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Traffic Management and Speed Limits in Local Streets

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Abstract:

This paper reviews past experience and current practice on traffic calming in Australia with specific reference to examples from New South Wales and South Australia. The discussion initially focuses on traffic calming approaches to deal with the car, starting out with its antecedents followed by an examination of practice in New South Wales and South Australia. The trend away from aggressive traffic calming approaches is noted as setting the scene for the debate on lower urban speed limits for local areas (usually 40kn/h or 50km/h). In examining the speed limit debate, two cases studies are compared and examined in detail: the 1986 Sydney 40km/h trials and the 1996 Unley 40km/h speed limit trials. The paper then concludes with suggestions for future directions regarding the management of traffic in local areas to ponder over.

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Introduction

This paper reviews past experience and current practice on traffic calming in Australia with specific emphasis on examples from New South Wales and South Australia. The discussion examines traffic calming approaches to deal with the car, starting out with its antecedents followed by an examination of practice in New South Wales and South Australia. The trend away from aggressive traffic calming approaches is noted as setting the scene for the debate on lower urban speed limits for local areas (usually 40km/h or 50km/h). In examining the speed limit debate, two case studies are compared and examined in detail: the 1986 Sydney 40km/h trials and the 1996 Unley 40km/h speed limit trials. The paper then concludes with suggestions for future directions regarding the management of traffic in local areas to ponder over.

Traffic calming antecedents

Traffic calming is not a new phenomenon. It is distinct from earlier attempts at managing cars in local areas through road hierarchy plans typified by Radburn in the USA, Alker Tripp's ideas in the 1940s (UK) and the 1963 Buchanan Report "Traffic in Towns" (UK) in that traffic calming further physically modifies the local road environment to make it more amenable in terms of safety and amenity to local use by pedestrians. The concept of attempting to manage cars in residential areas can be traced back to the Dutch Government's efforts in the early 1970s to introduce 'woonerfs'. Essentially a woonerf is an area in which the residential function clearly predominates over any provisions for traffic and this tends to be expressed through the physical design of the precinct. The equivalent concept in Australian terms is the 'shared zone', where pedestrians have priority over the cars and cars are restricted to a speed limit of 10km/h. The Dutch Government introduced its 'Woonerf Policy' in September 1976 (Royal Dutch Touring Club, 1980) which included some of the following attributes (paraphrased):

*it must primarily be in a residential area
*there should only be local traffic using the precinct
*traffic should not exceed 200 vehicles per hour in peak periods
*kerbing should be avoided since the area is the domain of the pedestrian
*entrances and exits to the 'woonerf' must be clearly signposted
*the precinct has an attractive streetscape for pedestrians
*measures must be used to control speeds and placed no more than 50m apart.

Some treated streets in the Netherlands are now 20 years old. According to Hass-Klau (1992), a leading European expert on traffic calming, traffic calming is generally considered to have been a success, although it has been combined with a strategy to promote cycling and public transport. Traffic accident injury rates for example are lower than what has been the experience in Britain and Germany. However, Hass-Klau notes that attempts to calm wide distributor roads with volumes of 10,000 or more vehicles over a 24 hour period, have not been successful.

An alternative to the woonerf has been the 30km/h 'stillevej' or zone, particularly where costs are high and the area to be treated has been extensive. The original Dutch requirements (Brindle, 1986) for this type of traffic calming treatment included the following:

*the lower speed must be logical for the character and condition of the road.
*it must service only local traffic

*there should be cordon signing, lower speed zoning signage and speed control installations
*public transport, service and emergency vehicles must not be unduly hindered
*traffic and pedestrians are separated
*speed control devices must be lit and safe for passage at 30km/h
*1km is the maximum distance that vehicles should have to travel under 30km/h conditions
*the maximum spacing of physical speed control devices was recommended at 80-90m.

Hass-Klau (1996) in commenting on the German experience of area-wide 30km/h speed limits relying purely on speed limit signs for compliance noted that where the road environment design fails to reflect the 30km/h speed limit, speeding is still a problem, particularly if police resources are limited for effective enforcement.

Snapshot of traffic calming in New South Wales

In March 1995 the Roads and Traffic Authority of New South Wales published a survey of the road safety and planning activities of Local Government Councils in NSW (Haworth & Bowland, 1995). At that time, there were 177 Councils in NSW, of which 133 participated in the survey. 107 (81%) out of the 133 Councils surveyed indicated that they had implemented physical traffic calming measures of some description. The survey produced some interesting findings regarding strategies and measures that NSW councils had used for controlling speeds in local streets, which are highlighted in table 1.

Table 1 Traffic calming measures: NSW Councils in 1995 (source: Haworth & Bowland (March, 1995))

TRAFFIC CALMING MEASURES IMPLEMENTED AS OF EARLY 1995 (Note: multiple responses possible)	Councils in large urban areas	Other councils (other urban, provincial, rural)	All Councils
Lower speed limits in local streets	11(79%)	62(67%)	73(68%)
Speed humps	9(64%)	40(43%)	49(46%)
Chicanes/speed humps	9(64%)	21(23%)	30(28%)
Threshold treatments	13(93%)	44(47%)	57(53%)
Roundabouts	14(100%)	66(71%)	80(75%)
Full or partial road closures	1(7%)	3(3%)	4(4%)
Kerb blisters	0(0%)	3(3%)	3(3%)
Pedestrian refuges	2(14%)	5(5%)	7(7%)
School speed zones	7(50%)	10(11%)	17(16%)
Road narrowing	3(21%)	3(3%)	6(6%)
Traffic islands, medians	2(14%)	2(2%)	4(4%)
Shared zones	2(14%)	1(1%)	3(3%)
Profile line markings	1(7%)	2(2%)	3(3%)
Traffic control markings	1(7%)	0(0%)	1(1%)
Wombat or magpie crossings	8(57%)	5(5%)	13(12%)
Channelisation	2(14%)	0(0%)	2(2%)
Landscaping	1(7%)	1(1%)	2(2%)

