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LATM Operational Successful and Financially Affordable: But are the Users Satisfied?

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SUMMARY A number of Local Area Traffic Management (LATM) schemes in Sydney have been evaluated from operational and financial points of view, within a formal LATM process. The data strongly indicate the considerable benefits can be expected in terms of reductions in crashes, speeds and volumes. Since community goals of LATM are normally translated into such design objectives by professionals, it can be concluded that LATM is operationally successful. Superficially LATM is costly for the ratepayer, especially for intricate designs. However, on the basis of community investment in maintaining the amenity of existing local area infrastructure, these costs are negligible and could be readily absorbed into medium term planning budgets. Moreover, in time the demonstrable benefits are likely to more than offset the costs. However, there is often considerable community controversy over LATM schemes, because of different aspirations of pressure groups. In addition, other sources of potential dissatisfaction to the various actors are identified, with constructive comments.

1 INTRODUCTION

Local Area Traffic Management (LATM) is slow in becoming the norm in Sydney. However, some area-wide LATM schemes have been implemented in some 14 (out of 43) Local Government Areas. The slowness arises through factors of community ambivalence, professional inexperience and, importantly, lack of funds.

This paper addresses the operational and financial status of LATM within the general framework of the LATM process. Its aim is to draw together experience in Sydney and to assist remedying the factors referred to above.

The data and analysis presented derive from continuing research into LATM (Ho, 1986; van den Dool, 1988). Some of the operational data were released to us by the Traffic Authority of NSW from its contribution to the ARRB Local Streets Information System ALSIS. However, all the analysis is independent of ALSIS.

2 THE LATM PROCESS

The LATM process is laid out in Figure 1; the use and understanding of such a flow diagram is essential to the successful execution of LATM Projects. Similar diagrams appear in a number of road authority publications (TA, 1986/1987; Pak Poy, 1987; NAASRA, 1988). Perhaps the most similar diagram is in the NAASRA document.

2.1 Problem

Problems will be identified by residents and by local government officers. However, attitudes to LATM will vary depending on the parties involved (Table I). The local community cannot be regarded as homogeneous and the local government officers (and their consultants) must be adept at devising community involvement which minimises this source of potential disruption to the LATM process.

