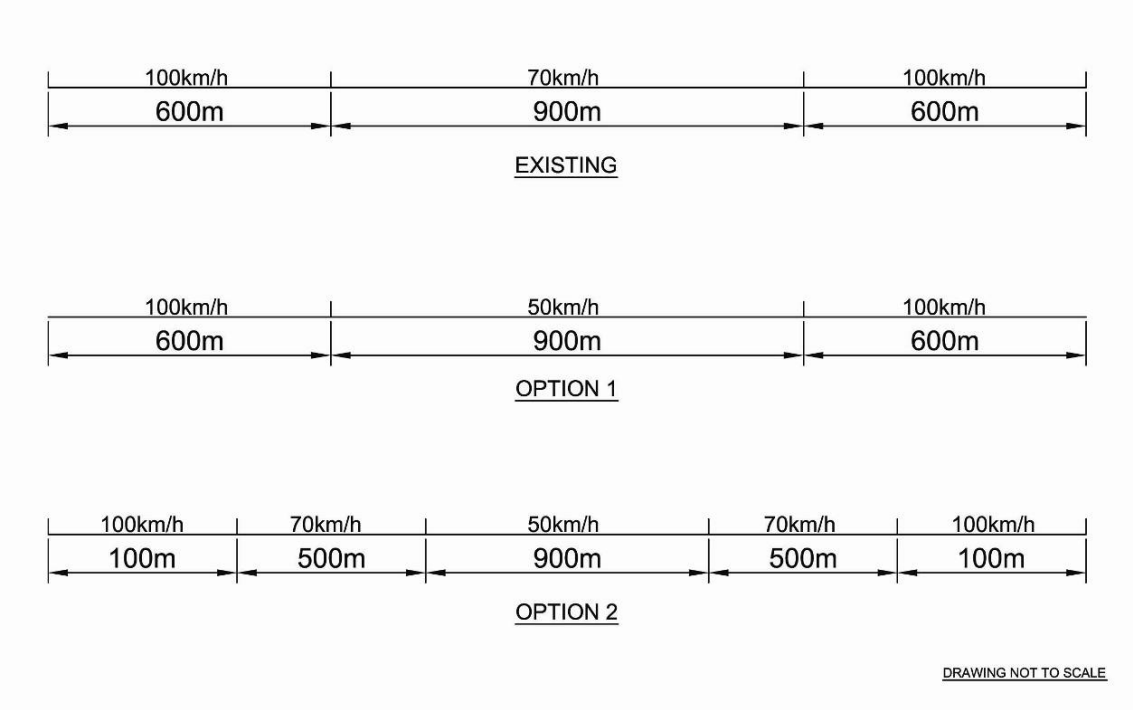

Figure 5 : Speed limit options tested

Each option was assessed using Land Transport NZ's 'Economic Evaluation Manual' values for travel time and vehicle operating costs. The recommended travel time value of $23.25 per hour for combined occupant, vehicle and freight time for a rural strategic route was applied. Vehicle Operating Costs for a rural strategic route were 19.9 cents/km, 20.1 cents/km and 21.7 cents/km for 50km/h, 70km/h and 100km/h posted speed limits respectively.

The changes in cost per vehicle are set out below:

OPTION	LENGTH (KM)	TRAVEL TIME (S)	TRAVEL TIME COST ($/VEH)	RUNNING COST ($/VEH)	TOTAL COST ($/VEH)	INCREASE ON EXISTING ($/VEHICLE)
Existing	2.6	89	$0.58	$0.44	$1.02	-
Option 1	2.6	108	$0.70	$0.44	$1.14	$0.12
Option 2	2.6	123	$0.80	$0.42	$1.22	$0.20

Table 1 : Comparison of travel time and vehicle operating costs

It can be seen that under the most extreme scenario, each vehicle experiences an increased delay of 34 seconds, equating to a cost of $0.20.

For the purposes of factoring this to the costs per year, a 2007 Annual Average Daily Traffic flow of 1,730 vehicles has been used. Although the road has a seasonal traffic flow, the 2006 traffic data suggests that the increased flows in June/July are offset by lower flows in April and May, and the February 2006 traffic flow was generally representative of the average flow seen between February and August.

Using an arithmetic growth present worth factor to calculate the value of time and vehicle operating costs over 25 years, and anticipating increases in traffic volume each year, the total present value of the cost imposed by reducing the speed limit in Options 1 and 2 compared with the existing arrangement can be calculated.