It shows that the adoption of the concept of lower speed limits in local streets is almost universal, with this being the most popular local area traffic management measure with 80% of councils in large urban areas and 68% of all councils having implemented lower speed limits. Amongst councils in large urban areas, the most popular physical traffic calming measures were found to be: roundabouts (100% usage); threshold treatments (93% usage); speed humps (64% usage); chicanes/slowpoints (64% usage); Wombat crossings (57% usage); and School speed zones (50% usage). For all other councils (ie

other urban areas, provincial and rural), the adoption of traffic calming was significantly less, however, the most popular physical traffic calming measures were found to be: roundabouts (71% usage); threshold treatments (47% usage) and speed humps (43% usage). Unfortunately, the data provided by Councils did not include the timeframe over which the traffic calming measures were implemented, but rather just provided a snapshot of the situation in early 1995. It is also lacking in terms of indicating how widespread the adoption of traffic calming measures was within the jurisdictions of the surveyed councils. Notwithstanding this point, it does serve to roughly indicate awareness of traffic calming measures amongst the surveyed councils. Other interesting findings about this survey include traffic calming measures which do not seem to have much currency in terms of their adoption by councils, such as the use of road narrowings (6% of all councils), full or partial road closures (only 4% of all councils), traffic islands/medians (4% of all councils), kerb blisters (3% of all councils), shared zones (3% of all councils) or channelisations (2% of all councils).

The South Australian Experience of traffic calming

Adelaide metropolitan councils such as Enfield, Woodville, Kensington/Norwood, Unley and Burnside were pioneers of residential street management in Australia, with many early schemes initiated in response to resident complaints in the early 1970s. However, many of the more notable comprehensive area-wide schemes around Australia did not occur until 1984 in the case of Sydney's Canterbury Council, 1981 in the case of Melbourne's City of Sandringham Council and 1986 in the case of Adelaide's City of Thebarton (Director General of Transport South Australia, 1987). In the case of Unley, which is the subject of a case study discussion later in this paper, the problem of local area traffic management can be traced back to 1969 with the publication by the Road Traffic Board of a report entitled "Report on Duthy Street, Unley", but it was not until 1983 that Unley took its first major "Traffic Management Review". As can be discerned from table 2 below, a major community backlash to schemes reliant on physical measures resulted in Unley Council deciding to experiment with a 40 km/h speed limit from the end of 1991 until the middle of 1996.

Table 2 History of local area traffic management in Unley (source: adapted from data in Unley's "City Traffic Plan" (1995) and Unley's Trial Report (1996a)

YEAR	SCHEME	DETAILS
1969	Report on Duthy Street, Unley	
1975	Implementation on 1975 scheme	34 road closures
1983	Traffic Management Review	9 roundabouts
1985	Action Plans local Crossing and Local Collector Roads	1 plateau
1987-89	Study evaluating Residential Street Management Projects	3 streets treated with physical speed controls
Late 1980s	Speed hump installation	7 speed humps
1989	Plateaus and speed humps	2 plateaus several speed humps
1989	Council's second major traffic management review	physical speed controls 1 plateaux
1990	Post Implementation Study-rejected by Council and residents	suggested physical speed control devices, turn bans and a diagonal closure
1991-93	15 month trial of 40km/h limit	40km/h zone trialed
1994-96	26 month further trial of 40km/h limit	40km/h zone trialed

However, it was not until 1987 that a landmark manual in traffic calming, entitled "Residential Street Management Manual" (Director General of Transport, South Australia, 1987) became available. With this manual, Australian local area traffic management practitioners finally had a practical, all encompassing guide on traffic calming which provided details on the various speed control measures available together with their indicative costs, helpful guidelines on the process necessary to facilitate successful implementation and support from the community, the principles underlying traffic calming and case studies of past schemes. Although the RSM Manual was a product of traffic calming mania in the early to mid 1980s that swept Australia, it nevertheless crystallised contemporary thinking in the field into one convenient reference source. Other Transport Departments in other states produced their own documentation on traffic calming but none were quite as comprehensive, thorough and as well thought out as the South Australian RSM Manual. Interesting features of the Manual were its strong emphasis on the need to garner strong community support and on the need to provide some scientific justification of local area traffic management through careful surveys and analysis of the traffic amenity and safety problems perceived by the community. A deficiency in the RSM Manual is that it tended to lead Councils down a costly infrastructure approach, tending to play down the value of a cheap, signposted speed zoned area-wide approach. The authors of the RSM Manual were right in a sense to emphasise the community consultation component of their manual given their predilection for costly speed control devices that more often than not raised the ire of local residents, particularly those who perceived a reduction in the immediate amenity of their property due to speed humps, chicanes or threshold treatments outside their houses.

In recent times, local councils have not been so keen to implement area-wide schemes that rely on aggressive speed control devices such as speed humps. In the case of Unley, there was strong opposition from Council and the community to the use of further road humps when a report entitled the "Post Implementation Study" recommended their use (City of Unley, 1995). Part of the disincentive appears to be the initial capital costs, together with increased ongoing maintenance costs in the vicinity of such devices due to heavy braking of vehicles to negotiate such devices. Added to this is the irritation many in the community have expressed with the noise that arises from vehicles that race through the speed control measures at higher than the recommended speed; the uncomfortable discontinuous nature of local area travel in residential zones with aggressive speed control devices; and the feeling of having to negotiate a tedious obstacle course.

