PEDESTRIAN/VEHICLE CONFLICT

IN THE MAIN STREET OF COUNTRY TOWNS

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PART 1 CONCEPTUAL BASIS

INTRODUCTION

Objectives

The purposes of this research project are to make an exploratory investigation of the factors influencing road safety in the 'main street' of country towns and and to explore how road safety may be improved. This, more limited, purpose must be seen within the longer term aim of developing guidelines for reducing the conflict between through traffic and the pedestrian environment in the main streets of country towns, and the preparation of a publication similar to *Road Safety in Residential Areas*, published by the Office of Road Safety, in 1982, or recent overseas examples (ANWB, 1986; Herrstedt, 1988).

The objectives of the study are:

- to develop a simple process of analysis and generating options for country towns;
- to test alternative techniques of data collection and analysis; and
- to add to the knowledge about pedestrian and vehicle conflict.

Road safety has been the subject of much investigation, and there is continuing action in improving it. *Two of the main areas of attention have been road safety in urban areas and on open roads.* There has been less investigation about the conflict in country towns, where the highway runs through the 'main street', which also is the main centre of activity for the local community. In some cases, there are proposals for removing this through traffic by constructing by-passes. However, lack of funds in constructing by-passes forces closer examination of the conflict between through traffic and the activity function of the main street.

The problem is pervasive: there are numerous towns throughout the nation where the highway runs through the main street. Motorists may be frustrated by speed and capacity constraints, while the *vehicles pose a threat to pedestrians in the town's main activity street. The problem is exacerbated* by the often high proportion of heavy vehicles on the highway. There are other negative associations, e.g noise and fumes, but there are also positive associations such as the value of passing trade to the local community. While safety is a dominant concern, it can not be seen in isolation.

Issues and scope

The central issue of concern is that of road safety in the 'Main Street' in country towns. Road safety is generally seen as an absence of accidents involving pedestrians, motorists and their passengers, vehicles and property.

The occurrence of accidents in a particular locality is, in practice, difficult to observe. One has to make use of historical data, such as the number of accidents per 10,000 vehicle kilometers of travel and compare them with rates for other localities. With the aid of traffic accident recording and reconstruction an attempt can be made to explain their cause, but reconstruction is only partially

possible as information on the accidents is incomplete, and the number of accidents is often too small to establish whether any apparent correlations are of statistical significance. An alternative approach is the study of traffic behaviour, especially of behaviour which is assumed to cause danger. The most applied form of this is conflict analysis.

Conflict analysis involves looking at risk and the scope for evasive action. When does a conflict lead to an accident; when is an accident avoidable? In other words, by which behavioural aspects, and in which circumstances are the seriousness of conflict determined? Conflict is not necessarily an indicator of a lack of safety, as some measure of conflict may be quite acceptable in certain conditions. Conflict analysis can be seen as a form of risk analysis to be used for arriving at an explanation of an objective, or perceived, lack of safety. Relevant questions are which behaviour under what conditions leads to what kinds of conflicts, how serious are theyt, and what is the probability of an accident in such conflicts? These questions have been addressed in recent overseas studies (Oppe, Kraay and van der Horst, 1985).

There are various techniques of conflict observation and analysis, but a key element is the use of video recording. The behaviour of road users is recorded by video cameras, preferably at a height of more than 4m above the road. Each frame is labelled by superimposing digital information at the beginning of each video line on the frame encoder. In this way, a particular frame can be searched automatically. There are also other, more conventional techniques, such as those involving speed and volume measurements, observations of jaywalkers and crossers, manouevring of vehicles etc. As one of the objectives of the research is to develop a low-cost and practical process of discovering and analysing conflict in country towns, a comparison is made between the video and conventional data collection techniques.

The scope of the study is limited to small country towns in New South Wales, as the budget for the study did not permit intensive study nor investigations in other States. However, the study aims to identify the significant objective and subjective variables related to road safety, and how they are related to the physical, economic and social characteristics of the 'main street', to develop ideas for the resolution of conflict, and to formulate a methodology for systematic study of the main streets in small country towns.

Approach

Conflict analysis, and the generation of options, require a systems approach to research. A systems approach is a conceptual tool which enables complex and dynamic situations to be understood in broad outline. An illustration of such a systems approach is shown in Figure 1-1.

The first task is the definition of the conflict area. Conflict may be in the form of impact or friction. Impact can be described as the effect of vehicles on the users of the road space and on the activities along its frontage. Friction can be described as the effect of other users of the road space and the associated frontage development on traffic performance. Understanding of the relative importance of impact and friction will help to clarify the kind of road/environment situation which exists. A type I road/environment situation signifies a situation where the traffic function is dominant and the road environment function subservient; the reverse situation exists in the case of a Type III road/environment. In Type II road/environments both the road function and the road frontage function are important, and that is likely to be the case in most of the main streets of country towns.

Questions then arise about the options available at strategic (longer term), developmental (medium term), and operational (short term) levels. Options may be related to land-use and transport manag

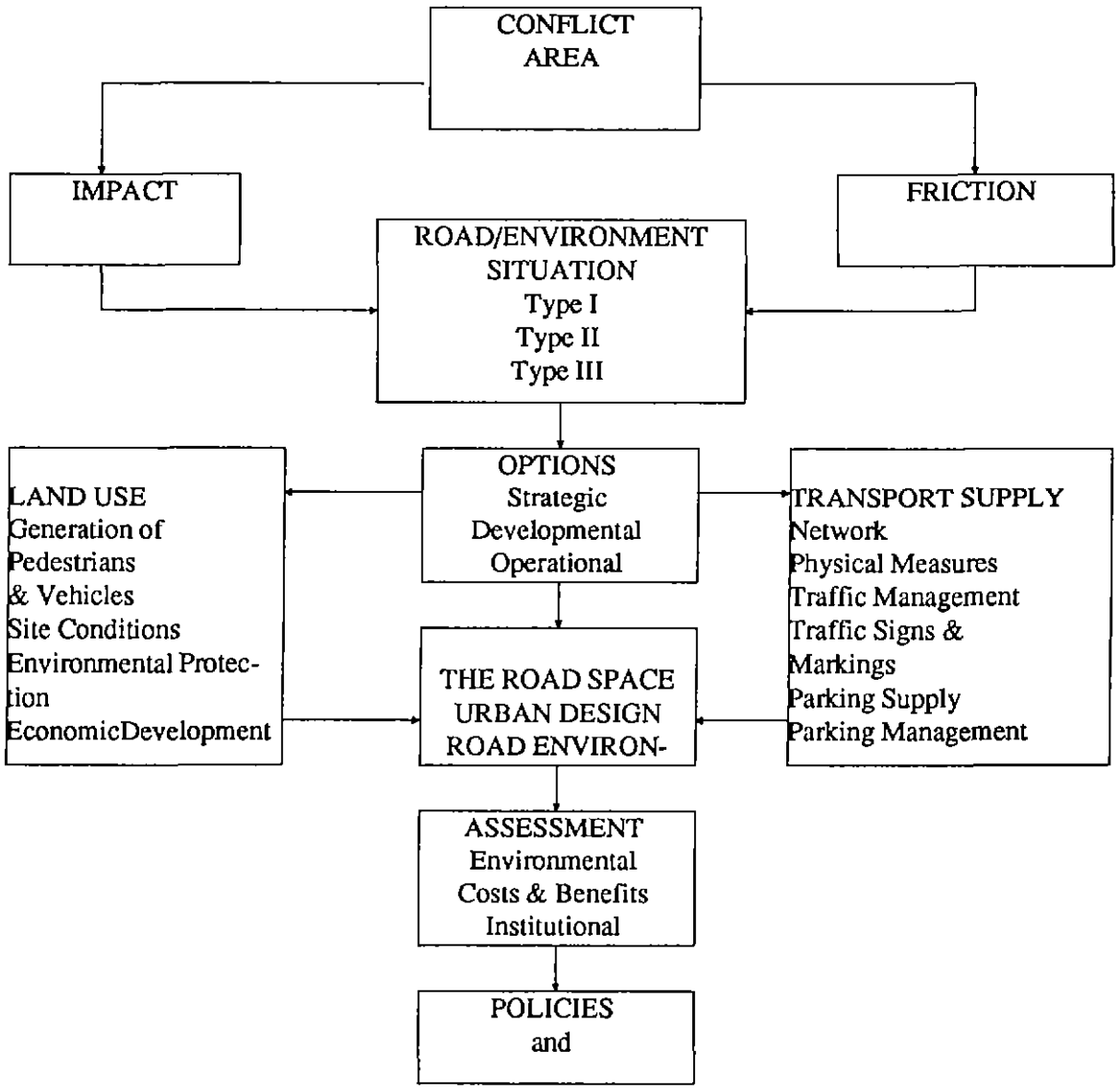


Figure 1-1 Systems View of Research Design

ment, and urban design. These options need to be assessed in physical, financial and institutional terms, before policies and actions can be decided upon.

In this study the focus is on the process of gaining an understanding of the nature of the conflict and developing options for, what is assumed to be, a Type II road/environment situation. The approach followed consists of three parts. Part I comprises the development of a conceptual framework, Part II involved the undertaking of two case studies, and Part III attempts to develop some preliminary guidelines for the process of determining conflict and formulating options of reducing it.

THE CONFLICT IN A BROADER CONTEXT

Introduction

In this, the first part of the study, the pedestrian/vehicle conflict is put in a broader context and the parameters are set for the case studies. The first step in this process is an exploration of relevant interactions. There are three types of traffic movements of significance in country towns: local, regional and through traffic. The regional traffic is the result of the service function of the town and its relationship with other towns in the region. Through traffic is inter-regional traffic, which may, or may not, be serviced by the town (Figure I-2).

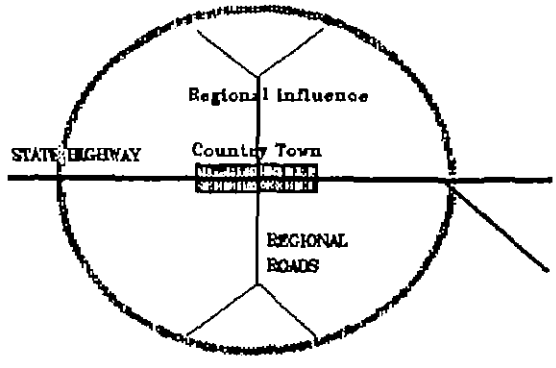


Figure I-2 Regional Interactions

In most cases, the highway runs through the main activity street of the town, as the centre of the town invariably developed along the confluence of roads serving the region (Figure I-3).