OPTION	TOTAL COST FOR ALL VEHICLES ($M)		
	2.5% Traffic Growth Rate	5% Traffic Growth Rate	7.5% Traffic Growth Rate
Existing	$7.35	$8.57	$9.78
Option 1	$8.20	$9.56	$10.91
Option 2	$8.80	$10.26	$11.72

Table 2 : Travel time and vehicle operating costs (without bypass)

It can be seen that even under the scenario of high traffic growth, the maximum costs incurred due to reducing the speed limit are less than $2M over a 25-year period.

5.2 Construction of a Bypass

It is possible to calculate the likely benefits in value of time and vehicle operating costs over 25 years, in the same manner as above. The possible bypass has been considered in conjunction with the 'existing' scenario and Options 1 and 2. In the analysis it has been assumed that the bypass would not impose an increase in journey length to traffic, and no allowance has been made for the reduction in vehicle speeds that would occur at the intersections of the bypass with Cardrona Valley Road.

No data is available regarding the number of vehicles which pass through Cardrona Village (and therefore could be expected to use a bypass) compared to those which stop within the village and consequently a sensitivity test has been carried out for various possible proportions.

OPTION	PERCENTAGE OF TRAFFIC USING BYPASS	TOTAL COST FOR ALL VEHICLES ($M)		
		2.5% Traffic Growth Rate	5% Traffic Growth Rate	7.5% Traffic Growth Rate
Existing + Bypass	25%	$6.93	$7.84	$8.76
	50%	$6.51	$7.12	$7.73
	75%	$6.09	$6.40	$6.70
Option 1+ Bypass	25%	$7.57	$8.59	$9.61
	50%	$6.94	$7.62	$8.30
	75%	$6.31	$6.65	$6.99
Option 2+ Bypass	25%	$8.02	$9.11	$10.21
	50%	$7.24	$7.97	$8.70
	75%	$6.46	$6.82	$7.19

Table 3 : Travel time and vehicle operating costs (with bypass)

5.3 Assessment of Possible Bypass Options

The benefits of constructing a bypass can be found through comparing the existing situation and Options 1 and 2, with the scenarios with a bypass in place.

OPTION	PERCENTAGE OF TRAFFIC USING BYPASS	DIFFERENCE IN COST FOR ALL VEHICLES ($M)		
		2.5% Traffic Growth Rate	5% Traffic Growth Rate	7.5% Traffic Growth Rate
Existing + Bypass	25%	$0.42	$0.73	$1.02
	50%	$0.84	$1.45	$2.05
	75%	$1.26	$2.17	$3.08
Option 1+ Bypass	25%	$0.63	$0.97	$1.30
	50%	$1.26	$1.94	$2.61
	75%	$1.89	$2.91	$3.92
Option 2+ Bypass	25%	$0.78	$1.15	$1.51
	50%	$1.56	$2.29	$3.02
	75%	$2.34	$3.44	$4.52

Table 4 : Benefits of possible scheme options

It can be seen that there is a significant range in benefit, from $0.42M to $4.52M, depending upon the traffic growth rate and the proportion of vehicles that would be expected to use the bypass.

A detailed breakdown of the costs of constructing a bypass is beyond the scope of the current commission. However, taking into account all factors (ranging from the cost of the design to the cost of land, road surfacing and fencing) an extremely conservative value is $1,250 per lineal metre. This figure has been used to calculate the benefit-cost ratio for the scenarios considered, as shown below:

OPTION	PERCENTAGE OF TRAFFIC USING BYPASS	BENEFIT-COST RATIOS		
		2.5% Traffic Growth Rate	5% Traffic Growth Rate	7.5% Traffic Growth Rate
Existing + Bypass	25%	0.16	0.28	0.39
	50%	0.32	0.55	0.78
	75%	0.48	0.83	*1.17*
Option 1+ Bypass	25%	0.24	0.37	0.50
	50%	0.48	0.74	0.99
	75%	0.72	*1.11*	*1.49*
Option 2+ Bypass	25%	0.30	0.44	0.58
	50%	0.59	0.87	*1.15*
	75%	0.89	*1.31*	*1.72*

Table 5 : Benefit-cost ratios for possible scheme options

In order for a scheme to be "regarded as economic or worthy of execution … the benefit-cost ratio must be greater than 1.0" (Land Transport NZ 'Economic Evaluation Manual, paragraph 2.9). Although there has been a move away from assessing a scheme solely by means of the benefit-cost ratio, it is still a significant element of any scheme analysis.