The capital costs can be significant. While its difficult to generalise what these costs might be, guesstimates can give some indication. The East Roseville Scheme in the Municipality of Willoughby (NSW) in 1985 spent around $1m/km^2 (indexed for inflation at an average of 6% p.a.) to aggressively traffic calm their area with physical measures (Allan, 1988). In these cash-strapped times for the public sector, it could be argued that if speed limits can achieve much the same outcome, it would probably be better to divert the savings from not building more speed control devices to other areas of a council's responsibilities. Whilst non-compliance with the speed limit by motorists is a real possibility and costs of enforcement are problematical, it could be argued that enforcement costs could be more than easily recouped through fines. Unfortunately for local government in South Australia though, this potential revenue stream goes to the state government and may not necessarily end up in improving road safety in problematical areas.

The speed limit debate

More than a decade ago, in 1986, the Traffic Authority of New South Wales initiated a nascent debate concerning the appropriateness of local area speed limits with the publication of results from a complex 40km/h speed limit trial conducted in eight residential precincts of metropolitan Sydney which were then matched against 7 control precincts in similar areas speed zoned with the existing 60km/h speed limit. This study developed out of concern about evaluations by Schnerring and Samadahl within the Traffic Authority that concluded that the state-wide Neighbourhood Road Safety Campaign of 1986 resulted in speed reductions that were too small to be meaningful. This concern suggested the need to instigate physical and legislative changes to reduce driving speeds on local streets, which is why it was considered necessary to trial 40km/h speed zones in residential precincts (Webster & Schnerring, 1986).

The trials included "before" and "after" community attitude and vehicle behaviour surveys. Essentially the aim of the trials was to ascertain what measures might best facilitate the introduction and community acceptance of a general 40km/h speed limit in local areas and whether introduction of a 40km/h speed limit would reduce vehicle speeds and traffic volumes. Four precincts had been exposed to an intensive Road Safety Campaign, two with the 40km/h speed limit and two 60km/h control precincts. Four precincts had been subjected to a low key Road Safety Campaign, two with the 40km/h speed limit and two 60km/h control precincts. Three precincts had widespread use of physical traffic calming measures, two with the 40km/h speed limit and one 60km/h control precinct. Four precincts were without exposure to either the campaign or traffic calming measures, two with the 40km/h speed limit and two 60km/h control precincts. In the experimental precincts, a total of 7,550 households were exposed to the 40km/h speed limit, while 8,080 households were located in the 60km/h "control" precincts. Community attitude, vehicle speed and number plate surveys were conducted in each of the 15 precincts in February 1986 before the start of the trial and in July 1986, at the conclusion of the trial. A total of 374 face-to-face "before" interviews and 375 "after" interviews were conducted.

The conclusions of the 1986 40km/h trials in Sydney from the community attitude surveys suggested that: there was "considerable support " for 40km/h zones; that they were an acceptable means of controlling traffic on local streets; that they increase safety on local streets; and that residents believed they had reduced their driving speeds. Rather surprisingly, the issue of enhanced residential amenity associated with the lower speed limits was not examined in the community attitude surveys. Interestingly, the media campaigning blitz of the previous year suggested that the Neighbourhood Road Safety Campaign had little impact on community perceptions and attitudes. The vehicle speed surveys confirmed that while the advertising campaign effected small decreases in mean speeds, they were still excessive in the 40km/h precincts. The vehicle speed surveys concluded that 40km/h speed zoned areas resulted in 'small reductions' in vehicle speeds, but emphasised that the 40km/h speed limit was much more effective when used in conjunction with physical changes to the road environment as part of a local area traffic management scheme. Table 3 indicates the changes in vehicle speeds effected by the 40km/h trials compared to the 60km/h control precincts. The reductions in vehicle speeds, while small in absolute terms, do however suggest significant safety gains according to Nilsson's "Fourth Power Rule". A major disappointment with this report, however, is that while the intention to measure the impact of lower speed limits in local areas on through traffic cutting through local areas was expressed, time constraints apparently prevented this from happening. The report did provide evidence that the impact on traffic volumes across the 8 precincts of introducing a 40km/h speed limit was insignificant, with traffic volumes down by a mere 4% compared to 3% in the control

precinct. There was some encouragement with regard to traffic calmed precincts, in that a 9% reduction in volumes occurred. However, Peter Croft (1997) of the Roads and Traffic Authority of NSW commented that while the idea of a lower urban speed limit of 50km/h has gained further support through the Austroads Urban Speed Management Study (1996) and the NSW Parliamentary Road Safety Committee (STAYSAFE) report (1996), at the time of reporting, there was no formal government position on the issue in NSW.