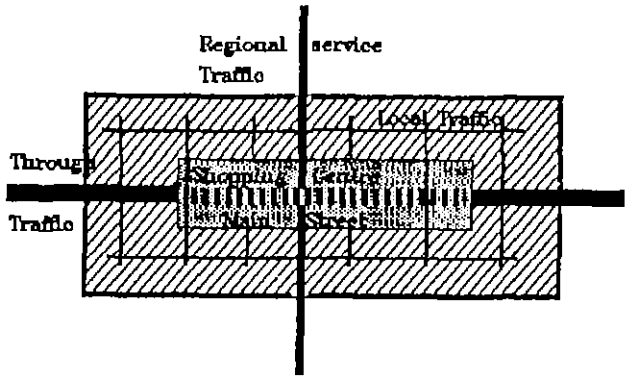
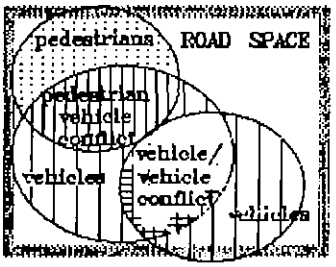


Figure I-3 Through and Local Traffic Functions

The regional roads and the inter-regional roads, in particular, have been upgraded progressively, and this has accentuated the conflict in the Main Street. The roads were widened and traffic volumes increased, making it harder for pedestrians to cross the road safely. As the centres continued to develop, the demand for parking increased, kerb-side parking (and in some cases, median parking) and short-term parking controls were introduced, leading to more conflict because of parking manouevring and double parking for deliveries. Pedestrian crossings are generally few and may not give complete protection for pedestrians as through traffic may be unfamiliar with their location. Jaywalking is common and can be hazardous when traffic speeds are high or vision impaired because of double parking. The different conflict situations in the road space are illustrated in Figure I-4.



pedestrians	vehicles
crossing	
legal	delay, safety
jaywalking	safety, delay
footpath	noise, fumes

	moving vehicles	manouevring vehicles	stationary vehicles
moving vehicles	safety delay	delay safety	delay
manouevring vehicles	delay safety	delay	delay
stationary vehicles	safety	delay	

Figure I-4 Pedetrian/vehicle conflict situations

The conflict can be seen from two perspectives: vehicle traffic has an impact on the road environment, including the safety of pedestrians which frontage development attracts, while the activities generated by the road environment affect the performance, including that of the safety of drivers, along the road. This leads to the proposition that, in environmental and transport planning terms, there are two basically different situations: those where the environment should be dominant - called 'precincts' - and traffic should be subservient, and those where traffic should be dominant - called 'corridors' - and the environment should be compatible with the traffic function. In between there is another situation: where both the traffic function and the road environment are important, perhaps at different times of the day or days of the week. This 'hybrid' situation is pervasive and typical of the 'Main Street' in country towns.

In each case, the conflict is the outcome of many interactions, and in order to address it properly there is a need to measure them accurately and understand them. The following sections briefly examine four of such interactions: land-use and transport, road space and frontage, responsibility and resources, and planning and implementation. There are other relationships, such as driver and pedestrian perception and behaviour, but these are not examined here.

Land-use and transport interaction

It is well understood that land-use activities create a transport demand and that changes in accessibility produce shifts in land-use activities. Land-use and transport interactions are particularly important in a broader context, as much what happens in the Main Street flows from them (Figure I-5). Through traffic is the result of inter-regional land-use activities and can not be influenced at the country town level. Access to a highway with inter-regional traffic, however, can lead to the development of vehicle-oriented uses, such as motels and service stations, and dependency on passing traffic, such as cafe's, chemists and newsagents. Planning for reducing through traffic in the Main Street by diversion must take such economic dependencies into account.

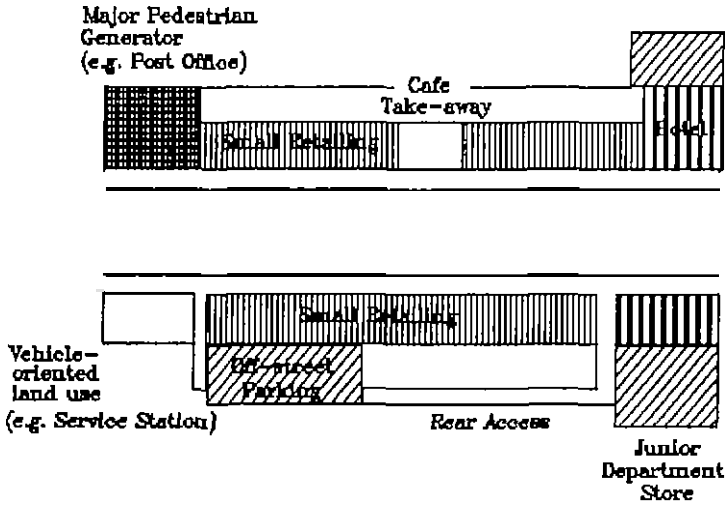


Figure I-5 Land-use Activities in the Main Street

Very little work has been done on the relationship between land-use activity and pedestrian generation in Australian country towns. It is an important relationship in the Main Street, as it determines where pedestrians will be attracted across and along the traffic stream. For instance, the siting of any new development such as a new post office or hotel outside the core is likely to increase the length over which conflict may occur.

Traffic and road environment

Friction

The prime function of transport facilities (roads) is to facilitate the safe and efficient movement of people and goods. In situations where the traffic performance is of dominant concern, friction caused by the road frontage is important. Causes and possible effects of the friction are summarised in Table I-1.

Table I-1 Friction: Cause and Possible Effects

CAUSE	POSSIBLE EFFECTS
Traffic generation	Vehicle movements which may conflict with the traffic stream
On-street parking	Searching movement Reduced attention to traffic Manouevring into and out of parking spaces Double parking where parking space is occupied
Loading/unloading	Backing onto the road/traffic from site See also under on-street parking
Pedestrian generation	Jaywalking Sudden driver responses
Bus stops	As for pedestrian generation
Access drives	Lack of visibility
Visual distraction (advertisements, display windows and sign proliferation)	Reduced driver attention

The principal factors of friction along urban arterial roads are (in order of severity): on-street parking and the movements associated with it, pedestrian crossing, and the number of access drives (Black, Westerman, Blinkhorn and McKittrick, 1988). Table I-2 shows the degree of friction by indicator and land-use type in qualitative terms.

Table I-2 Matrix Showing the Degree of Friction by Indicator and Land-use Type

DEGREE OF SEVERITY OF FRICTION

INDICATORS	most ←				least
parking manoeuvring	small offices retailing	large retailing	medium density housing		
driveways	car retailing		medium density housing	large retailing	
jaywalking	small offices retailing	car retailing	large retailing	medium density housing	low density housing

The most serious friction is caused by the shopping string, but while land use is clearly significant, the site conditions are equally important. Small and narrow sites create access and parking problems which have an effect on traffic performance. This situation can occur irrespective of the land-use category. Rear or side access reduces some of the potential for conflict. Figure 1-6 illustrates the kind of friction in the 'Main Street'.

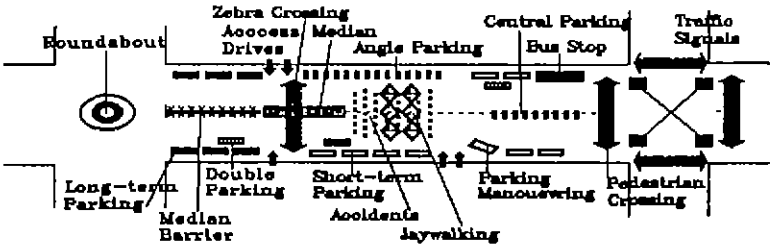


Figure 1-6 Friction in the 'Main Street'

Impact

The impact of traffic and traffic management is important in all situations but more so where the sensitivity of a frontage activity towards a particular effect is high. The causes and possible effects of traffic and traffic management on the road environment are shown in Table 1-3.

Table 1-3 Impact: Cause and Possible Effect

CAUSE	POSSIBLE EFFECT	CAUSE	POSSIBLE EFFECT
Traffic volumes	Need for pedestrian crossing	Traffic volumes	Emissions
Traffic speed		Traffic speed	
Traffic composition	Accidents and increased	Traffic composition	
Road geometry	conflict	Traffic management	
Traffic management	Perceived danger		
	Social barrier	Clearways	Impaired access
Traffic volumes		S-lanes	Loading/unloading
Traffic speed		Parking controls	problems
Traffic composition	Traffic noise		Business viability
Road geometr			
Pavement		Dangerous goods	Exposure to risk
Traffic management		movement	

t

Some effects are not directly related to road frontage (such as emissions and energy consumption), and not all have a direct bearing on safety. However, there is often no single cause-effect relationship: many factors are likely to play a role. For instance loading/unloading problems will lead to double parking and reduced visibility for and of jaywalkers.

The land-use category most affected is, again, the shopping string, largely because of the concentration of pedestrians of all kinds and in all conditions. Figure 1-7 summarises the impacts in the 'Main Street'.

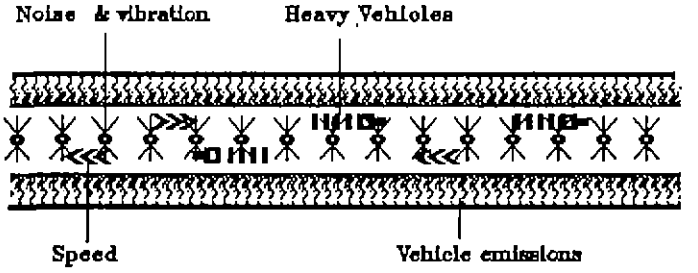


Figure I-7 Impacts in the 'Main Street'

There are also positive associations: businesses along busy traffic routes regard the opportunity for cheap advertising their presence to passing traffic as a positive factor. A highway frontage can be a place for business incubation: a low cost operation with a very visible address.

For the motorist in need of service, direct access to a service station is important. Roadside development can give a sense of interest and orientation (but also be a cause of confusion).

Planning horizons

It is clear that there are many interactions which influence the pedestrian/vehicle and vehicle/vehicle conflic in streets with a traffic and shopping function, The physical interactions in the Main Street can be summarised in a diagrammatic form, as illustrated in Figure 1.8. Planning for reducing these conflict must take these interactions into account.

Planning can be undertaken for different horizons: strategic planning, which is long-term in orientation; development planning, which deals with intermediate term actions (say 3 to 10 years), and operational planning, which is concerned with control and immediate actions. In ideal circumstances all forms of planning should be undertaken since each planning activity examines a problem from a different perspective.

With strategic planning, issues of the conflict can be addressed in more fundamental ways, such as the containment of the shopping centre, the possibility of diverting through traffic, or the desirable development of the land- use structure and transport system of the town as a whole. With develop-

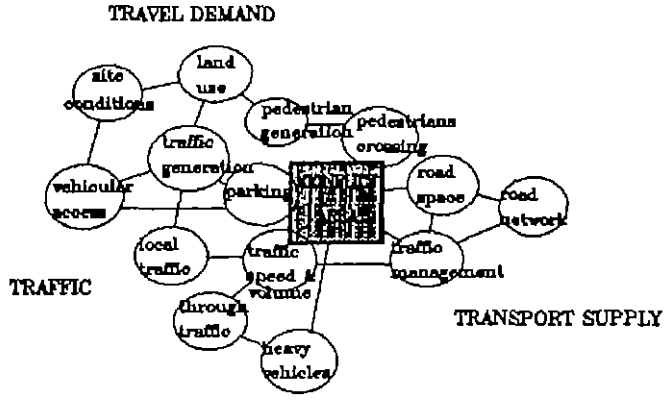


Figure 1-8 Interactions in the Main Street

ment and operational planning, the emphasis is almost wholly on what is achievable in the shorter term, and much of this will revolve around ameliorating measures, such as traffic management and the siting of pedestrian generators (Figure I-9).