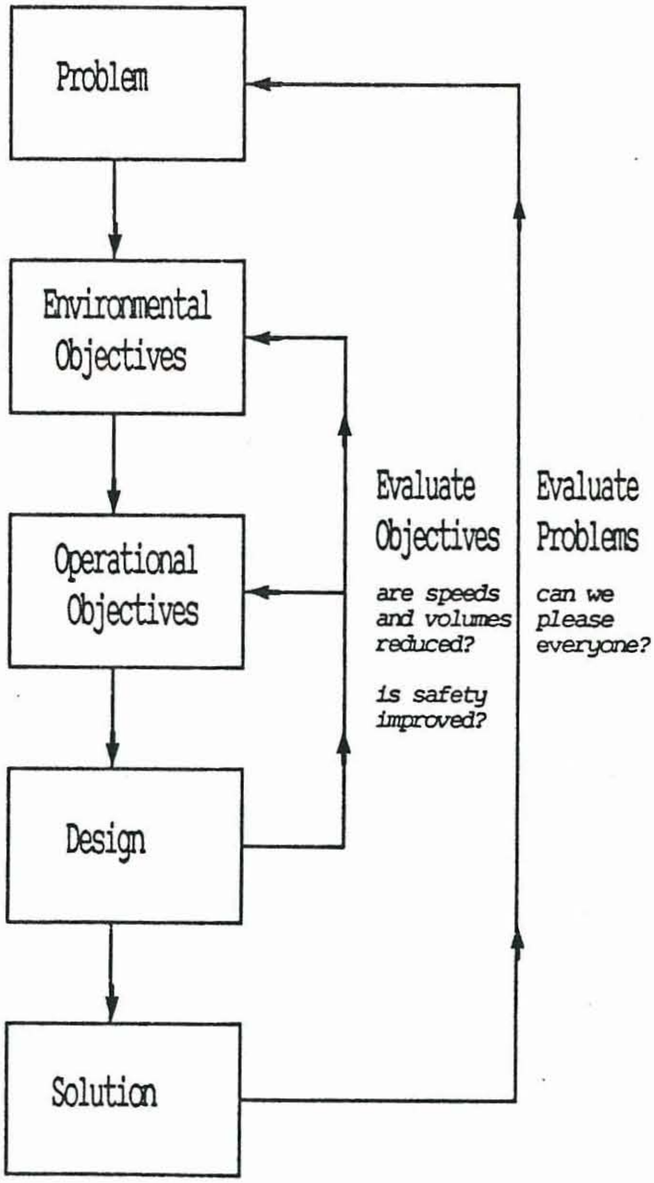


Figure 1 LATM Process

TABLE I

PARTIES INVOLVED IN LATM DISCUSSIONS

COMMUNITY ATTITUDES TO LATM

Party	Objective	Argument
Residents-pro	safety, amenity	LATM reduces speeds and volumes and thus a safer and nicer environment.
Residents-con	property value, noise	Properties adjacent to LATM devices reduce in value due to limited access and increased noise levels.
Motorists, (through traffic)	safety, speed, access civil liberties	LATM devices are dangerous and hinder thoroughfare on streets that are used for that purpose.
Politicians	votes	Either pro or contra LATM. Elections have been fought on these grounds. Subject to pressure groups.
Local Engineers, Planners	safety, amenity	Improve safety and amenity in LGA as a whole. Uncertainty in some cases due to lack of confirmative information. Must please all other parties.
DMR Engineers, Planners	main road travel times	At least maintain speeds on main roads surrounding the area as existed before LATM.
Essential Services	access	No perceived impediment to roads and property.

(Source: Northern Herald newspaper)

2.2 Environmental objectives

Notwithstanding the contradictions in Table I, there is community consensus on requirements of safety and amenity in local areas.

Safety is a general goal, but is sharpened in the local area because it is the domain of children, especially the young, and the elderly, to whom the community is protective. Whilst people may have to tolerate a poor environment in travel and work conditions, amenity or pleasantness becomes a prerequisite of their local area.

2.3 Operational objectives

The conceptual objectives above have to be translated into operational ones involving traffic parameters that are amenable to beneficial change. This is the aspect of the process which is least understood and least formalised. The contribution to be made here is to set out the framework, but with detailing to await further refinement.

Safety, as a concept, is translated into the one operational objective as lack of road crashes, or at least a reduction. Further, the number of accidents and their severity is a function of the inherent safeness of the road system, exposure and energy dissipated. This immediately leads to the conclusion that a reduction in traffic volumes and speeds on local roads will increase safety (see for example NAASRA, 1988).

However, this results only in qualitative operational objectives. To quantify these requires numerical relationships between the parameters mentioned above. The accident rate on a particular type of road is largely linear to traffic flow and thus a percentage reduction in volume should lead to a similar reduction in accident numbers. On the other hand crash severity rises sharply with speed, especially at higher speeds. A reduction in speeds could lead to a disproportionately greater decrease in reported casualty numbers.

Amenity, as a concept, can be translated into a number of operational objectives: reduction in noise, vibration, pollution, improved crossibility of roads, improved streetscape, improved potential for social interaction, etc. To quantify the operational objectives requires a knowledge of the formal relationships between the parameters; many are complex relationships, but they are known and in use in other traffic management tools (Ove Arup, 1980).

For example noise is a function of traffic volume, speed, traffic composition and distance. Noise is logarithmically related to volume and for a just noticeable difference in noise to occur, the volume needs to be halved. This is a large reduction, but unless this happens the residents may be disappointed with a scheme, having perhaps unrealistic expectations in the first place, through lack of appreciation of basic relationships.

However, noise will be reduced also by a reduction in speed and heavy vehicles (DMR, 1987). The knowledgeable professional may thus be able to put together a more practical package to meet residents' expectations.

To date no quantitative relationships are given in LATM manuals for local government officers to use. Rather, there are broad conclusions that (unspecified) reductions in speed and volume will improve safety and amenity (TA, 1986/1987; Pak Poy, 1987; NAASRA, 1988).

2.4 Design

The design of LATM on established grid-like road layouts is based on the use of individual modifications or devices. On an area-wide basis the aim is to create a lower speed regime as is implicit in new subdivision layouts, which use short narrow curved roads. The multiplicity of devices available are reasonably well documented in LATM manuals; in design detail and in advantages and disadvantages in given locations (see for example TA, 1986/1987). However, reference to the new road layouts and implications to LATM are missing. Also, considerable improvements can be achieved in presenting this information, especially when it comes to finding alternative solutions to specific problems (see for example SVT, 1986).