Table 3 Speed survey results of 40km/h speed limit trial in Sydney, 1986 (source: Webster & Schnerring (November 1986))

STRATEGY	Vehicle speed characteristics km/h	40 km/h Speed Limit Trial Precinct	40 km/h Speed Limit Trial Precinct	Control 60 km/h precinct	Control 60 km/h precinct
		BEFORE (March 1986)	AFTER (July 1986)	BEFORE (March 1986)	AFTER (July 1986)
Low level advertising neighbourhood traffic safety campaign	MEAN SPEED>	52	49	58	56
	85%tile SPEED>	61	58	66	66
Intensive advertising neighbourhood traffic safety campaign	MEAN SPEED>	58	54	56	58
	85%tile SPEED>	67	63	67	69
Traffic calmed	MEAN SPEED>	49	44	55	55
	85%tile SPEED>	58	53	64	65
No advertising or traffic calming	MEAN SPEED>	53	47	59	57
	85%tile SPEED>	64	61	71	68
All	MEAN SPEED>	53	48	57	57
	85%tile SPEED>	63	59	67	67

After a hiatus of 7 years, in 1993 a debate re-emerged concerning the appropriateness of then current speed limits. In 1997, there appears to be a trend by State Road Traffic Authorities, particularly in NSW, to introduce more appropriate speed limit zonings that reflect the design standards of the roads concerned, but as yet, there is still no statutory commitment to lower the general urban speed limit.

At a workshop entitled "The Speed Review" (Fildes & Lee, 1993), there was considerable discussion and general support by Barton and Cunningham of Vic Roads concerning the merits of reducing the general urban speed limit from 60km/h to 50km/h and Peter Croft of the Roads and Traffic Authority of NSW indicated a continuing commitment to review the lowering of speed limits in residential areas. An interesting point to come out of this workshop is that it highlighted the fact that Australia's urban speed limit of 60km/h is significantly out of step with current practice in Europe where countries have generally reduced their general urban speed limit to 50km/h. The trend towards lower, more appropriate urban speed limits in Europe has been driven by the reduction in traffic accident fatality and injury rates that have accompanied previous speed limit trials. Max Cameron (1992) quoted the work of Engel and Thomsen's 1988 study of the impact on accident risks resulting from a lowering of the general urban speed limit from 60km/h to 50km/h in Denmark in 1985, which suggested risk reductions for all accidents of 8.7%, for fatalities of 24.1%, for severe injuries of 7% and for minor injuries of 10.6%. Interestingly, Vic Roads' policy at the time (Barton & Cunningham, 1993) favoured "lowering the general urban limit to 50km/h with arterial roads being

signed upwards at 60km/h or above, and retaining the option to set lower speed limits where physical devices have been installed".

In 1994, the Federal Office of Road Safety and Department of Transport under the Keating Federal Labor government, released its National Road Safety Action Plan 1994 (Federal Office of Road Safety, 1994). Although it had little to say about local roads, clause 24 did call on all levels of government, the National Road Transport Commission and Austroads to implement a nationally harmonious urban speed management policy which recognised the specific needs of traffic routes and local streets. The change of federal government and the financial stringencies that have consequently been imposed since then, may explain why little explicit action appears to have occurred in this regard. While there appears to have been plenty of discussion largely in support for lower speed limits, politicians are still strangely reticent to act decisively in this regard. It seems to be a situation akin to that which transpired over the issue of gun control up until the Port Arthur massacre in 1996 where politicians expressed support for change in their public announcements about the issue, but were loathe to take action, lest they alienate a significant voting constituency.

The New South Wales Government may be poised for success in achieving a lower speed limit if its 1996-97 Speed Management and Strategy Plan is to be believed (Roads and Traffic Authority of NSW, 1996). For example it puts forward a strategy that calls for finalisation of a system of speed limits across both the urban and rural road network, and under 'actions' indicates that this strategy would include a lower limit on residential streets, with the key date for action by the Roads and Traffic Authority noted as June 1997. Interestingly, it also notes as an objective that drivers believe that the speed limits are appropriate, which requires a strategy to ensure that the physical road environment encourages safe driving speeds. For this strategy to succeed, the Plan still perceives there to be a strong, important role for traffic calming, even if it requires the state government in assisting with funding.

In April 1994 (Department of Transport), the South Australian Government released a discussion paper about the issue of urban speed limits for public comment. Responses from the public were to be utilised in a report on lower urban speed limits to the South Australian Minister for Transport, Diana Laidlaw to be released later in that year. The discussion paper examined the idea of the need for a 'lower speed culture' by having a more credible speed limit for local areas. The paper noted that local area traffic management schemes have resulted in a rather piecemeal approach to the issue of urban speed limits, resident support has not always been in favour of traffic calming and there was a desire to try and maintain uniformity in local area speed limits. The considerations that the paper examined in evaluating a move towards a lower urban speed limit were: safety; mobility for private vehicles, public transport, delivery vehicles and emergency services; amenity; the environment; and the speed culture. It also examined the implementation process and canvassed three options: doing nothing, a 50km/h option and a 40km/h option. On the issue of compliance, the paper suggested the need to nurture through education, training and publicity the development of a 'low-speed culture' in society. It also stressed the need for national uniformity for a national urban speed limit.

In response to this discussion paper's public submissions, in November 1994 (Taylor), a report entitled "The General Urban Speed Limit for South Australia" was prepared for the Minister for Transport, Diana Laidlaw. Essentially structured along the same lines as the Discussion Paper for public comment, it provided greater elaboration from the Urban Speed Limits Advisory Group on the need for lower urban speed limits and the associated benefits to be expected in terms of safety, amenity and the environment. It

noted that the only significant disbenefit would be that local area travel times would increase marginally with the lower speed limit.