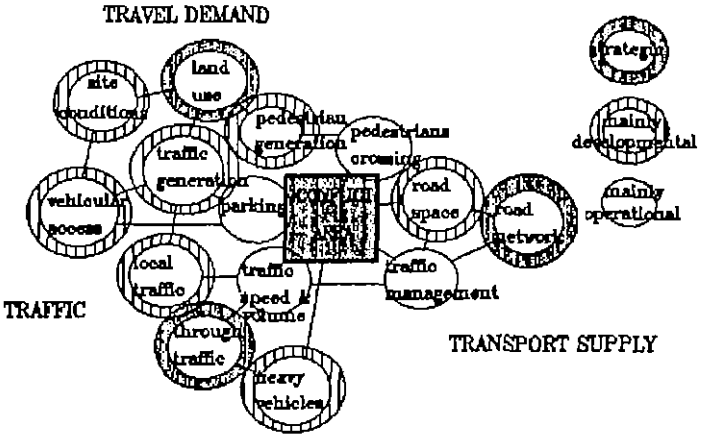


Figure 1-9 Strategic, developmental and operational interactions

Responsibility and resources

The significance of the interactions described above is reasonably well-understood, but the ability to manage them is quite another matter. This can be attributed to the fact that responsibilities for

decision are divided (Figure I-10), and resources to implement proposals for improvement are limited

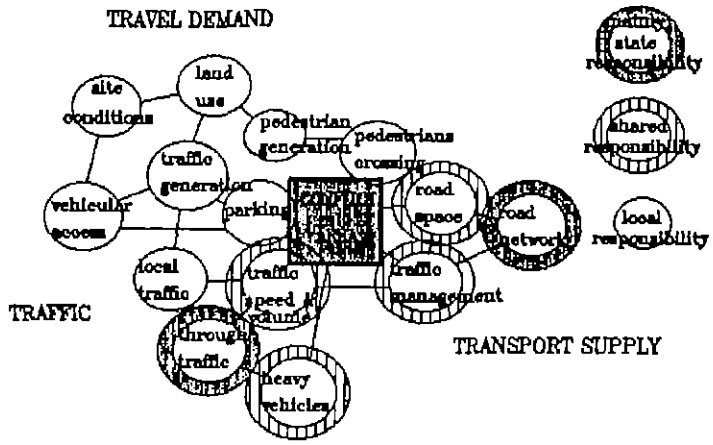


Figure 1-10 Responsibilities

Many land-use and development decisions (which produce the vehicle and pedestrian trips) are made by the private sector, and while these decisions are constrained by planning instruments prepared and administered by local government, there is no guarantee that the constraints will always endure. The Court may overturn them and the State Government may intervene. Some decisions are made by governments at all levels: In the two case studies dealt with in Part II, the Post Office location creates a safety problem, and that was a Federal Government siting decision.

Decisions on the Main Roads are made by state government, while decisions on other roads are made by local government bodies. Road safety is a matter of concern to governments at all levels, but coordination of policies and programs has been notoriously poor, while funding constraints make it impossible to accurately predict when and where improvements will be made.

Decisions on parking policy are made by local government and subject to change, depending on the views of the elected representatives of the day. The actual provision of parking space is a divided responsibility; both the private sector and local government play a role. The pricing of the parking space is also a divided responsibility.

While there are management solutions to improve coordination, there will continue to be major uncertainties, and a risk assessment of failure is essential. Such an assessment will point to those elements which are most sensitive and should be a powerful tool in formulating policies and preparing fall-back positions.

It will be clear that management is a crucial element in the successful development of centres. It is not sufficient to have a plan; there must be strong leadership, efficient organisation and effective control. It must be seen as a partnership between the many public agencies and private organisations which play a role. It must also be seen as an ongoing process, in which strategic directions

are reassessed in the light of new opportunities and constraints. But there must be continuity and consistency in implementation, so that uncertainty is minimised.

CONCEPTUAL APPROACH

Road/environment typology

It is clear that the conflict between vehicles and pedestrians must be seen within the context of both the road function and the road environment as the major centre of the community. Mention was made of the three types of road: roads as corridors where the traffic performance is dominant (Type I), roads in precincts were the environment is dominant (type III), and roads where both the traffic and road environment functions are important (Type II).

Conflict occurs in each of the three situations, but the fundamental problem in all of them is an imbalance between speed, volume and vehicle type on the one hand, and the type of frontage development and activities on the other. Corridors should be converted from 'seams' in the local community structure to 'edges', precincts should be made safe and 'becalmed', and type II situations should be treated to achieve an acceptable level of speed and volume to ensure that the conflict with pedestrians and other vehicles is minimised. Figure I-11 shows the relationships between road functions and types.

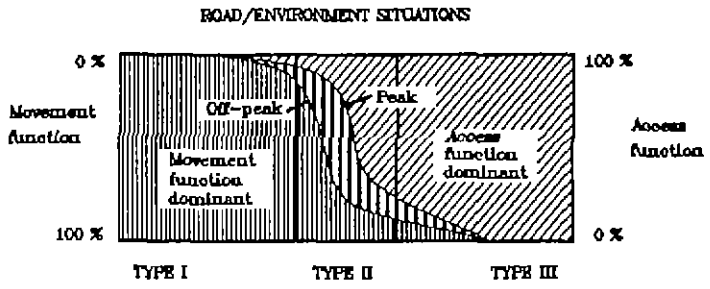


Figure I-11 Movement and Access Functions and Road Type

If such conditions are used as a rough indicator of an acceptable balance between vehicle movements within a centre and the quality of its pedestrian environment, it is possible to determine the combination of development, intensity and transport supply to achieve these conditions in a specific situation. If the elements of the transport supply package (parking, public transport, and circulation) are not in tune, and if the total supply package is not in balance with the transport demand, an unacceptable environment will occur.

The Main Street has often been regarded by State road authorities as a Type I situation, on the grounds that the inter-regional function of the State Highway should predominate. There are many illustrations of this approach in which the road has been upgraded at the expense of the quality of the road environment. The impact on pedestrian safety received scant attention. In other cases,

where such 'improvement' was impracticable, by-passes were planned and developed. The situation then becomes a Type III road, where the precinctual quality can predominate.

However, by-passes take time and funds to construct, and the basic premise of this project that the Type I corridor should, on safety grounds (but by no means solely for that reason), become a Type II road when it enters the Main Street.

Related research

The problem of how to deal with type II roads has received little attention until recently. The most notable work is being carried out overseas: in Canada (City of Toronto, 1982), the Netherlands (Ministry of Transport and Public Works, 1985; Papendrecht, 1985; Van Herk and Homan, 1988) and Denmark (Herrstedt, 1985; 1988).

Both the Danish and Dutch work involves the study of country towns and the development of measures to reduce vehicle speed through the design of the road space. A distinction is made between the transition zone (near the entry to the town) and the core zone (where the retailing activities are concentrated). In the transition zone measures are introduced which elicit a change in driver behaviour through changes in visibility, axial shifts, splitter islands, and treatment of the side of the road (e.g. kerbing, landscaping), so that a portal effect is created. In the core zone, a wide variety of measures are used, including axial shifts, pavement changes, narrowing of carriageway at frequent intervals. In Denmark, the technique is called 'Environmentally Adapted Roads'. In both countries before and after studies have been carried out. However, in neither country is the road frontage development treated as a variable.

Fundamental to any actions is an understanding of the variables and their likely effect. This was the purpose of a study, funded by the Traffic Authority of New South Wales (Black, Westerman and Kuiper, 1987), which examined the conflict between pedestrians and vehicles in shopping strings along major traffic routes in Sydney. The objectives were to gain insight into the attraction of pedestrians to shopping strings, the friction between crossing pedestrians and vehicles using the same road space, how this relationship was influenced by the type of road and its configuration, and what measures could reduce the conflict.

As expected, it was found that there was a strong correlation between floor space and number of shoppers to the centre. There is also a positive correlation between total floorspace and the number of businesses visited: the larger the centre, the greater the number of linked trips. The average number of pedestrians in the centres over a 20 minute. period ranged from 150 to 950. The study showed that about 35 - 50 per cent of these pedestrians will cross the road at some time during thier visit..

The behaviour of crossing pedestrians was analysed by separating pedestrians who are crossing legally at a crossing facility from those who cross elsewhere or against the lights (defined here as 'jaywalkers'). It was found that jaywalking is an inherent characteristic of centres with high pedestrian activity. Although the correlation was not strong, the vehicle flow had an influence on the proportion of jaywalkers. The correlation with vehicle speed was a little stronger: the number of jaywalkers seems to increase rapidly as the average vehicle speed decreases to about 25 km/h in areas without a median. In areas with a median, the same pattern occurs but at the higher speed of about 35 km/h. Futher analysis showed that there also seemed to be a correlation between pedestrian density, vehicle density and speed. This is shown in Figure 1-11.

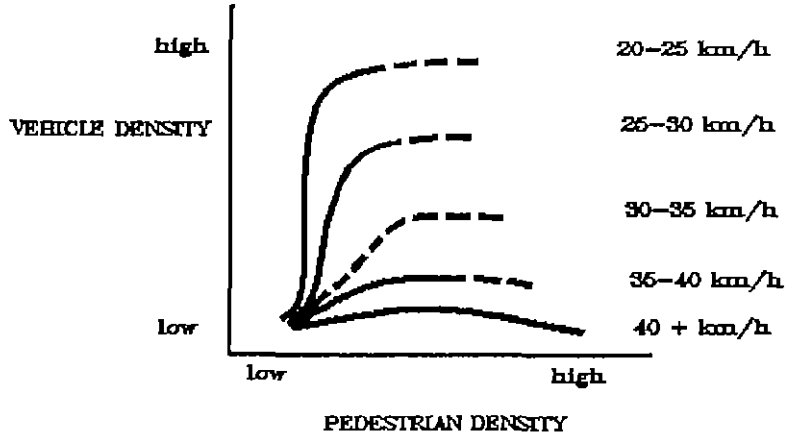


Figure 1-11 Pedestrian and Vehicle Density, and Vehicle Speed

Speed appears to be a major issue in the pedestrian/vehicle conflict and this aspect may be very relevant in the case of the Main Street in country towns. In a systems approach, there is a need to take account of the factors which bring pedestrians and vehicles into the main street, and how they behave when they get there. These dynamic aspects will, in turn, be influenced by the fixed siutaion of the road characteristics, site conditions (such as driveways, driveway access and on-site parking), and the frontage activities (particularly whether they generate pedestrians or vehicles).