It can be seen that in 21 of the 27 scenarios, the benefit-cost ratio lies below 1 showing that the scheme is not economically viable. Only with 5.0% traffic growth does any scheme have a benefit-cost ratio of above 1, and this requires 75% of all traffic to use the bypass (that is, avoid the village). Although a higher traffic growth rate results in improved cost-benefits ratios, the ratio does not rise above 2.0 in any instance.

5.4 Sensitivity Tests of Bypass Benefits and Costs

5.4.1 Bypass Cost

It is considered that the indicative cost of the bypass set out above is extremely conservative. An increase in the cost of the bypass of 15% (to around $1,450 per lineal metre) would be sufficient for even the highest benefit-cost ratio to fall below 1.5.

5.4.2 Inclusion of Accidents

At present, the accident record through Cardrona Village shows just two reported crashes, neither of which resulted in injury. Consequently, although this analysis has excluded the costs and benefits of accidents, the modest record suggests that road safety benefits will not be sufficient to significantly affect the benefit-cost ratios above.

5.4.3 Rate of Traffic Growth

Although three scenarios have been considered for traffic growth, there is data to suggest that the recent growth on Cardrona Valley Road has been in the order of 11%, considerably greater than the maximum rate of 7.5% used in the analysis. Traffic surveys carried out by Transit New Zealand on the entrance to Wanaka (near to the entrance to Mt Iron reserve) also show an annual increase of 9.5% per annum between 2002 and 2005, with the location of the counter suggesting that this increase may be due to a greater volume of longer-distance traffic (such as may also use the Crown Range Road route).

It is understood that modelling undertaken by Gabites Porter consultants on behalf of Queenstown Lakes District Council for the 'Future Link' project used an annual growth rate of 7% within the Wanaka township itself. However, a notional rate of 2% per annum is described in Land Transport NZ's 'Economic Evaluation Manual' for strategic rural roads within Otago.

Given the difference in observed growth rates, it is extremely difficult to forecast future traffic growth with any certainty. However the traffic data from the State Highways near to Wanaka suggests that the recent traffic growth on Cardrona Valley Road is not purely due to drivers choosing the latter route in preference to the former.

Since the sealing of the Crown Range Road is relatively recent, it is not considered that there is sufficient traffic data to reliably calculate traffic growth through Cardrona Village. However, even under the 7.5% scenario described above, the benefit cost ratio is only in the order of 1.7.

5.4.4 'Intangible' Effects

The Economic Evaluation Manual allows for the assessment of intangible effects, such as air and water quality, emissions, noise, vibration, areas of special cultural and historical significance, ecological impacts, visual impacts, community severance, overshadowing, isolation and the health benefits of walking and cycling.

Of particular relevance to Cardrona Village and the consideration of a bypass option could be noise, special cultural and historical significance, and severance.

A bypass could potentially benefit the immediate environment of the main street of the township in terms of reduced traffic flows and noise, although the degree to which this was achieved would depend upon the route of the bypass. Conversely, there could potentially be a loss of trade as drivers avoid the village.

5.5 Conclusion

Overall, it is not considered that a bypass to Cardrona Village is currently economically viable, unless the high traffic growth rate recently observed is maintained in future and a large proportion of vehicles presently within the village are 'through' traffic. However there is insufficient information available at present to form a conclusion as to either of these.

In order to provide a more robust basis for evaluating traffic flows within the village, it is suggested that a traffic count is carried out at least every two years on one approach to the village (that is, in a location where trips made entirely within the village are not counted) and the results compared to ascertain growth. A vehicle registration number-plate survey at either end of the village would also be of use to determine the amount of vehicles that stop within the village.

The analysis shows that even with a reduction to 50km/h through the village and 70km/h 'transition' zones between the 50km/h area and the 100km/h approaches, the delay to each vehicle would only be in the order of 34 seconds compared to the existing situation. The overall travel time between Wanaka and the State Highway 6 / Crown Range Road intersection is approximately 45 minutes, meaning that the increase in journey time due to a reduced speed limit through the village will be at most just 1%. It is therefore not considered that this increase in travel time will adversely affect traffic using Cardrona Valley Road.