While this report examined the issues fairly and comprehensively, if viewed in a political context, it perhaps failed to provide a document that decisively demanded change to a lower speed limit of 50km/h. Instead it equivocated between a 40km/h and 50km/h limit. This may have occurred because much of the frame of reference of the report focused on the City of Unley's experience of its trial 40km/h speed limit (reduced from a 60km/h limit), making it difficult to present a convincing case for the introduction of a 50km/h limit since it is based on an assumption that the Unley data can be simply extrapolated to make inferences about driver behaviour with a 50km/h speed limit. There may also be a problem with the Unley case study, in that it is not generally representative of local road systems in suburbs throughout Adelaide, so to use it as a basis for the widespread adoption of lower speed limits is somewhat problematical. While the 40km/h speed limit may be entirely appropriate for Unley's narrow treelined late 19th century grid network of streets, it may be unnecessarily low for local road networks in newer residential subdivisions with geometric design speeds of 50-60km/h.

The report did in fact come down in favour of a general 50km/h urban speed limit which should be adopted in the immediate future, with higher appropriate speed zones for arterial roads. Other key recommendations included making allowances for 40km/h traffic calmed precincts, significant publicity and education programs in advance of adopting a 50km/h speed limit; national uniformity; a functional road hierarchy classification of all roads in the metropolitan area; and a long term goal towards a local general street speed limit of 40km/h.

Current moves towards the achievement of a general urban speed limit of 50km/h have effectively been placed on hold for the time being. In November 1996, Transport Ministers Australia-wide agreed to retain the status quo, that is retention of the 60km/h general urban speed limit, and for local government to continue to exercise their discretion to introduce lower limits on local roads (Larsson, 1997). However, Larrson notes that in South Australia, there has effectively been a moratorium on the establishment of local area speed limits due to the continuing 40km/h trial in Unley. It does seem now that the South Australian Department of Transport is confident that they have resolved the theoretical issue of whether or not a local area 40km/h speed limit should be introduced, since they have indicated in the preface of their traffic control standard for 40km/h Local Area Speed Limits (Department of Transport, 1997) that further consultation with local councils will be in the context of practical application of the standard and not theoretical (or philosophical) considerations. Essentially the standard indicates that a 40km/h limit can be introduced by local councils, providing that the average of mean speeds on streets longer than 200m without "high-level" physical speed control treatments is not more than 50km/h.

The Unley experience with the 40km/h continuing trial

Context

Few local government areas in South Australia, or even Australia have devoted as much of their resources and analytical skills to bear on solving traffic problems in local areas over such an extended period of time (since 1969!) as has been the case with the City of Unley (see table 2). This has partly been a reflection of Unley's situation in being an inner city suburban area with a traditional grid network of streets, nestling on the

perimeter of Adelaide CBD's southern parklands, bounded by major arterial roads and intersected by three north-south arterial roads, Goodwood, Unley and Fullarton Roads. Growing congestion on the arterial roads within Unley's jurisdiction resulted in a significant increase of traffic in the area's local streets as motorists tried to find alternative 'rat-run' routes through the area. Up until the late 1980s, Unley had tackled its problems by relying on aggressive traffic calming measures such as speed humps and road closures. However, with the release of a major traffic management review completed in 1990, which recommended the use of further aggressive traffic calming devices, there was a major backlash from councillors and the community, prompting the council to reconsider its traditional approach to local area traffic management. This community pressure resulted in the development of the only 40km/h zone in South Australia at the time it was introduced. The notion of introducing a 40km/h zone was a central theme reinforced in the City of Unley's "City Traffic Plan" released in February 1995.

Unley's "vision" and rationale for the 40km/h zone

An interesting approach taken in Unley's "City Traffic Plan" was its declaration of the vision it wanted to aim towards and its articulation of the 'philosophies' that apparently underpin its vision for the area. The 'vision' Unley emphasises is that its residential streets are places to live, not traffic channels or places for managing roads for cars. It almost seems to be put forward as a nostalgic vision attempting to recapture the feeling of Unley's streets as a social place at the turn of the century.

The seven philosophies that provide the supporting rationale underpinning the City of Unley's vision are:

1. A lower speed environment in local streets, with clear preference given towards a 40km/h speed limit, citing as support for the position the 1994 Speed Limits Advisory Committee Report (Taylor, 1994).
2. To limit traffic exposure on local streets to no more than 800 vehicles per day.
3. Develop local area traffic management schemes only through close community consultation, to allow the community to develop a sense of ownership over the project.
4. Dealing with traffic in a strategic manner with the source of problems on the main road network being identified before tackling the problems of unwanted traffic in local streets.
5. The Council appears to have a road hierarchy plan in place, but is faced with the problem that while many higher order roads in the local area road hierarchy make geographic sense, they are not necessarily compatible with the character and desired amenity of the area. The City Traffic Plan seems to imply that this apparent contradiction will be solved by continuing with the road hierarchy but using lower speed limits to maintain some semblance of amenity.
6. The Council advocates having a systematic program in place for dealing with accident 'black spot' locations as they become apparent. It also advocates a proactive approach, based on the 'warrant' system, which seeks to identify hazardous locations before they develop an accident reputation.
7. The final philosophy advocates a desire to "reclaim" the arterial roads dissecting Unley outside of the peak hour periods, for pedestrians and businesses along these roads.

Sequence of events

The history of actions involved in Unley's 40 km/h speed trial are detailed in table 4. The initial trial was guided by a Working Party appointed by the State Government. It began in December 1991 and that early phase concluded in February 1993. Essentially the early

phase trialed the use of entry "residential 40km/h speed zone" signage to the trial precincts. A decision was made to extend the trial a further 26 months from February 1994 to March 1996, mainly to experiment with a range of elements on traffic speeds including signage, pavement markings and low level visual impact traffic calming devices. This was driven by the notion that greater speed reductions could be achieved using more explicit signage and traffic calming measures within the precinct. A total of seven surveys were conducted, the last of which concluded in March 1996.