Research focus

The focus of this research is on both a process and its application to two specific areas. However, it is an exploration and not a comprehensive project. The overall research structure is shown in Figure I-12. The focus of the research project is limited to Type II situations, and to developmental and operational options.

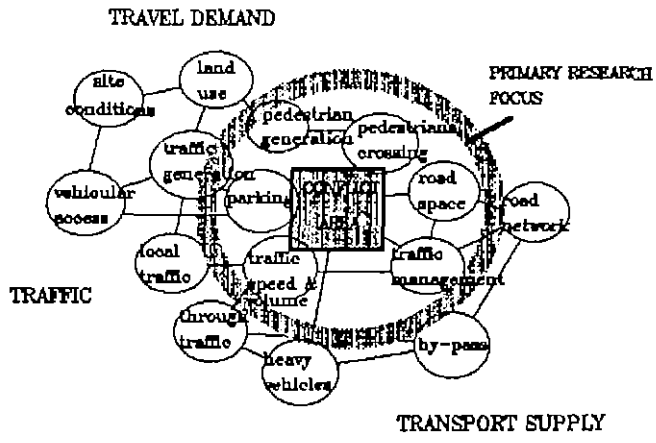


Figure 1-12 Overall research focus

PART II CASE STUDIES

INTRODUCTION

Objectives

The objective of the study was to test the conceptual framework, with the main focus on its general suitability as a cost-effective process of identifying, and reducing, conflict between pedestrians and vehicles, and between pedestrians and vehicles. The conceptual framework is applicable to those country towns where the highway is also the main activity street.

In view of the very limited budget for data collection, the testing was only for two relatively small towns, and even then the testing could be little more than exploratory.

Selection of areas

The budget for the study limited the survey to two towns. The selection of the towns was based on the following premises:

- There should be some prime facie evidence of conflict, and accident statistics were to be used for this purpose;
- There was no existing by-pass nor were there firm plans to construct one;
- There should not be seasonal major fluctuations due to tourism;
- The towns should not be so large as to make it impossible to undertake the essential surveys with the resources available within two days; and
- The towns should be within reasonable distance from Sydney to minimise costs of survey wroko.

The preliminary list of towns was prepared and details on vehicle accidents during the period 1985-87 were obtained from the Traffic Authority of New South Wales Table II-1).

TABLE II-1 Accidents involving vehicles in NSW Towns, 1985-87

TOWN	VEHICLE ACCIDENTS	TOWN	VEHICLE ACCIDENTS
Berry	21	Musswellbrook	59
Cowra	39	Orange City	189
Forbes	25	Parkes	37
Gunning	6	Scone	20
Mittagong	87	Singleton	33
Moruya	17	Ulladulla	45
Moss Vale	57	Yass	97

This list was reduced to 4: Moss Vale, Orange City, Parkes, and Ulladulla, because of information available about plans for by-passes, the number of accidents, and convenience. A site visit was made; Orange was discarded because it was too large and Ulladlulla because it had a major tourist function. This led to the final selection of Moss Vale and Parkes.

Research approach

The approach was greatly influenced by the objective of developing and preliminary testing of a process based on the conceptual model, set out in Part I. It was considered important to develop a 'minimal', low-cost, approach which would not require specialised skill or extensive resources.

It was also felt that the study should add to the accumulated knowledge about road/environment interactions in relation to road safety. Previous studies (Black, Westerman, and Kuiper, 1987; and Black, Westerman, Blinkhorn and McKittirck, 1988) showed that there were relationships between:

- frontage land use and site conditions and the friction they caused to road traffic;
- the level of pedestrian activity on the footpath and the number of pedestrians crossing; and
- the nature and extent of pedestrian/vehicle conflict and pedestrian density, vehicle density, vehicle speed and the presence/absence of a median.

This required information on land use and site conditions, pedestrian and vehicle movements, vehicle speed and the physical characteristics and management of the road space. As conflict is not necessarily expressed in accidents, it is important to observe pedestrian and vehicle behaviour, and that can best be done through video observation.

It was also essential to know the total amount of traffic and the proportion of through traffic, and to relate this to the trade done in the centre. This information is necessary in order to identify whether there is a need for alternative routing of through traffic, and what the impact of this might be on the business activity in the Main Street.

Scope

The study was not of the whole town, but of the Main Street only. For the Main Street, the section containing the main pedestrian activity was studied. The focus was mostly on the developmental/operational aspects. It was assumed that major strategic issues such as long-term land-use policy and the development of a by-pass would not be considered, as that would require more time and resources than were available to this study. Similarly, it was assumed that there were no deficiencies in the town's structure which required significant network changes.

Thus, the emphasis was, deliberately, on applied research: the aim of developing some simple processes and indicators which can be used for the development of practical measures, mostly in the intermediate to the short term, to improve the Main Street.

Although the focus was on the pedestrian/vehicle conflict in the Main Street, it was realised that this is a part of the larger question of roads and their environments, and the integrated development of the town as a whole. The data base should be capable of being used and integrated into this broader context.

DATA SELECTION AND PROCUREMENT

Data needs were determined for the following categories: function and role of the Main Street, the built environment, road space management, vehicle movement, pedestrian movement, conflict behaviour, and conflict perception.

Priorities were identified so that essential elements were covered, but others would not be overlooked. Those elements which were not essential could perhaps be covered in part, depending on time and resources available.

A decision was made to concentrate on the active parts of the Main Street, i.e. those segements where there was contiguous retail development and where there were pedestrian movements.

The whole approach was dictated by low cost: two visits, two professional people, and maximum use of local resources: information from Council officers, the use of High School students with some surveys, and the assistance of the local Chamber of Commerce with the business survey.

The purpose, means and priority of data collection are set out in Table II-2.

Basic surveys

Numberplate survey

A sample survey of 10 per cent (all vehicles where the last digit on the numberplate is 0), carried out continuously between 9.30 and 15.30 on a Friday, was made. It was expected to yield information on total traffic, through traffic, regional function (measured by the number of vehicles going out and returning later), local function (measured by the number of vehicles coming in and going out again, after deducting the through, non stopping, traffic), and the accumulation of vehicles in the centre. The period used may not cover the typical peak hour employment traffic which occurs in most cities, but was not considered critical in country towns, and not so relevant where the specific purpose is the study of the pedestrian/vehicle conflict, as there are fewer pedestrians around at the vehicle peak hours.

Speed survey

Speed observations, using stop watches, were made for segments of about 100 - 150m length for half an hour in the hour.

Pedestrian movements

Jaywalking was observed and recorded for the same segments where speed observations are made, and during the same periods, so that the speed and jaywalking data can be related.

Pedestrians crossing at legal crossings were observed and counted. In the case of zebra crossings, the number of vehicles stopping to give right of way to pedestrians were recorded, again for the same period as the jaywalkers.

Pedestrians on the footpaths in both directions and for the same periods as before were counted.

In this way there is a coordinated set of pedestrian movements which can be related to vehicle speed and vehicle volume (obtained from the numberplate survey).

Table II-2 Type, purpose and method of data collection

TYPE	WHAT	PRIORITY	HOW	WHEN
FUNCTION AND ROLE OF THE MAIN STREET	Local, regional and passing trade		Business survey	B
	Origin and frequency of visits	1	Visitors survey	B
		1		
BUILT ENVIRONMENT	The road pattern and land-use structure of the town		Local Authority	A
	Width and physical characteristics of the road space of the Main Street.	1	Local Authority and field survey	B
	Land-use frontage classified by pedestrian and vehicle orientation.	1	Field survey	A
	Site access.	1	Field survey	A
	Off-street parking areas location, capacity, utilisation	1	Local Authority	B
	Streetscape	2	Field observ.	A
		2		
ROAD SPACE MANAGEMENT	Road hierarchy		Local Authority	A
	Intersection control	1	Local Authority	B
	Kerb lane control	1	Local Authority	B
	Median control (if any)	1	Local Authority	B
	Parking duration	1	Local Authority	B
	Legal crossing	1	Local Authority	A
		1		
VEHICLE MOVEMENTS	Traffic volumes for a period of 6 hours from 9.30 - 15.30 on a normal Friday.		Number plate survey	B
	Through traffic	1	Number Plate survey	B
	Heavy vehicles	1	Number Plate survey	B
	Traffic speed	1	Stop watch survey	B
		1	Video observation	B
PEDESTRIAN MOVEMENTS	Pedestrians on footpaths		Pedestrian count	B
	Legal crossers	1	Pedestrian count	B
	Jaywalkers	1	Pedestrian count	B
		1		
CONFLICT BEHAVIOUR	Delay caused by manouevring vehicles		Video observ.	B
	Incidence of double parking	1	Video observ.	B
	Vehicle delay at legal crossings	1	Part of pede-strian count	B
		1		
	Jaywalker/vehicle conflict		Video observ.	B
	Accidents	1	Accident stats. Local police and Traffic Committee	C
		1		
			Visitor survey	B

Priority; 1 = essential, 2 = desirable, 3 useful;

Video observation

The video recording was made in an elevated position where the most active segment of the Main Street could be observed. The recording was made at the same time as the speed and pedestrian surveys. The data which it yields are: vehicle manouevring, parking, double parking, pedestrian behaviour, pedestrian/vehicle conflict, vehicle time to cover a fixed distance (and hence vehicle speed).

Visitor interview

Simple questionnaires were used to find out where people come from, how they got there, what places and how many they visit, what their perception is of the Main Street, whether there is a safety problem, and what should be done about it. The questionnaire is designed to take only a few moments so that a sample of about 70 interviews can be easily achieved by one interviewer.

Business questionnaire

This is a longer survey, left with the business people in the Main Street, and collected later, which seeks to establish the nature of commercial activity, the source of its clientele, the economic significance of through traffic, the perception of the Main street, and, as for the visitor survey, how the pedestrian and vehicle conflict is perceived.

Land-use survey

Here, a simple land use survey, distinguishing between pedestrian and vehicle oriented uses, was carried out.

Road space data

Data were obtained about the street space: road width, carriageway width, parking, median, intersections.

Management

Data were also obtained about traffic control, parking controls and road hierarchy classification.

Traffic data

In most cases, some traffic counts are available, although they may be a little out of date. However, they may give an indication of the diurnal weekly and monthly variations in traffic. These are used to check the data obtained directly during the surveys.

DESCRIPTION OF MOSS VALE AND PARKES

Location, function and structure

Moss Vale is 130 km from Sydney and is situated on the Illawarra Highway which links the Hume Highway with the Princes Highway at Shellharbour. The town has a population of about 7,000. Several regional roads link the town to the local region. Figure 2-1 shows the structure of the town..