Entry thresholds create and highlight a separation between the arterial and local road regimes, even though basic road geometry may be little different, especially width. Mid block devices (slow points, speed humps, platforms) split long road sections into short ones. Importantly, landscaping of the road edges will visually diminish the apparent road width, while that of the devices themselves will reduce the visual connection with the next section. This reinforces the concept of short streets and helps to overcome impressions of annoying individual points to be traversed. Intersection treatments (blisters, roundabouts) minimise conflicts by preventing straight through paths.

All these treatments reduce speed by changing the trajectory of vehicles, either laterally (roundabouts, slow points) or vertically (humps, platforms). The speed reduction at the device depends on the severity of enforced change in trajectory. The reduction between devices depends on the distance between devices. Single lane devices can create additional speed reductions through conflicting movements, as well as delays.

Changes in volume will depend on changes in access through road closures, reductions in real and perceived level of service on the local street, the amount of through traffic to be deterred and the level of service on the adjacent main road network. It should be noted that the use of road closures is generally minimised, because these affect local as well as through traffic. Whereas the real level of service can generally be measured in terms of travel times or average speeds, the perceived level of service is also thought to play a major role in discouraging traffic from using local streets. Perceived level of service will depend on maximum speed, number of times there is need to slow down and increased work load to negotiate the devices.

Thus in coming to a design, the local government officer ideally needs quantitative relationships between reduction in accidents, speed, volume and the type and density of devices. LATM manuals give indications of speed reductions, type of device and the placement, but little in volume or accident reduction relationships (see for example TA, 1986/1987; NAASRA, 1988). In Section 3 of this paper data from in-service LATM will be presented on the accident, speed and volume changes actually realised.

2.5 Solution

The layout of the chosen devices will be superimposed on the existing area road layout. Figure 2a shows the type of layout used in the schemes for which data are presented here. This layout uses devices throughout the area on