Methodology of the 40km/h continuing trial

The trial area was divided into three areas, which were then monitored for vehicle speeds and traffic volumes:

1. Area 1 was retained as a control, to allow reference with the initial trials. This area used standard 900x600mm entry and exit threshold signs advising motorists of the 40km/h limit in a local traffic area.
2. In addition to the measures used in area 1, area 2 was used to trial low impact elements including small intermediary signage (ie 40km/h zone signs 450x300mm located at midblock locations within the precinct) and painted entry speed limit pavement markings 1000x2500mm.
3. Area 3 was used to trial "high impact elements" which included large 1400x600mm entry/exit threshold signs advising motorists of the 40km/h limit in a residential speed zone. Moreover, it included intermediary signage (ie 40km/h zone signs 450x600mm located at midblock locations within the precinct), painted entry and mid-block speed limit pavement markings 3400x4200mm, thresholds and kerb blister treatments.

Table 4 Program of Unley 40 km/h trial (source: adapted from data in Executive Summary of Trial Report, City of Unley (June, 1996b) and Community Survey by Braithwaite (June, 1996).

DATE	ACTION
	INITIAL TRIAL
Nov 1991	Initial speed survey prior to commencement of trials (still 60km/h)
Dec 1991	Start of Unley 40 km/h local area speed zone
Feb 1993	Final speed survey of initial trial (Survey A)
	CONTINUING TRIAL
Feb 1994	First speed survey (Survey 1) prior to installation of devices/elements and 12 months after final survey in initial trial
March 1994	Installation of low impact intermediary signs in Area 2 and high impact intermediary signs in Area 3 First community survey of 124 residents in five minute face to face interviews
June 1994	Second speed survey (survey 2)
August 1994	Installation of new high impact entry signs in Area 3
Nov 1994	Third speed survey (Survey 3) Installation of low impact entry pavement markings in Area 2 and high impact entry and intermediate pavement markings in Area 3
Dec 1994	Second community survey. 100 residents were interviewed, 85 of which had previously been interviewed.
March 1995	Fourth speed survey (Survey 4)
July 1995	Fifth speed survey (Survey 5)
Sept 1995	Low level physical traffic management devices installed in three streets
Nov 1995	Sixth speed survey (Survey 6)
March 1996	Seventh speed survey (Survey 7)
May 1996	Third community survey. Telephone survey of 409 residents. Each area targeted 140 residents.

Community surveys (Braithwaite, 1996) were also conducted from March 1994 to June 1996 to gauge community attitudes in each of the trial areas to the 40km/h speed limit. As indicated by table 4, a total of three surveys were carried out. 124 residents were interviewed in the first survey in March 1994; 100 residents were surveyed in the second survey in December 1994 (85 of which had previously been interviewed); and 409 residents drawn roughly equally from each of the three areas were interviewed by phone for the third survey in May 1996.

Results of the 40km/h continuing trial

The community attitude surveys: The three surveys (Braithwaite, 1996) conducted indicated very strong resident support (86%) for the 40 km/h speed limit, while 78% of residents wanted to see the 40km/h trial made permanent. Most people (83%) nominated a driving speed below 50km/h to be appropriate for their street. There were high proportions of residents in the first two surveys (80% and 73% respectively), who believed that there had been insufficient police enforcement of the 40km/h limit, but this declined to 51% in the third survey. In the third survey, around 47% of residents supported the use of speed cameras to enforce the limit (in the first two surveys, support was 52% and 46% respectively). It is interesting to note that in the first community survey (before the introduction of the high visual impact signposting), 72% of residents believed that the level of signposting of the 40km/h speed limit was inadequate, but this was reduced to 22% by the third survey, while for residents actually within area 3, only 11% of residents perceived the level of signposting to be inadequate. Community acceptance of traffic control measures, as determined in the third survey, found that a lower speed limit had the highest level of acceptability at 81%, while roundabouts were acceptable to 79% of residents. Community attitudes (third survey) were somewhat divided on the use of speed plateaus (52% acceptance) and street narrowings (47% found these unacceptable), while traffic lights and speed humps were decisively rejected by residents (70% and 76% respectively).

Traffic speed and volume surveys: Tables 5 and 6 detail comparisons at the start (before the installation of devices and new signage in areas 2 and 3) and conclusion (after the installation of new signage and traffic calming devices) of the results of the surveys for traffic speeds and volumes respectively during the trial 40km/h speed limit. Unley Council also conducted 7 day surveys, but because of the absence of comparative data for many streets for before and after analysis, these have not been included from Unley's Continuing Trial Report.

The lack of change in the speeds for area 1 (the control precinct) with means fairly close to the desired speed limit, demonstrate that the minimalist usage of speed limit signage (located only at the entry points to the precinct), can achieve consistent results in the long term. The results do not appear to have been so clear cut for area 2 with moderate to large increases in mean speeds (from 2-14km/h) occurring, although the sample size is probably too small to make a definitive judgement. Although Council in its report (City of Unley, 1996a) gave the impression of worthwhile and significant reductions in speeds (without qualifications) through the use of what it terms "high impact" traffic calming elements, close scrutiny of the before and after situations in table 5 for area 3 do not provide such a convincing case, since there seems to be wide variation in the results with some streets experiencing decreases of up to 8km/h but others increasing by up to 9km/h. An examination of the 85th percentile of vehicle speeds largely mirrors the discussion about mean speeds, except that they are at a much higher level.