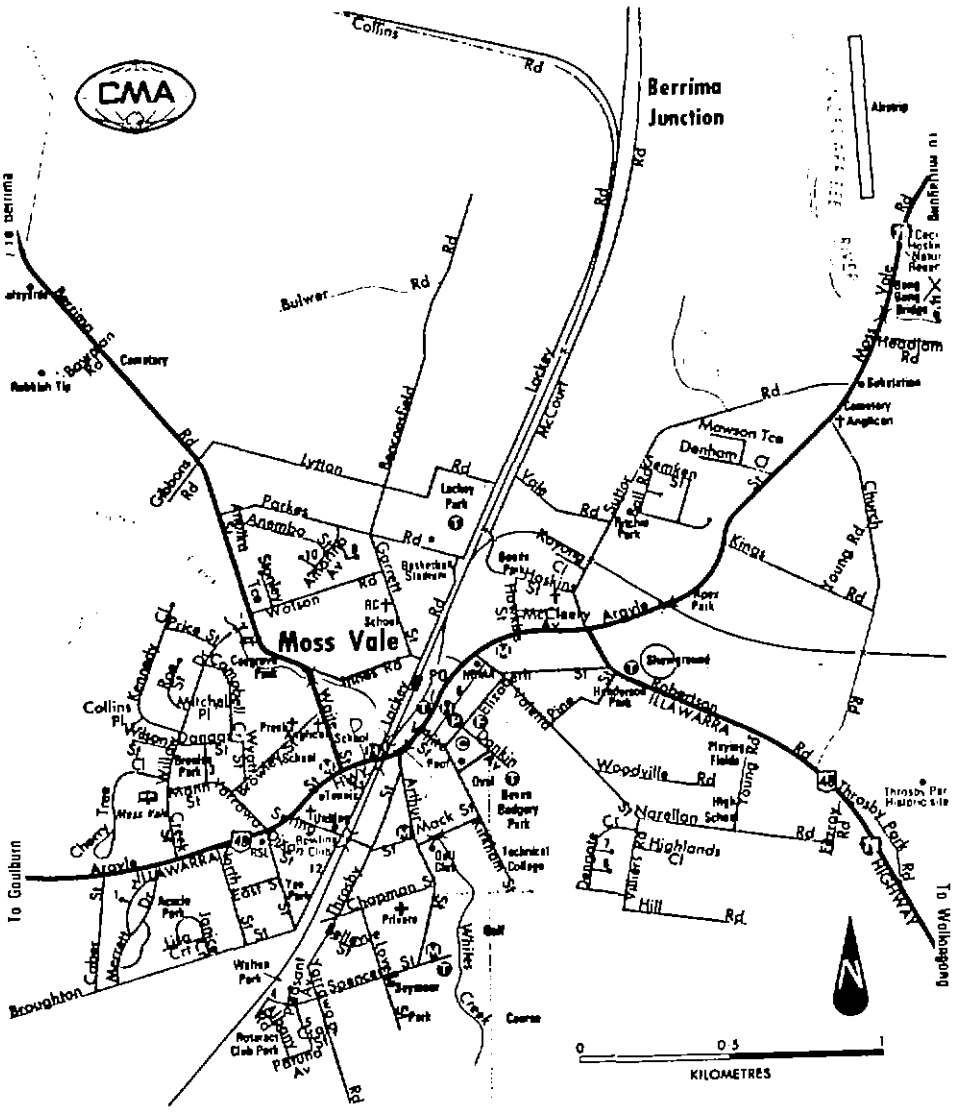


Figure 2-1 Location and general structure of Moss Vale, NSW

Parkes is situated 365 km from Sydney on the major Melbourne-Brisbane inland route, the Newell Highway. The town has a population of 9,500 and serves the region of the shire with a population of about 15,000. Figure 2-2 shows the structure of the town.

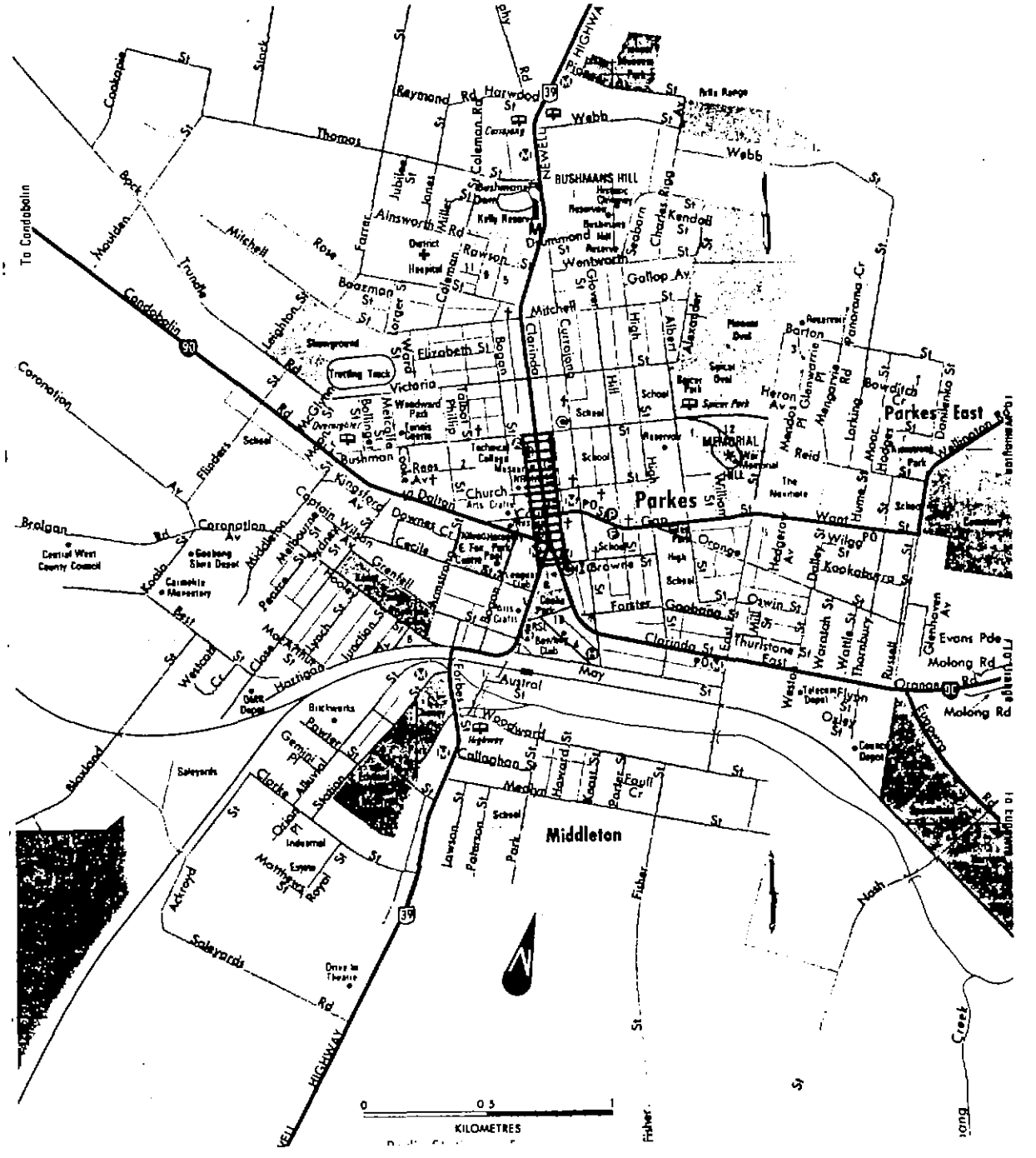


Figure 2-2 Location and general structure of Parkes, NSW

The Main Street

Moss Vale

The 'Main Street' in Moss Vale is elongated and extends over a distance of 600 meters. Most commercial activity is on the east side, but the post office, railway station, regional bus stop and the town's main park is located on the west side. The core of the centre lies in a valley. The highway from the north-east curves down a slope into the town centre, runs under a narrow railway bridge and curves up to the south-west away from the town.

From neither approaches to the centre along the highway is there a clear image of the main street, and traffic comes down relatively fast and without clear visibility. One of the main pedestrian movements is across to the Post Office, which is at the edge of the core, on the rise towards the north-east. There is no pedestrian crossing as it has been considered too dangerous by the Local Traffic Committee with the lack of visibility and the speed of the vehicles.

There is no rear access to most of the commercial frontage sites. The highway is wider in the core of the centre and delivery vehicles have been observed double parking without impeding traffic flow. However, the lack of visibility when there was double parking makes jaywalking dangerous, and *several potential accident situations were observed.*

The lack of rear access does not appear to be a problem in the fringe commercial areas, despite the fact that there is no room for double parking, because trading is not intensive.

The Main Street varies in width, ranging from 13.7 to 15.0 m between kerbs. There is parallel parking on both sides, and a zone designated for buses. There is one legal pedestrian crossing (zebra); there are no traffic signals. There are no traffic islands or other measures for channelling traffic at intersections or midblock sections.

The section studied, with the survey points identified, is shown in Figure 2-3.

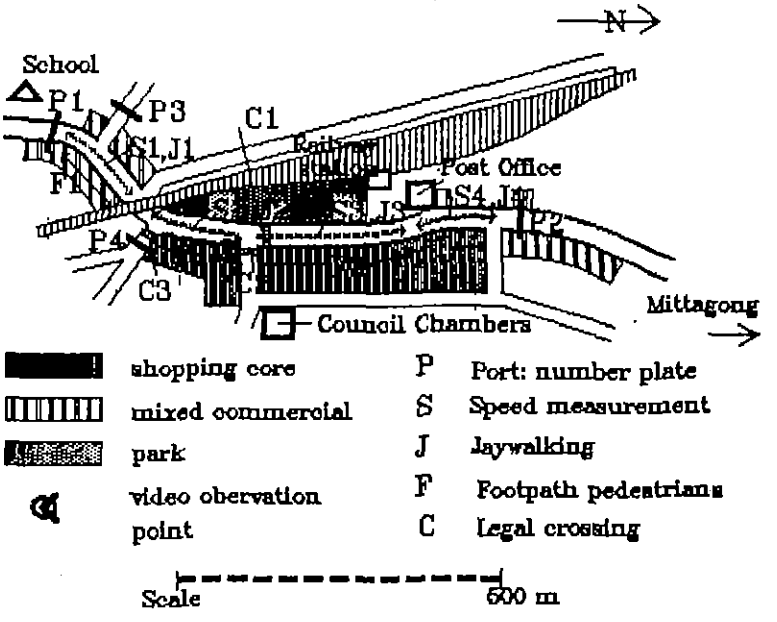


Figure 2-3 Area studied and survey points, Moss Vale

Parkes

The Parkes Centre is concentrated in a 400 meter section of the Highway and developed on both sides. There are two major vehicle - oriented (and also pedestrian-oriented) retail uses: both supermarkets, situated at either end of the centre.

The core of the centre is located from the junction between the Newell Highway and Welcome St to Church Street, a distance of about 180 meters. There are rear access lanes behind all frontage developments.

A new Post Office will be contructed in Welcome St, on the edge of the centre, and this will create additional pedestrian traffic through the junction with the Newell Highway.

The Main Street has a width between kerbs of 18.75 m. There is angle parking (60 degree) on both sides. There are three legal crossings, but no traffic signals. A traffic island is provided at the intersection of Clarinda, Welcome, and Dalton streets.