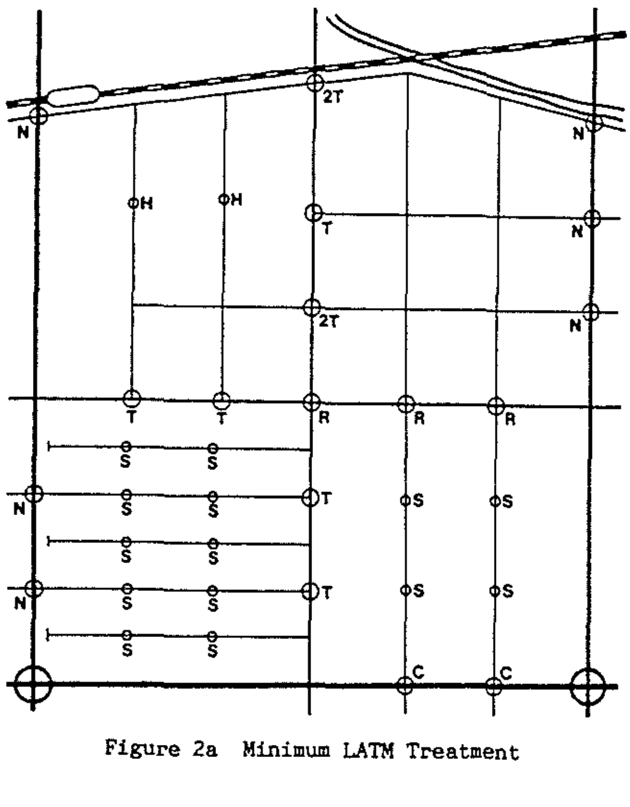


Figure 2a Minimum LATM Treatment

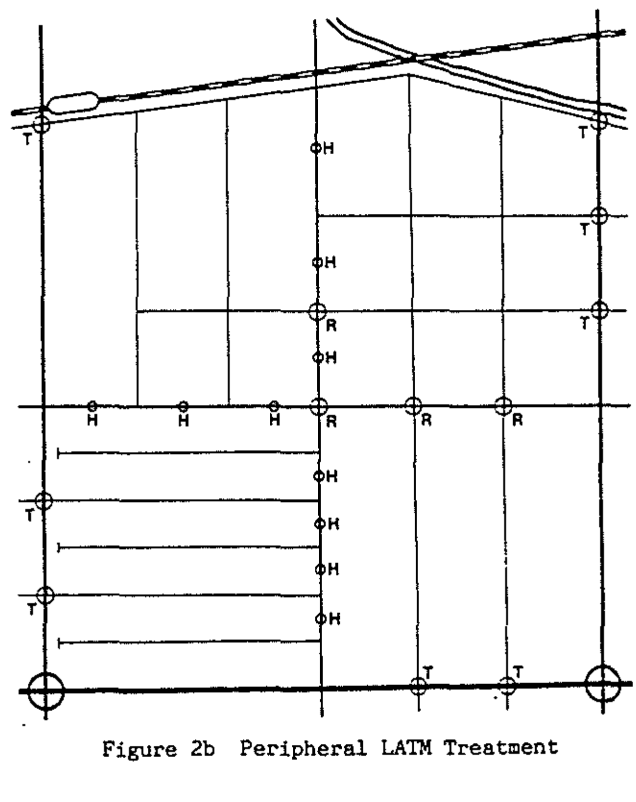


Figure 2b Peripheral LATM Treatment

problem roads at the maximum spacings recommended in the NSW Traffic Authority provisional LATM guidelines (TA, 1983). Figure 2b shows an area with only peripheral and collector road treatment, now increasingly used to support 40 km/h speed zoning, albeit restricted support because of lack of funds.

The detailed design and location of devices needs to take into account maintenance, ease of property access, parking, cleaning, drainage and access of service vehicles. These aspects will influence attitudes of individuals affected by LATM.

The designer will be influenced by the costs of devices and strategic policy on LATM will be influenced by whether benefits accruing will outweigh costs to the local community.

In Section 5 of this paper data will be presented on costs and benefits of LATM.

3 OPERATIONAL PERFORMANCE

3.1 Volume

Reported changes in volumes are shown in Table II. At 54 out of 67 measurement sites there were decreases in volumes with 53 being statistically significant (chi-square test, 5% level). The overall mean reduction was 34%, with some 12 sites recording at least half or better reduction.

Obviously, the reduction at a particular site will depend on through traffic volume to be deterred, provision for volume increases on main roads, severity of treatment and skill of its designer. The above data do not allow other than these general conclusions to be drawn.

However, there were volume increases at 13 sites, 9 being significant. Very large increases in volumes were recorded in one scheme (East Roseville), showing that care is needed to prevent mere diversion of through traffic from one local street to another.

3.2 Traffic speeds

Reported changes in speeds at mid block between devices are shown in Table III. There is a general reduction in speed, even though the majority of traffic was travelling below the 60 km/h speed limit in force in the before period. After the implementation of LATM, the mean and 85 percentile speeds appear to fall to about 40 and 47 km/h respectively. However, the actual reductions varied between 6 and 10 km/h, depending on how great the initial speeds were.

There is a considerable amount of data relating to speed and distance from an LATM device (van den Dool, 1988). Figures 3a and 3b show the consolidated data for all devices for mean and 85 percentile speeds.

There appears to be little difference in speed reducing effects between the various devices. T-intersection treatments appear less effective, showing statistically significant differences to other devices at close distances (chi-square test, 5% level), whereas entry thresholds appear more effective in achieving somewhat slower speeds. This last result could be explained by turning traffic automatically slowing down.

At the device, the mean and 85 percentile speeds are about 26 and 34 km/h respectively. To reduce the midblock speed to 40 km/h the maximum distance from a device should be 70 m (mean) or 40 m (85 percentile). Thus to keep the 85 percentile speed below 40 km/h, the devices should be located no more than 80 m apart. This finding generally supports guidance given in the NSW manual (TA, 1986/1987).

3.3 Safety

Reported crash data for five schemes are presented in Table IVa for towaway and casualty accidents and in Table IVb for casualty accidents only. All reported accidents went down in each scheme (mean 37%, range 24% to 63%). The overall reduction is statistically significant (5% level, using chi-square test) with some individual

TABLE II

CHANGES IN DAILY TRAFFIC VOLUMES

Area	No. of Sites*	Decrease			Increase		
		No. Signif. (total no.)	Mean	Range	No. Signif. (total no.)	Mean	Range
Belmore/Lakemba	2	2 (2)	33%	17%-48%	0 (0)	___	___
East Roseville	32	25 (2)	44%	9%-90%	6 (7)	107%	3%-315%
Greenacre	2	1 (1)	48%	___	0 (1)	1%	___
Mosman West Ward	30	24 (25)	25%	2%-44%	3 (5)	3%	0%-7%
Sylvania Waters	1	1 (1)	22%	___	0 (0)	___	___
Overall	67	53 (54)	34%	2%-90%	9 (13)	59%	0%-315%

*sites were traffic volume data were available in both the before and after studies
(Sources: Detailed survey report by various local government engineering department).