Table 5 Comparison (1994 and 1996) of speeds in Unley's 40km/h trial (source: Produced from data in Trial Report, City of Unley, (June, 1996a))

24 HOUR SURVEY LOCATIONS	Vehicle speed characteristics km/h	BEFORE: February 1994 survey 1	AFTER March 1996 survey 7
AREA 1: Control precinct using existing 40km/h signage			No change in environment
Charles Street	MEAN SPEED> 85%tile SPEED>	32 45	33 46
Hughes Street	MEAN SPEED> 85%tile SPEED>	33 42	33 42
Palmerston Road	MEAN SPEED> 85%tile SPEED>	39 53	38 54
Salisbury Street	MEAN SPEED> 85%tile SPEED>	44 57	44 56
Young Street	MEAN SPEED> 85%tile SPEED>	46 58	47 58
AREA 2: Low environmental impact 40km/h signage treatment			Changes in signage/entry treatments
Hart Street	MEAN SPEED> 85%tile SPEED>	32 44	34 46
Opey Avenue	MEAN SPEED> 85%tile SPEED>	22 34	34 43
AREA 3: High environmental impact 40km/h signage			Changes in signage/entry treatments, traffic calming.
Belleview Place	MEAN SPEED> 85%tile SPEED>	32 45	33 46
Charra Street	MEAN SPEED> 85%tile SPEED>	41 52	33 43
Commercial Road	MEAN SPEED> 85%tile SPEED>	26 38	25 35
Esmond Street	MEAN SPEED> 85%tile SPEED>	31 41	27 38
George Street (north)	MEAN SPEED> 85%tile SPEED>	39 49	37 47
George Street (south)	MEAN SPEED> 85%tile SPEED>	38 50	39 51
High Street (east)	MEAN SPEED> 85%tile SPEED>	38 51	37 49
High Street (west)	MEAN SPEED> 85%tile SPEED>	35 49	31 45
Omar Place	MEAN SPEED> 85%tile SPEED>	27 38	36 49
Thornber Street	MEAN SPEED> 85%tile SPEED>	36 51	41 53
Whistler Avenue	MEAN SPEED> 85%tile SPEED>	36 58	41 58

On a more positive note though, none of the areas had vehicles at the 85th percentile of vehicle speeds exceeding 60km/h, although somewhat worryingly, two streets had vehicles approaching this magnitude of speeds. If the determination of speed limits is selected on the basis of what the 85th percentile of vehicle speeds are, then a fairly convincing case could be made for the introduction of a 50km/h speed limit on many of Unley's Streets. However, it could be argued that perhaps the 85th percentile of vehicle speeds is not appropriate for local streets because the overriding criteria for speed limit determination should be based on pedestrian safety and local amenity, not on the utility

Table 6 Traffic volumes compared (1994 with 1996) in Unley's 40km/h trial (source: Produced from data in Trial Report, City of Unley, (June, 1996a))

24 HOUR SURVEY LOCATIONS	BEFORE: February 1994 survey 1	AFTER March 1996 survey 7	% CHANGE IN TRAFFIC VOLUMES
AREA 1: Control precinct using existing 40km/h signage			No change in environment
Charles Street	375	453	+17%
Hughes Street	764	788	+3%
Palmerston Road	560	421	-33%
Salisbury Street	795	775	-3%
Young Street	1343	1521	+12%
TOTAL FOR AREA 1	3837	3958	+3%
AREA 2: Low environmental impact 40km/h signage treatment			Changes in signage/entry treatments
Hart Street	224	216	-4%
Opey Avenue	817	902	+9%
TOTAL FOR AREA 2	1041	1118	+7%
AREA 3: High environmental impact 40km/h signage			Changes in signage/entry treatments, traffic calming.
Belleview Place	250	181	-38%
Charra Street	270	236	-13%
Commercial Road	1057	976	-8%
Esmond Street	433	475	+10%
George Street (north)	502	517	+3%
George Street (south)	362	408	+13%
High Street (east)	492	563	+14%
High Street (west)	274	442	+61%
Omar Place	226	159	-30%
Thornber Street	406	440	+8%
Whistler Avenue	342	563	+65%
TOTAL FOR AREA 3	4614	4960	+7%

function for motorists travelling from A to B in the shortest possible time. The survey findings implies that whatever residents may be saying with regard to their attitudes to the speed limit, the behaviour of drivers on many streets (and residents would constitute a fair proportion of them) suggests that they do not perceive the 40km/h speed to be appropriate. To be fair though, compared to the experience with the 40km/h trials in Sydney a decade previously in which the figures generally suggested a blatant disregard for the speed limit, the City of Unley's record has been much more encouraging in getting driver behaviour closer to the 40km/h speed limit. Nevertheless, if Council is serious about having drivers comply with a 40km/h speed limit for reasons of amenity and safety, then they may need to consider much more aggressive traffic calming and enforcement measures than are currently being utilised.

Table 6 details the impact on traffic volumes of the Unley 40km/h trials. Across the three areas from February 1994 to March 1997, traffic volumes increased by almost 6% for the 24 hour survey. The increase for area 1 was fairly small at 3% but was 7% for areas 2 and 3. Eleven streets experienced increases in traffic volume ranging from 3% to 65% (3 streets in area 1, 1 street in area 2, 7 streets in area 3), while only 7 streets experienced a decrease (2 streets in area 1, 1 street in area 2 and 4 streets in area 3), which ranged from 3% to 38%. Based on this evidence, it would seem that if the intention of a 40km/h zone is to lower traffic volumes, this objective is not likely to be achieved, even though

intuitively the lower speed limits of local streets compared to arterial roads would make them less attractive as rat-runs. However, it needs to be stressed that none of the daily traffic volumes experienced in the trial area are at levels that might cause grave concern, since it is generally acknowledged that up to 2,000 vehicles per day can be accommodated on a local through street. Even by using Unley Council's 800 vehicles/day as the guiding criterion for the introduction of control measures, only one of the 18 streets surveyed presents a problem.