6. APPROPRIATE VEHICLE SPEEDS WITHIN CARDRONA VILLAGE

The 'Land Transport Rule: Setting of Speed Limits 2003' specifies the legal procedure for establishing speed limits, but the rule incorporates the Land Transport New Zealand publication 'Speed Limits New Zealand' as the way in which the appropriate calculations can be carried out.

The objective of the speed limits policy is "to balance the interests of mobility and safety by ensuring speed limits are safe, appropriate and credible for the level of roadside development and the category of road for which they are set", with "the level of roadside development and the function of a road (being) the primary determinants of the appropriate speed limit". The road geometry is a secondary factor to roadside development.

Speed Limits New Zealand describes an in-depth procedure for calculating the appropriate speed limits within a settlement which takes into account various factors which are grouped into two general categories, 'development rating' (being the extent of the frontage and side road development) and 'roadway rating' (being the activities and use of the road). The individual ratings are then summed, with the total determining appropriate speed limit.

The 'development rating' is relatively data intensive and hence only an initial estimate has been made, but an evaluation of the 'roadway rating' is more straightforward, as below:

RATING	TABLE	CATEGORY	DESCRIPTION	SCORE
Development	SLNZ4	Frontage development	Frontage activity on main road	4 to 7
	SLNZ5	Side road development	Frontage activity on side roads	1 or 2
Roadway	SLNZ6	Pedestrians	No footpath but useable shoulder	1
	SLNZ7	Cyclists	Cyclists impede moving traffic	1
	SLNZ8	Parking	Vehicles park close to moving traffic but do not obstruct it	1
	SLNZ9	Geometry	2 lanes, flush median or undivided, open visibility	0
	SLNZ10	Traffic Control	None (traffic has priority)	0
	SLNZ11	Use	Residential / rural residential	0
			Total	8 to 12

Table 6 : Rating Criteria

Under the criteria of Speed Limits New Zealand, the Cardrona Village environment is a 'rural' area, and therefore a total score of between 6 and 10 (inclusive) is appropriate for a 70km/h speed limit, with values of 11 or more justifying a speed limit of 50km/h. There is no provision for a 60km/h limit within a rural area.

The rating in Cardrona Village varies between 8 to 12, depending on which location is under consideration (and dependent primarily upon the extent of roadside frontage).

From the analysis, and although much of Cardrona Village would not qualify for a 50km/h speed limit, it might be assumed that a short section of the road could have a reduced speed limit. Under Speed Limits New Zealand however this is clearly not the case, since the minimum length of road over which a 50km/h limit can be installed is 500m, and the document notes that all five 100m length components must achieve the minimum rating score. To clarify the reasons for this, it goes on to state that "it is not appropriate to install a 500m long … speed restriction in a rural area, for example, if the only development is located in a 100m section of road in the middle of the proposed speed limit. In these circumstances road users will see no reason for the change in speed limit and compliance will be poor (which) makes judgement of speed and distance difficult for all road users (and) such conditions will usually contribute to a reduction in safety."

It is unlikely that the roadway environment is likely to change significantly in future. Consequently, it is the extent of frontage development (and to a lesser extent the amount of development on the side roads) which will be the primary drivers of any reduced speed limit. Speed Limits New Zealand shows

that it is not appropriate to reduce speed limits based upon potential future development – the development must be present or imminent, otherwise drivers will not comply with the lowered limit.

On this basis, it is considered that the 70km/h speed limit through the village is presently appropriate but as roadside development increases, the case for a reduction in the limit is likely to become stronger. Given the minimum requirement for the length of the section of a 50km/h limit, this suggests that clustering key development over a short (500m) section of the Cardrona Valley Road may facilitate the implementation of a reduced speed on that part of the road. As set out previously (Section 5.5), the increase in delay to each vehicle due to a reduced speed limit in Cardrona Village would be in the order of 34 seconds (compared to an overall travel time between Wanaka and the State Highway 6 / Crown Range Road intersection of approximately 45 minutes) and it is therefore not considered that this increase in travel time will adversely affect traffic using Cardrona Valley Road.