The section studied, with the survey points identified, is shown in Figure 2-4.

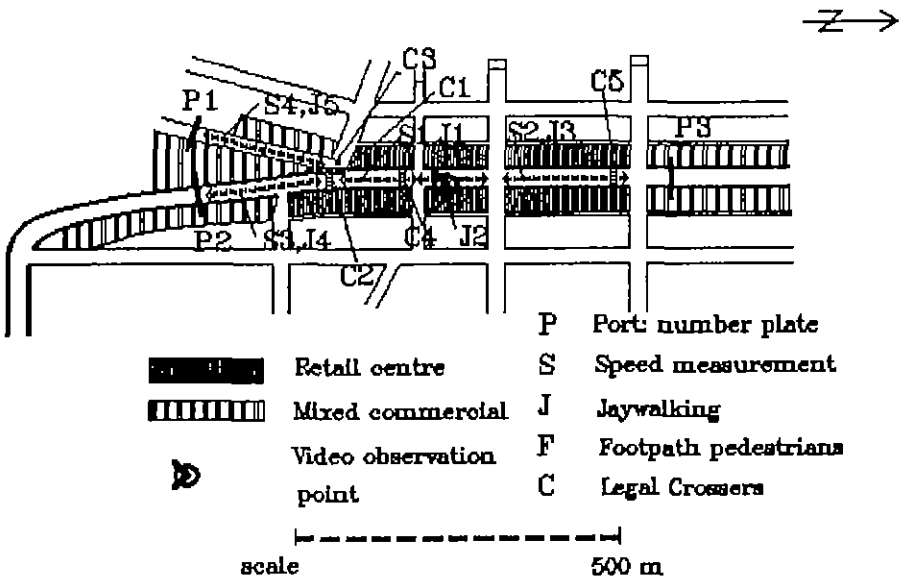


Figure 2-4 Study area and survey points, Parkes

Economic activity

The economic activity in the towns can be assessed by determining the origin of visitors to the towns and their means of travel, and the proportion of trade attributed to them.

As anticipated in both of the two country towns, the majority of people surveyed arrived by car; in Moss Vale, 65% as the driver an 10% as passengers, and in Parkes, 63% as the driver and 14% as

passengers. The other significant means of transport was to walk, accounting for 17% of Moss Vale respondants and 14% in Parkes. Those who arrived by car were asked where the vehicle was parked, which, compared to the length of time they anticipated staying, yields information on the type of parking required by regular visitors.

In each town, shopping or appointments were given as the chief reason for being in the Main Street for for shopping or appointments accounted for 69% of the total respondants in Moss Vale, and 66% in Parkes. The survey also included the opinions of those who were employed in the town itself comprising 17% of the total sample in Moss Vale and 20% in Parkes. The remaining 14%, in each case, did not fall into these categories and included people looking for work and truck-drivers taking a meal-stop. The information gained from these questions, when compared against the information given about parking and pedestrian danger in the street, yield information about the relative pressure on long and short term parking and the turnover rate.

The business questionnaire related to the financial dealings of the businesses, their establishment, including whether the property and/or the business was owned, rented or managed, the annual turnover and the degree to which they depended on passing trade, particularly orientated to the highway. An indication of the economic profile of the towns is shown in *Table II-3*

Table II-3 Main characteristics of trade, Moss Vale and Parkes

Customer patronage	MOSS VALE per cent	PARKES per cent
Local	63	74
District	32	20
Passing trade	5	6
Total	100	100
Average weekly turnover	$9,752	0,542
Dependence on passing trade	per cent of establishments	per cent of establishments
<10 %	79	94

The Table shows that both towns serve their immediate regional areas and that passing trade is a relatively small. It should be noted that the survey did not include hotel/motel establishments, which are generally not located in the shopping centre. Tourism does not appear to have an impact on either town. In Parkes 21 businesses report a seasonal variation in trade as opposed to 15 which do not. In Moss Vale 18 report a seasonal variation as opposed to 15 which do not.

The towns are similar in terms of the average length of time businesses have been established; 10 years in Parkes and 9 years in Moss Vale. In Parkes the majority of businesses are owned (23 of 36) as are many of the properties in which the business is conducted (17 of 36). In Moss Vale the level of ownership is not quite as high with 20 of 29 businesses owned and only 7 of 29 properties owned. In Parkes 17 of the 36 businesses who responded rent the premises; in Moss Vale 22 of a total of 29 businesses rent premises. In both towns the average rent is about $200 per week. The average weekly turnover is also very similar: about $10,000 per week.

PEDESTRIAN AND VEHICLE ACTIVITY

Total traffic

Both towns have a highway running through the Main Street, but there are also some regional roads connecting with the Highway in the town centre. The numberplate data represent a 10 per cent sample (the accuracy of which was checked by counting all vehicles at a control point). The AADT values for the highways have been established by the Department of Main Roads at other times; the results of the numberplate survey were checked with these values and were found to be close. Table II-4 shows the estimated traffic volumes.

Table II-4 Estimated Ttraffic Volumes at the Cordon Points, Moss Vales and Parkes

MOSS VALE				PARKES			
	IN	OUT	TOTAL		IN	OUT	TOTAL
Period 0930-1530 :				Period: 1000-1530			
Highway S	1680	1760	3440	Welcome S	990	1090	2080
Highway N	3850	2620	6470	Highway S	2130	1210	3340
Regional W	980	820	1800	Highway N	1670	1470	3140
Regional SE	630	670	1300				
TOTAL	7140	5870	13010	TOTAL	4790	3770	8560
% Highway			76.17				75.70

The figures show that the proportion of traffic on the Highway, as distinct from other regional or local roads, to total traffic is remarkably similar for Moss Vale and Parkes (about 76%). There are differences in traffic volumes which can be attributed to through traffic and regional function, but these can not be deduced from traffic volumes alone. This requires further analysis of the numberplate data. Variations in traffic volumes during the day are shown in Table II-5. The locations of the entry and exit 'ports' are shown on Figures 2-3 and 2-4.

Table II-5 Vehicle Traffic Through the Cordon, Moss Vale and Parkes

	MOSS VALE					PARKES			
Period	P1	P2	P3	P4	SUM	P1	P2	P3	SUM
0940-1010	400	570	210	120	1300	160	180	330	670
1010-1040	230	480	90	120	920	160	220	180	560
1040-1110	350	520	80	120	1070	220	260	310	790
1110-1140	290	470	110	70	940	150	290	240	680
1140-1210	330	410	120	120	980	180	230	220	630
1210-1240	280	640	170	150	1240	200	140	200	540
1240-1310	230	390	110	90	820	180	160	380	720
1310-1340	330	390	100	60	880	200	160	130	490
1340-1410	210	400	130	110	850	160	170	310	640
1410-1440	320	430	230	50	1030	240	100	280	620
1440-1510	470	580	190	130	1370	90	210	300	600
Avg veh/h	625	960	280	207	2073	353	385	524	1262

The table shows that the level of traffic is about 80 percent higher in Moss Vale (2100 veh/hr) than in Parkes (1300 veh/hr), and that in Parkes there is little variation during the day, while there is more peaking in Moss Vale.

Through and local traffic

In order to ascertain the extent of through, regional and local traffic, the numberplate data were analysed according to origin and destination at the cordon points.

First the matched vehicles were separated from the unmatched vehicles. The differences between Moss Vale and Parkes are very small; about 75 per cent were matched. The unmatched vehicles may be caused by errors in recording of the numberplate (estimated to be not more than 4%) or by the fact that vehicles passed one of the cordon points before or after the survey was conducted.

Table II - 6 Matched and Unmatched Vehicles, Moss Vale and Parkes

TOTAL VEHICLES

	MOSS VALE number	per cent	PARKES number	per cent
Matched	473	75.6	246	72.8
Unmatched	153	24.4	92	27.2
All vehicles (sample of 10%)	626	100	338	100

The matched vehicles were then sorted by origin and destination, with the origin representing the entry 'port' and the destination the exit 'port'. Where the time lapse between 'in' and 'out' had a negative value, vehicles were going out first and returning later; where they had a positive value vehicle are coming in first and then going out. The former category comprises, typically, trips serving the region or trips to another centre, while the latter are either through trips or trips to the local centre. The results are shown in Table II-7 and Table II-8.

Table II-7 Origin and Destination of Outgoing Vehicles, Moss Vale and Parkes

MOSS VALE

Vehicles going out first and returning later		D-1 IN	D-2 IN	D-3 IN	D-4 IN	TOTAL OUT
O-1	OUT	21	37	12	9	79
O-2	OUT	34	45	17	15	111
O-3	OUT	9	13	10	3	35
O-4	OUT	6	11	3	1	21
	IN	70	106	42	28	246

PARKES

Vehicles going out first and returning later		D-1 IN	D-2 IN	D-3 IN	TOTAL OUT
O-1	OUT	20	11	11	42
O-2	OUT	17	15	14	46
O-3	OUT	23	16	14	53
TOTAL	IN	60	42	39	141

The proportion of all trips going out and returning later is similar for Moss Vale (39 per cent) and Parkes (41 per cent), but there are different forces at work. In Moss Vale there are links with Bowral and Mittagong, while there are no major communities close to Parkes. Parkes, therefore, has, relatively, a stronger regional service function than Moss Vale.

Table II-8 Origin and Destination of Incoming Vehicles Moss Vale and Parkes

MOSS VALE
Destination Moss Vale and Through Traffic

		D-1 OUT	D-2 OUT	D-3 OUT	D-4 OUT	TOTAL IN
O-1	IN	47	68	15	17	147
O-2	IN	14	37	9	7	67
O-3	IN	2	3	1	1	7
O-4	IN	1	4	0	1	6
TOTAL	OUT	64	112	25	26	227

Period 9.30 - 15.30 Friday 4.11.1988

PARKES
Destination Parkes and Through Traffic

		D-1 OUT	D-2 OUT	D-3 OUT	TOTAL IN
O-1	IN	11	4	2	17
O-2	IN	20	9	2	31
O-3	IN	47	5	5	57
TOTAL	OUT	78	18	9	105

Period 10.00 - 15.10 Friday 7.10.1988

The final step is to separate the through traffic from the local traffic. Table II-9 shows inward trips by time lapse between entry and exit. The time lapse is calculated by deducting the time of exit of a vehicle from the time of entry.

Table II-9 Inward Trips by Time Lapse, Moss Vale and Parkes

MOSS VALE	<10 min	10-29 in	0-59 min	60+ min	TOTAL trips	PARKES <10 min	10-29 min	30-59 min	60 + min	TOTAL trips
Local	5	12	13	32	62	3	8	7	31	49
Highway	8	11	10	63	92	1	3	1	2	7
Welcome S	8	8	2	30	48	2	1	9	37	49
TOTAL	21	31	25	125	202	6	12	17	70	105

Separation of local from through trips is more uncertain. Some trips are clearly local: those that enter and exit through the same 'port', and those that enter and exit through adjacent ports. Other trips are clearly through trips: those that enter one port and exit another in the opposite direction and take less than 10 minutes to travel between the two ports.