TABLE III *

MIDBLOCK SPEED CHANGES

Area	Period	Number of Sites	Mean Bef.	Mean Aft.	85% Bef.	85% Aft.	% > 60 Bef.	% > 60 Aft.	% > 40 Bef.	% > 40 Aft.
East Roseville	Peak	23	47	42	55	48	-	-	-	-
	Off-Pk.	23	43	39	53	47	-	-	-	-
Belmore/ Lakemba	Peak	2	54	38	62	45	-	-	-	-
Sylvania Waters	24 hr.	14	-	-	67	47	-	-	-	-
Mosman West Ward	24 hr.	30	-	-	-	-	17	5	77	55
Roseville/ Lindfield	24 hr.	15	49	-	57	-	-	-	-	-

Bef. = Before; Aft. = After.

TABLE IVa *

ALL CRASHES BY LATM SCHEME

Area	Before Period (in months)	Before No.	Before No./Year	After Period (in months)	After No.	After No./Year	Change No./Year	Change %
Belmore/ Lakemba	18	19	12.67	18	10	6.67	-6.00	-47%
East Roseville	9	10	13.33	27	11	4.89	-8.44	-63%
Greenacre	24	117	58.50	36	115	38.33	-20.17	-34%
Mosman West Ward	36	55	18.33	12	14	14.00	-4.33	-24%
Sylvania Waters	24	18	9.00	24	13	6.50	-2.50	-28%
Overall	__	__	111.83	__	__	70.39	-41.44	-37%