7. POTENTIAL MEASURES TO CONTROL VEHICLE SPEEDS

The speed data gathered by the traffic counter showed a high degree of compliance with the posted maximum speed limit through Cardona Village. However, an overview of further measures that could be implemented is set out below. This is based upon Land Transport New Zealand Research Report 300 "Speed Change Management for New Zealand Roads" (2006), which aims to identify and develop New Zealand speed management approaches that influence drivers' choice of speed. This report is based upon current New Zealand practice coupled with international literature, and assesses the effectiveness of a wide range of speed management methods.

Overall, there are two types of speed management treatments which are identified, 'speed change' and 'speed maintenance'. Speed change treatments indicate to a driver that they should change their speed, such as when moving from a rural to an urban environment. Speed maintenance treatments encourage drivers to maintain an appropriate speed through an area. The research shows that the optimum results occur when a combination of physical and visual factors at an entrance to an area are used in combination with downstream changes in the roadway or built environment which serve to maintain the speed change.

In passing it is instructive to note that Speed Limits New Zealand sets out that speed limits must be nationally consistent, and that "consistency is an important aspect of road users' perceptions of a reasonable speed limit, and will influence their willingness to comply". Arbitrarily reducing the speed limit will therefore be unlikely to reduce in significant reductions in vehicle speeds, merely an increase in non-compliance.

7.1 Gateway Treatments

Gateway treatments are used to reduce drivers' speeds when entering an urban area or village. There are existing gateway treatments at Cardrona Village in the form of signs, pavement markings and formed, vegetated kerb extensions.

It is possible to use further visual treatments to optically narrow the road, such as widening the flush medians, using edge lines, transverse lines and central planted islands. While further physical restrictions such as speed humps, rumble strips and chicanes have been shown to be very effective in

reducing speed in conjunction with gateway features, these are only suitable in moderate and low speed environments and therefore unsuitable for installation at Cardrona Village.

Research shows that speed reductions due to gateway treatments can be temporary and dissipate after 250m if the environment downstream is not conducive to maintaining the lower speed. It is therefore essential to further reinforce the change in roading environment subsequent to the gateway.

7.2 Road and Lane Widths

Research has shown that manipulating road width (that is, the width of the seal) can have direct and long lasting effects on speed. The report suggests that for a 100km/h speed limit road, a carriageway width of 6.0m results in an average speed of 80km/h without any further treatments being required, compared to a width of 8.0m having an average speed of 90-100km/h.

The site surveys carried out as part of this commission showed that the width of Cardrona Valley Road was in excess of 10m in places including at the hotel (which can be expected to be a focus of pedestrian movements) where there is a seal extension on the western side of the road up around 3.0m. Over other parts of the road there are wide grassed berms/verges which may also contribute to a driver perception of a wide road width.

Notwithstanding this, the presence of edge markings and central flush median reduce the widths of the traffic lanes between 3.0m to 3.3m. Visual narrowings such as these have been shown to reduce vehicle speeds. However there are mixed results in respect of the performance of flush medians. In some studies reductions of up to 4.8km/h in average speed have been recorded, but in other cases they have been shown to result in increases of up to 7.5km/h in the average speed.

7.3 Roadside Features

Several roadside features have been shown to influence driver speeds to a greater or lesser extent, including cycle lanes, pedestrian footpaths, areas for parallel parking and edge posts. These provide visual cues for drivers of a narrowed traffic lane, and therefore contribute to reduced speeds. The presence of parked cars in an adjacent parking lane for example, can reduce traffic speeds by up to 25km/h. However the results of these measures can be somewhat variable, with cycle lanes and footpaths having lower levels of effectiveness. It is of note that under Speed Limits New Zealand, the provision of a footpath has a lower rating score than a shoulder which pedestrians can walk on. As such, it actually *diminishes* the case for reducing the speed limit.

There is also a reduction in traffic speeds as the number of side road intersections and driveways increases, with more frequent access points generally producing lower speeds. The use of this particular technique must be balanced against the role of the frontage road within the road hierarchy, since increased access points introduce additional potential conflicts and hence road safety concerns.

The lateral clearance between the edge of the road carriageway and roadside objects has a significant effect upon vehicle speed. Research shows reducing the lateral clearance from 30m to 15m decreases speed by just 3%, but that a reduction to 7.5m reduces speed by 16%. The definition of 'roadside objects' in this case includes buildings, trees and parked cars. The distance of housing from the road shows a positive correlation with car speed reduction within the urban area, and the amount of architectural detail also serves to slow vehicles speeds. While there have been some mixed results for trees, one interpretation of the varying results is that a continuous line of vegetation creates improved

road delineation and therefore results in increased speeds, whereas discrete groups of planting create a speed reduction.