Using the same approach to determine through traffic in Parkes, we can identify that there are at least 49 local trips and 3 through trips, but that classifies only half of all the inward trips. The remaining trips are entering one side of the cordon and leaving at the opposite side but involve stopping for periods of 10, or more, minutes. As the local road pattern permits many different ways to return out-

side the cordon and there are parking areas outside the Main Street, it is likely that a high proportion of the remaining trips are not through and stopping trips, but local trips. It can therefore be assumed that the local trips represent at least 90 per cent of all the inward trips.

By following the same reasoning for Moss Vale the proportion of through traffic is greater than in Parkes, but most of this through traffic stops in the centre of Moss Vale. The straight through traffic is not more than 10 per cent.

Heavy and commercial vehicles

A distinction was made between heavy vehicles, commercial vehicles and cars. Heavy vehicles are semi-trailers, large and medium trucks, coaches, buses. Commercial vehicles include all of the above plus small trucks, minibuses and vans. Utility vans were generally not included since they are popular private transport, especially in Parkes, unless they were obviously used for commercial purposes all the time i.e loaded with ladders etc. Taxis were recorded as cars rather than commercial vehicles.

Video recorded data were analysed which showed that the proportion of heavy vehicles in Moss Vale was 6.6 per cent, compared with 2.3 per cent in Parkes. The proportion of commercial vehicles in Moss Vale and Parkes respectively were: 9.7 and 16.5 per cent. It should be noted that there is a by-pass route in Parkes for heavy vehicles.

Pedestrian activity

The pedestrians activity on the footpath are shown in Table II-10 (see Figures 2-3, 2-4 for location).

Table II-10 Pedestrian Activity on the Footpath, Moss Vale and Parkes

MOSS VALE					PARKES 3				
	F1	F2	F3	F4	F1	F2	F3	F4	F5
Period	n	n	n	n	n	n	n	n	n
0940-1010	20	192	96	43	167	209	109	61	18
1040-1110	27	127	87	112	117	221	145	101	20
1140-1210	19	91	59	89	259	254	123	179	58
1240-1310	36	115	94	90	107	129	136	145	34
1340-1410	26	123	108	70	115	197	66	88	148
1440-1510	40	209	89	115	156	214	44	46	90
Total	168	857	533	519	921	1224	623	620	368
Average Pedestrians/h	*56*	*286*	*178*	*173*	*307*	*408*	*208*	*207*	*123*

The number of pedestrians crossing at legal crossings is shown in Table II-11.

Table II-11 Pedestrians Crossing at Legal Crossings, Moss Vale and Parkes.

MOSS VALE				PARKES				
	C1	C2	C3	C1	C2	C3	C4	C5
Period	n	n	n	n	n	n	n	n
0940-1010	27	146	38	112	71	40	143	32
1040-1110	11	72	n.a.	83	84	35	329	17
1140-1210	20	52	42	81	76	124	210	14
1240-1310	19	72	22	125	93	167	205	12
1340-1410	18	68	n.a.	91	79	46	101	7
1440-1510	38	138	n.a.	138	70	85	112	n.a.
Total	133	548	34	630	472	497*	1100	82
Av flow/h Two-way	44	183	68	210	157	83	367	33

* split Wellcome St 50%

There are notable differences between the towns: there is less crossing at Moss Vale then there is at Parkes, but as noted before, the pedestrian activity on the footpath in Moss Vale is less than in Parkes, and the centres have a very different land-use pattern. In both towns, the level of pedestrian activity drops off sharply away from the core.

An important aspects of pedestrian and vehicle interaction is the amount of jaywalking and the behaviour of jaywalkers. Table II-12 shows the amount of jaywalking for the road segments identified on Figure 2-3 and 2-4.

Table II-12 Jaywalking in Moss Vale and Parkes

MOSS VALE					PARKES				
	J1	J2	J3	J4	J1	J2	J3	J4	J5
Period	n	n	n	n	n	n	n	n	n
0940-1010	103	69	73	51	68	126	131	37	n.a
1040-1110	71	67	54	32	97	96	70	44	66
1140-1210	90	69	87	45	45	42	136	74	46
1240-1310	77	88	69	59	128	125	n.a	n.a	75
1340-1410	64	78	51	72	144	43	142	71	n.a
1440-1510	55	70	46	56	69	90	48	33	54
Total	460	441	380	315	551	522	527	259	241
Running %	14	17	20	18	7	3	4	4	10
Av.jaywalkers /h/100m	188	147	127	105	184	174	211	104	120

The data show interesting features. Both data sets show the large amount of jaywalking which does occur. The amount of jaywalking per 100 m of length is very high in Parkes, and this is related to the compact nature of the shopping centre. Parkes also seems to have a more leisurely pace: few jaywalkers run across the road, whereas between 14 and 20 per cent of the Moss Vale jaywalkers feel the need to run. This will be related to vehicle speeds later.

Finally, a measure of crossing can be calculated for each town by using indices, derived by dividing all pedestrians crossing by the total pedestrians in the road space. The results are shown in TableII-13.

Table II-13 Pedestrian Crossing Indices, Moss Vale and Parkes

	MOSS VALE				PARKES			
Period	A2	A3	A4	AVG	A1	A2	A3	AVG
0940-1010	.26	.51	.54	.44	.50	.49	.50	.50
1040-1110	.35	.43	.22	.33	.63	.26	.51	.47
1140-1210	.43	.64	.34	.47	.39	.33	.41	.38
1240-1310	.43	.48	.40	.44	.68	.53	.37	.52
1340-1410	.39	.39	.51	.43	.51	.49	.28	.43
1440-1510	.25	.49	.33	.35	.45	.39	.23	.36
Total	.34	.49	.38	.40	.53	.43	.36	.44

*Indices are derived by dividing all pedestrians crossing by the total pedestrians in the road space

Another way of measuring pedestrian activity in the road space is to divide all pedestrians crossing by the total pedestrians on the footpath. In the central and busiest part of the two towns, the ratio exceeds unity (1.03 for Moss Vale, 1.12 for Parkes). In the peripheral sections the ratio always exceeds 0.50.

CONFLICT

Accidents

During the period between 1985 and 1987, 57 accidents were reported in Moss Vale. Of these 31 were in the main shopping area. The figures for Parkes for the corresponding period show that of a total 37 accidents, 21 were within the main shopping area. Although the number and type of accidents is too small for statistical analysis, they are useful for understanding the nature of the conflict.

Only one fatal accident occurred in Moss Vale but the majority of accidents were relatively minor. In sixteen cases, vehicles required towing, and in a further ten cases, some treatment of victims was required. In only a few cases were victims taken to hospital.

In Parkes there were no fatal accidents. Five accidents involved tow-aways, and nine required some treatment of victims. Six of those requiring treatment, were taken to hospital.

CODE	DESCRIPTION	MOSS VALE	PARKES
0	Pedestrian nearside	0	5
2	Pedestrian farside	2	1
10	Cross traffic	3	6
13	Right near	3	0
20	Head on	1	0
21	Right through	3	2
30	Rear end	5	2
32	Right rear	3	1
33	Lane sideswipe	1	0
40	U-turn	1	1
42	Leaving parking	1	1
45	Reversing	1	0
47	Emerging from drive	1	0
48	From footpath	0	1
59	Other overtaking	1	0
60	Parked	3	1
73	Off-road object	1	0
TOTAL		31	21

Table II-14 Number and Type of Accidents, Moss Vale and Parkes

In Moss Vale, there is a clustering of accidents involving rear end collisions, rear right collisions and rear near side collisions. The majority of these accidents occur in the vicinity of the railway station and post office, suggesting a possible problem area in terms of visibility and speed. There are relatively few pedestrian accidents, yet other observations indicate a situation of pedestrian/vehicle conflict (e.g. high vehicle speeds and a high proportion of jay-walkers running across the road).

In Parkes, the greatest conflict (in terms of reported accidents) involves pedestrians and cross traffic. Although the majority of these accidents were not serious, they do signify that there is a conflict arising from the side streets (and the turning movements associated with them). This is supported by the results from the pedestrian and business surveys.

It is also worth noting that a clear majority of these accidents, in both Moss Vale and Parkes, occurred during the day in fine, clear conditions.

Pedestrian/vehicle conflict

One of the most important conflicts between pedestrian and vehicles arises from vehicle speed. The vehicle speed in the various road segments (see relevant plans) are set out in Table II-15.

Table II-15 Average Vehicle Speed by Time Period and Segment, Moss Vale and Parkes

	MOSS VALE				PARKES			
Period	S1	S2	S3	S4	S1**	S2	S3	S4
0940-1010	48.40	39.22	38.29	48.65	20.90	32.39	47.78	43.58
1040-1110	51.89	47.75	45.36	49.16	19.98	30.04	33.55	42.07
1140-1210	54.12	46.11	44.09	48.76	note*	30.47	44.60	n.a.
1240-1310	50.21	43.58	53.15	47.71	19.84	39.18	33.07	46.57
1340-1410	51.94	40.19	34.74	49.93		34.63	31.82	41.66
1440-1510	42.66	43.85	41.15	51.34		39.82	43.30	n.a.
Average	49.8	43.5	42.8	49.3	20.2	34.4	39.0	43.5

n.a. = not available

* For two periods, one lasting 7 minutes, and the second 6 minutes, traffic came to a stop.

** For this segment video recordings were made and analysed. The data shown here are based on stop watch observations.

Vehicle speed can be related to the pedestrians crossing. First the jaywalkers were singled out. Jaywalking was 'normalised', i.e. the number of jaywalkers were determined for the relevant speed segment and then expressed over a unit of distance of 100m. In this way the 'density' of jaywalkers in each of the segments can be compared. The result is shown in Table II-16.

Table II-16 Jaywalking per 100m of Segment, Moss Vale and Parkes

JAYWALKERS	MOSS VALE				PARKES			
	A1	A2	A3	A4	A1	A2	A3	A4
Period		n	n	n	n	n	n	n
0940-1010	55	41	50	42	126	79	22	
1040-1110	38	40	37	26	125	42	27	48
1140-1210	48	41	60	37	56	82	45	34
1240-1310	41	53	47	49	164	55		
1340-1410	34	47	35	60	121	86	43	
1440-1510	29	42	32	46	103	29	20	39
avg/30min	41	44	43	43	116	64	31	44

The evenness in jaywalking in Moss Vale is related to the distribution of land-use activities, compared with the peaking of jaywalking in the core of Parkes, which is very concentrated. However, it should be noted that pedestrians crossing at legal crossings are excluded.

A correlation analysis was carries out between vehicle speed and jaywalking. A high correlation exists when the average figures are used (r = 0-.92; regression line: Y = 153.84 - 2.49 X). The correlation is lower when the data for all the half hour periods are used (r = 0-.59; regression line: Y = 105.69 - 1.37 X). X = vehicle speed and Y = number of jaywalkers. The correlation coefficient between vehicle speed and the proportion of jaywalkers running across the road is r = 0.72 with a regression line: Y = -7.50 + 0.47 X.