Conclusions

The survey conducted by the NSW Roads and Traffic Authority, suggested widespread acceptance in local government of the need to have lower speed limits in local areas and almost universal acceptance of roundabouts as the key traffic calming measure. Aggressive traffic calming measures such as speed humps do not appear to have too much currency amongst local governments in NSW. The South Australian experience with traffic calming was briefly commented upon, with the production of the Residential Street Management Manual in 1987 noted as a landmark document on physical traffic calming measures, which bestowed enormous credibility on traffic calming being a legitimate practice for local councils to conduct. With reference to the City of Unley's experience of community responses to traffic calming, it was noted that the pendulum of community opinion may be swinging against the science of traffic calming to favour more appropriate speed limits.

This then set the context of discussion for the debate on speed limits. Sydney's 1986 speed limit trial was reviewed, noting the modest modification of driving behaviour in the community towards compliance to lower speed limits, but also noting the disappointing impact of public education/advertising campaigns to encourage community compliance with lower speed limits. However, it needs to be said that sustained, long term public education campaigns may have an effect on public attitudes in the long term. It was noted that successful community compliance with lower speed limits was more likely to occur when combined with aggressive traffic calming measures.

However, despite the disappointment with that original Sydney 40km/h trial, a review of government publications and the output of Transport/Road Safety Government Departments during the past decade does suggest a groundswell of opinion amongst policy-makers in favour of lower speed limits in local areas, but some confusion as to whether it should be 40 or 50km/h. Current thinking seems to favour a reduction in the blanket urban speed limit to 50km/h, while allowing Councils the option to have a 40km/h zone if they so desire. However, as yet, State Transport Ministers have not decided to commit themselves to lower local speed limits.

In South Australia in 1994, the issue of urban speed limits received considerable attention by the South Australian Government with the release to the public of a discussion paper on speed limits which formed the basis of a report by the Urban Speed Limits Advisory Group to the state government. The recommendations essentially supported the introduction of a general 50km/h limit on local streets, but with an expressed long term goal to aim for a 40km/h general local urban area limit. It appears that until a national strategy is agreed upon, resolution of this issue seems unlikely to eventuate. A major problem with the debate on urban speed limits does seem to be that while public pronouncements from policy-makers and related stakeholders call for a 50km/h limit, their views seemed to be based on trials using a 40km/h limit. It could be argued that the move towards lower speed limits would have much greater credibility with the public if there had been direct correspondence between local area speed limit trials and the use of a

50km/h speed limit trial. Furthermore, given that the 50km/h urban speed limit is now the accepted norm in many developed countries, Government Transport Departments would have had a stronger case to make for a lower speed limit if the intention was to bring it in line with international best practice, rather than suggesting an unrealistically low speed limit which may make the middle and outer suburbs in Australian cities even more transport dysfunctional than they already seem to be. Ultimately, technology may make the debate on speed limit uniformity redundant. Road pricing technology may make it possible to set up a system whereby every single street is given a speed limit zoning appropriate to its particular environment, geometric characteristics and circumstances which would then be relayed by radio waves to transponders in the vehicles as they travel along the particular street in question. In this system, vehicle speedometers could incorporate an instrument that would indicate to drivers what the recommended speed limit for the particular road section is.

Another interesting recommendation of the Urban Speed Limits Advisory Group in its 1994 report was the use of education and training in creating a low speed culture. The 40km/h speed limit trials in Sydney conducted a decade ago directly investigated this approach with disappointing results. This approach may work in the longer term, but as with the drink driving issue, it takes a concerted, relentless approach over many years to change social norms. Drink driving has become anti-social, but judging from road safety campaigns in the media, the message has to be continually reinforced. As with Anti-Drink Driving campaigns, perhaps a co-ordinated approach of countermeasures that includes signposting of lower speed limits, traffic calming, police enforcement, driver infringement penalties, a media campaign and public education in schools and the community, may be the most effective way of ensuring compliance.

The City of Unley 40km/h speed limit trials have demonstrated that simply having a lower speed limit can produce consistent results in driver behaviour closer to the intent of the speed limit over the longer term. However, despite Unley's self-congratulation over the success of the trials, there were some worrying anomalies, suggesting that if drivers perceive the road environment to be capable of allowing higher speeds, then they will drive at the higher speeds, an experience confirmed by the Sydney 40km/h trials in 1986. The Unley experience suggested that lower speed limits in local areas will have no impact in reducing traffic volumes, even though permitted speeds are 33% lower thereby negating local streets as being a useful shortcut in terms of time savings. Although the trials suggested a reasonable degree of compliance when looking at mean speeds, examination of the 85th percentile data suggested that in a large number of streets, drivers were behaving more as if a 50km/h limit in place. If the views of Unley's residents in the Community Attitude survey can be taken as a proxy for community views in general, in which overwhelming support was indicated for a 40km/h speed limit, the time may be right for governments to introduce lower speed limits.

On the issue of speed limits versus traffic calming, the Unley and Sydney experiences do seem to suggest that little has changed over the past decade, in that aggressive physical traffic calming measures in the absence of strong police enforcement are still the best way of encouraging motorists to voluntarily comply with lower urban speed limits.

Acknowledgments

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