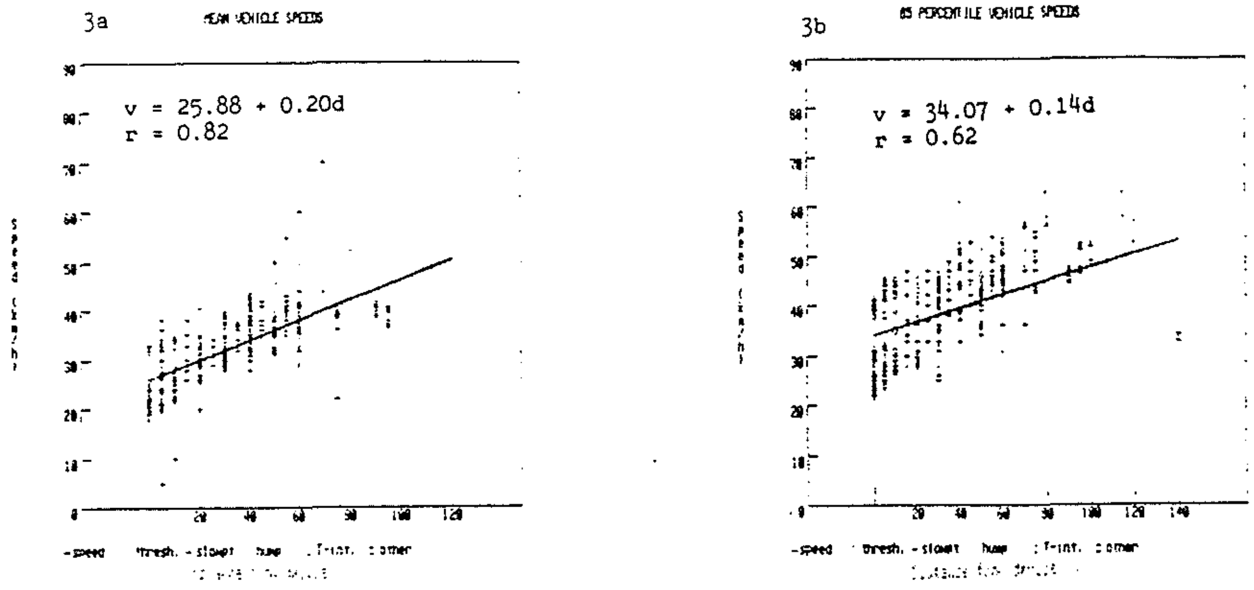
TABLE IVb *

MOST SERIOUS CRASHES BY LATM SCHEME

Area	Before Period (in months)	Before No.	Before No./	After Period (in months)	After No.	After No./	Change No./Year	Change %
Belmore/ Lakemba	18	4	2.67	18	5	3.33	+0.66	+25%
East Roseville	9	3	4.00	27	2	0.89	-3.11	-78%
Greenacre	NA	NA	NA	NA	NA	NA	NA	NA
Mosman West Ward	36	12	4.00	12	4	4.00	0.00	0%
Sylvania Waters	24	12	6.00	24	1	0.50	-5.50	-92%
Overall	__	__	16.67	__	__	8.72	-7.95	-48%

NA = not available

*(Sources: detailed survey reports by various local government engineering departments)



Figures 3a and 3b The effect of distance on speeds

reductions being also significant.

Overall casualty accidents were down by 48%, with major reductions in two schemes and no change or a slight increase in the other two. The total numbers were small and statistical significance is not demonstrated.

The accident pattern in a sample of six Local Government Areas was examined using the routine data produced by the Traffic Authority of NSW (1988). This showed that on average 30% (range: 16% - 44%) of towaway and 34% (range: 16% - 45%) of casualty accidents occurred on roads designated as minor. Thus there is a large group of accidents that can be targeted through LATM.

Furthermore, of the crashes on minor roads 63% involved local residents whereas those on major roads involved only 44% of local residents. Therefore the majority of accidents on local roads cannot be attributed to through traffic unfamiliar and uncaring for the area. It is warranted to aim LATM at local as well as through traffic.

3.4 Noise

Noise data has been collected for a limited number of sites, before and after the installation of LATM. Confounding factors, such as short time of recording and fluctuations in traffic flow, do not allow conclusions to be drawn. It is suggested that there may be some increase of noise at some devices where there is an increase of accelerating vehicles. However, the reported changes were in the order of 1 - 2 dBA, which is not regarded as noticeably different.

Nevertheless, the data on traffic speed and volume reduction suggest that a noticeable difference of 3dB(A) would have occurred in the many situations which had reductions in volume of 50%, or had somewhat lesser reductions coupled with the greater speed changes. Possibly these inferred reductions in noise levels could be counter balanced by the suggested increases at the devices.

4 EVALUATE OBJECTIVES

The data strongly suggests that operational objectives (general speed and volume reductions) in well designed schemes are being met with consequential reductions in accidents. Although data on changes in noise levels is limited, the reductions in volumes and speeds would infer perceivable reductions. There is no data at all on other operational objectives.

Thus it can be said with certainty that the environmental objective of safety is being enhanced while that of amenity may be inferred.

5 FINANCIAL PERFORMANCE

5.1 Costs

Table V gives actual unit costs for various LATM devices: these values are those given by Ho and Fisher (1988), factored for inflation since the data was originally collected in 1985. A single cost, the adopted device cost which is towards the lower end of the range, is used for subsequent analyses.

For both roundabouts and road closures a range is given, because these devices can vary considerably in size and detail. Cost components of 2.5% and 5% need to added for design and landscaping respectively. Trials in temporary materials are expensive additions, costs being 40% to 70% of those for permanent ones.

Applying these adopted device costs to the LATM schemes for the simulated but representative areas shown in Figures 2a and 2b, gives the following unit area costs per square kilometre:

- minimal - $259,000
- peripheral - $148,000

At first sight this appears to be costly. However, it represents only about 10% of the basic costs of the local roads and about 0.25% of the property value. Thus the cost of upgrading an area to overcome impacts of motor vehicles is small, relative to the original assets.