7.4 Other Measures

Road roughness has strong effects on drivers' speeds and increases in roughness can produce a 14% to 23% reduction in vehicle speed. However the additional noise that these types of measures tend to create means that they are generally not suitable for use within 200m of residential areas.

Painted patterns such as transverse lines on the road can be used to influence drivers' perception of speed. These measures are relatively new and although short term results show a benefit, there are no longer term studies yet which prove the effectiveness of the measures.

7.5 Conclusions

For the current pattern of development in Cardrona Village, the combination of gateway features and narrow lane widths appears to represent the most appropriate combination of measures to reduce vehicle speeds.

Site visits have shown that while the lanes at the northern gateway are 2.8m in width, the lanes at the southern gateway are 3.1m in width, which may potentially result in the former being more effective that latter. Reducing the lane width at the southern gateway may therefore achieve some further benefits in reducing vehicle speeds. The data also suggests that re-marking the lines which delineate the edge of the traffic lanes to provide lanes which are no more than 3.0m in width may be beneficial in maintaining the reduction in vehicles speeds created by the gateways. There may also be benefits to be gained through removing the existing central flush median.

In respect of the future form of development within the village, the research strongly suggests that permitting the built environment to be located close to the road as possible (subject to good urban design and planning considerations) will assist in reducing vehicle speeds. Any planting between the buildings and the traffic lanes should be undertaken to create groups of bushes and trees, and should not create a continuous line of vegetation.

While forming a parking lane by the side of the traffic lanes, and allowing a greater number of accesses per unit length of road will also provide speed reductions, both of these techniques will also introduce road safety concerns and therefore should only be implemented after a more comprehensive study.

8. CONCLUSIONS

The information available shows a high level of adherence to the present 70km/h speed limit within Cardrona Village with 81% of vehicles travelling at 60km/h or less, and only 4% of vehicles travelling in excess of 70km/h. There are no recorded accidents which appear to be related to vehicle speeds.

The primary determinant of the appropriate speed limit is the extent of roadside development ('Speed Limits New Zealand', Land Transport NZ). Using the appropriate standards, the present speed limit is considered to be appropriate for the current pattern of development in the village. As the village

develops, the case for a reduction in speed limit will be strengthened. However the standards clearly show that it is not appropriate to base the prevailing speed limits upon possible future development, since those speed limits will not be complied with.

For the current pattern of development in Cardrona Village, the gateway features and narrow lane widths appear to represent the most appropriate combination of measures to reduce vehicle speeds. Further benefits may be achieved through narrowing the lane widths at the gateway features, and re-marking the lines which delineate the edge of the traffic lanes through the village such that they are no more than 3.0m in width. There may also be benefits to be gained through removing the existing central flush median. However a footpath will be of limited effectiveness, and under Speed Limits New Zealand, will weaken the case for a reduced speed limit.

In respect of the future form of development within the village, the research strongly suggests that permitting the built environment to be located close to the road as possible (subject to good urban design and planning considerations) will assist in reducing vehicle speeds. Any planting between the buildings and the traffic lanes should be undertaken to create discrete groups of bushes and trees, and should not create a continuous line of vegetation. Forming a parking lane by the side of the traffic lanes and allowing a greater number of accesses per unit length of road will also provide speed reductions, but may also introduce road safety concerns and therefore should only be implemented after a more comprehensive study. Clustering key development over a short (500m) section of the Cardrona Valley Road may facilitate the implementation of a reduced speed limit on that part of the road in due course.

A preliminary evaluation shows a bypass to Cardrona Village is not currently economically viable unless the present high rate of traffic growth is maintained and a high proportion of traffic presently recorded within the village does not have an origin or destination in the settlement itself. Even then, the calculations suggest that the benefit-cost ratio is not particularly high, in part because reducing the speed limit to 50km/h through the village increases the delay to each vehicle only by around 34 seconds. This compares to a travel time of approximately 45 minutes between Wanaka and the State Highway 6 / Crown Range Road intersection.

In the event that a reduced speed limit through Cardrona Village was introduced, it is not considered that the slight increase in journey time would adversely affect traffic using the road.

Traffic Design Group Ltd
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