TABLE V

SUMMARY OF UNIT COSTS FOR LATM TRAFFIC CONTROL DEVICES

Device	Sydney	Willoughby	Canterbury	Hornsby	Sutherland	Campbelltown	Adopted Device Cost
Threshold	15000	12500	9500	8500		6000	9500
Roundabout	25000	8500	8000	12500	6000	12500	6000-12500
Road Hump	7500	4500	4000	19000	4000	4000	4000
Slow Point or Road Narrow	10000	5000	5500		4000		5500
Closure	40000	8000	23000	37500		31000	8000-23000

Note: All costs exclude costs of work associated with major drainage and utility diversions

5.2 Benefits

Ho and Fisher (1988) described in detail the assessment of benefits of improved safety and amenity, based on documented data and methodologies. The derived assumptions used were:

- safety - half of the annual crashes occur on local roads;
  - LATM will reduce these crashes by half;
- amenity - LATM will give rise to a 15% property appreciation.

Standard monetary values for towaway and casualty accidents were used. Property appreciation was capitalised into an annual return, as an increase in Council income at a rate of 0.25% on an average property value. This leads to a benefit/cost ratio of 3.9 for the minimum treatment.

However, in this paper a more conservative view is taken, in that only 30% of accidents occur on local roads, with LATM having the potential of a 40 % accident reduction (see Section 3). The previous 50% value for crashes occurring on local roads included those occurring at the local/arterial road interface. Further, the property value appreciation is taken as 10%; the relative appreciation between quiet and noisy houses will be less when the housing market is booming.

These revised inputs and a factor for inflation lead to an annual benefit per square kilometre of $100,600, of which about 50% derives from improved safety and 50% from improved amenity. Using a 10 year service life and a 10% discount rate, a benefit/cost ratio of 2.4 is obtained. For a 20 year life and a 7% discount rate the ratio is 4.1.

The ratio will be less for a more intensive treatment say with extensive closures, and more for a softer one, say the peripheral treatment shown in Figure 2b. However, there is uncertainty about the safety returns, especially for the softer treatment. The values given above for the minimal treatment are reasonably robust and compare favourably with those for recent urban arterial road projects.

It should be noted that only costs and benefits (safety, amenity) associated with the local area and the residents are addressed. Any changes in accessibility within the local area can be minimised at the design stage and if made small appear to be of minor consequence to the residents of that area. Changes in journey times on the neighbouring arterial roads have not been consistently measured, but from one study (Mehta, 1985) they appear to be minimal.

5.3 Financing LATM

Even though the upgrading costs of LATM are small compared to the value of the existing infrastructure and benefits are high in comparison, there is a problem of financing LATM.

An estimate has been made of the total area within the Sydney Statistical Division which needs LATM (Ho, 1986). To the land area of each of 38 local government areas (excluding 5 largely uninhabited ones) a series of factors were applied to obtain an LATM equivalent area:

- urbanisation factor - density of sealed road;
- street layout factor - proportion of grid layout;
- traffic environment factor - susceptibility to through traffic intrusion;
- land use factor - presence of non residential land uses.

The equivalent areas are close to the actual areas of the older, inner local government areas, whereas those for the councils near the periphery of the region are much less, due to their developing nature with low residential density and modern road layouts.

The total equivalent area is 450 sq km which is about 12% of the total area of the 38 Councils, but this area will contain about half the total length of local roads. Using the unit area costs derived in Section 5.1, the total cost of applying LATM to the 450 sq km will be:

- $119 M for minimal treatment;
- $68 M for peripheral treatment.

Obviously these sums cannot be dispensed in one year, since it would amount to some 40% of the annual local road budget. It would need an investment of about 4% per annum for a staged implementation over a 10 year period, with a continuing investment thereafter to maintain the schemes.

A major aspect of LATM is accident reduction and local road accidents are one of a diminishing number of large target accident groups, which can be specifically addressed. Central government has encouraged local government to undertake LATM in a Neighbourhood Road Safety Program (TA, 1986) as part of a total society response to the road safety problem, with the now demonstrated benefits occurring to the public purse. Therefore it would not be unreasonable for central government to subsidize LATM on a dollar-for-dollar basis with, the local government dollar being associated with the local amenity benefit. Priorities should be assigned based on total number of crashes.

6 EVALUATE PROBLEMS

With the demonstrated achievement of operational objectives and of being a sound investment, LATM might be expected to please all. This is not necessarily so; the parties noted in Table I are equivocal to a greater or lesser extent. An extensively documented case study by Donovan (1988) has listed some 38 arguments for and against a scheme, which came up in local discussion.

Local government elections have turned on candidates attitudes to LATM and referenda on the topic have taken place, see Table VI. Aldermen may change stance, depending on their perceptions of the pressure groups active at the different stages of the LATM process (van den Dool, 1988). The degree of involvement and vociferousness appears to depend on socio-economic status. LATM in the north shore suburbs of Sydney attracts great attention. This is especially so if perceived de facto traffic routes are involved; see for example Tryon Road, Ku-ring-gai Municipality (Donovan, 1988; van den Dool, 1988).

As well as these outward manifestations of displeasure, other aspects, which could influence achieving a job well done and satisfaction with it, have been identified here.

6.1 Residents

Lack of understanding of the implications of the relationship between environmental objectives espoused and necessary modifications to traffic and the means adopted to do this. This may lead to unrealistic expectations and conflicts between traffic and environmental aspirations.

6.2 Aldermen

Same lack in understanding of the operational characteristics of LATM as residents, leading to equivocal attitudes to LATM. This, coupled with insufficient specifically targeted funding, may inhibit policy and strategy formulation on, importantly, crash reduction on local roads.

6.3 Professionals

Lack of information in LATM manuals setting out relationships between the necessary quantitative changes in the traffic regime and the desired reductions in accidents, noise, etc inhibit understanding on how to implement the operational objectives of LATM.

Limited information on how to produce the stated necessary changes in the traffic regime by LATM design could produce uncertainty as to the outcome of a scheme.

Limited funding frustrates delivery of safety and amenity on local roads.

TABLE VI

PRESS REPORTS ON LATM: REMOVE OR CONTINUE

Area	Argument	% No	% Yes
Mosman (all wards)	continue diagonal slowpoints continue speed humps continue road closures continue roundabouts	77 70 73 33	23 30 27 67
Mosman (all wards)	remove diagonal slowpoints remove roundabouts remove speed humps	64 82 50	36 18 50
Mosman West Ward, Middle Harbour	remove speed humps	>>50	<<50
Mosman East Ward, Balmoral	remove speed humps	7	93
West Lindfield (residents)	create 40 km/h area complete proposed scheme	12 47	88 53
West Lindfield (alderman)	remove constrictions in Tryon Road	22	78
North Sydney (non-compulsory referendum)	some access restrictions speed humps and roundabouts	5 38	95 62

(Source: various editions of "The Northern Herald" since July 1987)

6.4 Central Government

Frustration at the slow pace of implementation of LATM to counter minor road crashes; these have been identified as a major target group of accidents, one of the few remaining at which to aim remedial measures in order to maintain the downward trend of the road accident rate.

7 CONCLUSIONS

. Available data from LATM schemes in Sydney suggest them to be operationally successful; at the traffic level reductions in speed and volumes, at the environmental level reductions in accidents and, inferred, in noise.

. Mean speeds are down to 40 km/h (although still with a large proportion above) and the data show devices need to be placed about 80 m maximum apart: this supports and enhances advice in LATM manuals.

. Manuals contain little quantitative advice on relationships between desired outcomes in safety and amenity and the necessary changes in traffic regimes. This is a major constraint on professionals in adequately translating residents' perceptions into operational objectives and counselling residents and aldermen on optimum solutions.

. The data strongly suggest LATM to be a sound investment of public money with the benefit/cost ratio being conservatively estimated to be above two. The returns come from accident reductions (50%) and improved amenity (50%).

. However, residents, aldermen and professionals associated with LATM can be equivocal, controversial and frustrated, because of different perceptions and aspirations. Due to this and financial constraints the overall implementation in Sydney is slow, in spite of a major accident group to be targeted.

8 RECOMMENDATIONS

. Official LATM manuals be upgraded to provide more information on the LATM process, now this is to hand and omissions have been identified. This especially applies to the development of special quantative operational objectives.

. Professionals at supervisory and design levels associated with LATM be made aware (through upgraded manuals, in service training and the like) of the benefits of LATM and of up-dated design processes. Beside aiding professional design, this will assist in meeting residents' aspirations and counselling to them and Aldermen on the implications and benefits.

. Central Government promote local road safety by specific funding. This could be on a dollar-for-dollar basis: the Federal or State Government funding the society wide safety program and the councils funding community amenity enhancement.

. As a condition of funding an insistence on before-and-after evaluation of schemes. The data presented here illustrate a rather piecemeal approach; see for example Table III where four different speed measures have been employed. Data are a prerequisite for evaluation and upgrading of techniques and standard data collection sheets should be developed for extensive use by local government.

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