Next, the correlation between vehicle speed and all crossers was analysed. The normalised number of crossers for each section are shown in Table II-17.

Table II-17 All Crossers per 100m of Segment, Moss Vale and Parkes

	MOSS VALE				PARKES			
	A1	A2	A3	A4	A1	A2	A3	A4
period								
0940-1010	55	91	68	42	226	99	33	49
1040-1110	38	84	45	28	342	53	39	76
1140-1210	48	91	73	37	203	91	56	93
1240-1310	41	93	60	49	306	190	35	33
1340-1410	34	89	47	60	198	90	55	57
1440-1510	29	77	58	46	185	35	31	83
Avg/30min /100m	41	88	59	43	243	93	42	82

The correlation between vehicle speed and all crossing is high: the correlation coefficient is 0.90; the regression line is:

Y = 342.93 - 6.43 X,
in which X = vehicle speed and Y = the number of crossers.

When the values for each half hour are used the correlation drops to .63 with the regression line of Y = 215.89 - 3.45 X.

Another way of analysing the relationship between pedestrians and vehicles is to relate the use of the road space by pedestrian crossers and by moving vehicles. This involves calculating the pedestrian and vehicle densities for a given area. The pedestrian density can be defined as the number of pedestrians crossing (legally and otherwise) per 20 minutes over a road segment of 10 metres, multiplied with the seconds they are on that part of the carriageway which is also used for moving vehicles. An average pedestrian crossing speed of 1.65 m/s is used. The vehicle density is calculated by multiplying the number of vehicles during 20-minute period moving through the area with the average travel time for a 10-metre segment. In order to make the results clearer graphically, the vehicle density is further divided by a factor of ten.

Thus a measure of pedestrian seconds and vehicle seconds using the same road space is obtained, which can be related to vehicle speed. As Figure 2-5 shows, the vehicle densities for Moss Vale and Parkes are similar (but for different reasons), while the pedestrian densities are higher in Parkes than they are in Moss Vale. The vehicle speeds are also different, and this suggests that pedestrian densities are a major determinant of vehicle speed (or vice versa).

The relationship can be illustrated in Figure 2-6. The coefficient of correlation is 0.77.

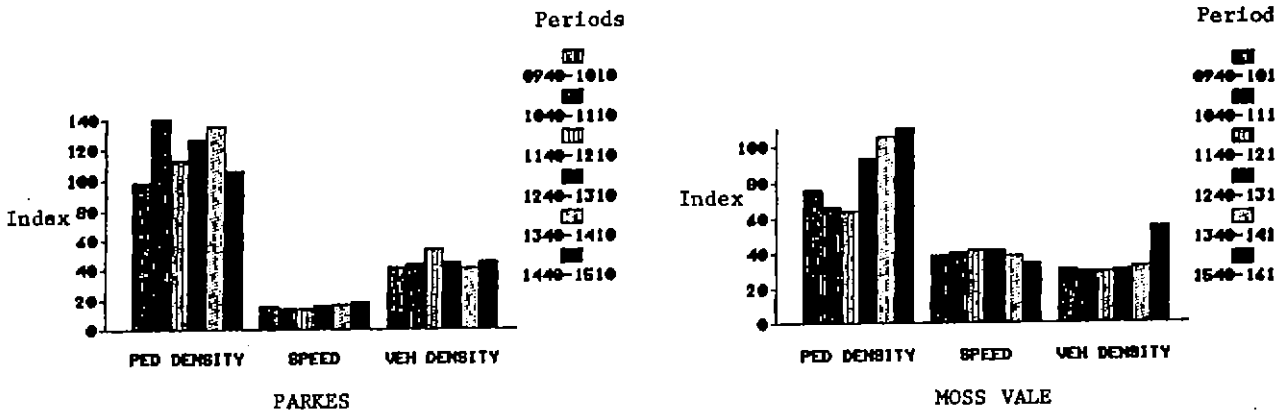


Figure 2-5 Relationship between Pedestrian, Vehicle Densities and Speed

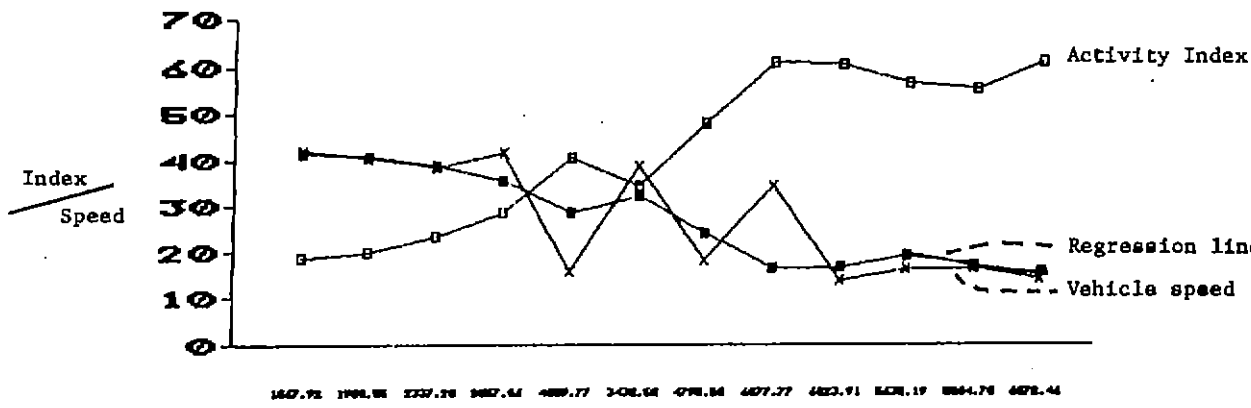


Figure 2-6 Road Space Activity and Vehicle Speed

A third measure of potential conflict is the number and proportion of 'heavy' vehicles. In Moss Vale, the proportion of heavy vehicles 6.3 per cent. compared with 2.5 per cent in Parkes.

Vehicle/vehicle conflict

The vehicle/moving vehicle conflict and the vehicle/manouevring vehicle conflict were analysed through video analysis.

The 116 metre section of the Illawarra Highway covered by the video in Moss Vale incorporated the area from the intersection of Kirkham Street to the Bay Street turn-off to the railway station. It features retail development on the eastern side and the municipal park on the western side. Both sides of the road permit parallel parking as well as incorporating local bus-stops. The regional bus-stop is located on the western side adjacent to the park.

In Parkes the video covered an area of the Newell Highway between the Church and Welcome Street intersections concentrated on traffic and pedestrian movements around the uncontrolled Court Street intersection. Both blocks feature 60 degree rear-to-kerb angle parking on both sides.

The major characteristics of moving vehicle conflict observed in the video recording of Moss Vale include the high proportion of heavy commercial vehicles, particularly semi-trailers and large articulated trucks, and a visibility problem of pedestrians crossings from a distance.

The heavy vehicles are most likely to be passing through Moss Vale en route to their final destinations; they travel long distances and visibly regard the town as being incidental to the highway, evident in their reluctance and, in some cases, inability to stop at marked pedestrian crossings. This factor noticeably affects the perception of safety by the aged and smaller children as they cross the road. Despite the presence of the heavy vehicles there is also a high proportion of jaywalkers, generated chiefly by the parallel parking by the side of the park.

In Parkes, the moving vehicle problems are different in nature. The strict grid pattern gives rise to a desire for vehicles as well as pedestrians to cross the Newell Highway from one side to the other. The intersection of the Highway with Court Street, which was part of the area surveyed using the video, is not signal controlled and leads to difficult, and potentially dangerous, traffic movements in order to cross the barrier that the highway constitutes.

Manoeuvring Vehicle Conflict

The video analysis of the township of Parkes, in particular, reveals a very high incidence of vehicle manoeuvring conflict as well as great variety in the nature of this conflict. The stop-start nature of traffic movement in the main street is partly the result of an almost continuous stream of legal pedestrian crossing on the marked pedestrian crossings which banks up traffic as far as the next intersection, and partly the consequence of angle parking manoeuvres. These factors also contribute to the very high incidence of jaywalking, encouraged by the low overall speed.

This high level of usage of one of the main pedestrian crossings in the town as well as the high incidence of jaywalking is indicative of the strength of the retailing function on both sides of the Newell

Highway. The street is, by nature, a shopping street serving chiefly the local region [a fact revealed by the analysis of the business questionnaire].

Also indicative of the strength of the centre is the high rate of vehicle turn-over in the well utilised on-street angle parking areas. It is, however, this very characteristic that is another major cause of the severe lack of even traffic flow in this stretch of the Newell Highway.

There is much less evidence of a vehicle manouevring conflict in Moss Vale. This is due in part to the presence of parallel parking and the width of the carriageway. However, there is evidence of double parking associated with goods delivery.

Vehicle/road environment conflict

The conflict between the traffic and the road environment can be measured in the pedestrian activity generated, access drives, the presence or absence of rear and side access, parking, traffic noise and fumes.

Some of these aspects have been considered before. The amount of pedestrian crossing and pedestrians on the footpath are closely related to what happens along the frontage. The location of major pedestrian generators is a critical factor in this regard, and this is demonstrated clearly by the post office in Moss Vale and the concentrated retail activity in Parkes.

The presence/absence of rear/side access has an effect on loading and unloading. In the case of Moss Vale few properties have rear or side access, and there is evidence of double parking for deliveries. That does not appear to occur in Parkes where all properties have rear access.

The effect of traffic on frontage parking was dealt with in the previous section, which showed that the frequency of manouevring and the delay caused are directly related to parking controls (both duration and form - such as parallel or angle parking).

The study did not assess the impact of traffic noise and fumes on the road environment, as it was not central to the project. However, the relationship between traffic volumes, road gradients and vehicle mix and noise levels experienced on the footpath is well understood. The noise levels in Moss Vale would appear to be greater than in Parkes (although no measurements were made)while the impact of fumes is greater in Parkes (due to angle parking) than in Moss Vale where parallel parking is in force.

Perception of conflict

The interviews of visitors in the main street provided information about the perceptions of pedestrians in respect of the 'main street' environment. Respondants were asked how they perceived the traffic in the main street in terms of how busy in was. It must be noted that the term 'busy' refers to both the traffic composition as well as its volume and speed; the greater the number of heavy vehicles, the busier the street will be perceived to be.

The results of the traffic assessment are set out in Table II-18

Table II-18 Perception of the Business, Moss Vale and Parkes

	PARKES per cent	MOSS VALE per cent
Very Busy	.10	.08
Busy	.25	.40
Moderately Busy	.45	.39
Not Very Busy	.17	.13
Not Busy	.04	.01

It should be noted that in Moss Vale, which experiences both faster traffic speeds and a significant proportion of heavy vehicles (chiefly semi-trailers, medium trucks and coaches accounting for an average of 10% average daily traffic), more people perceive the street to be busy whereas in Parkes, most people regard the street as being only moderately busy.

Respondants were also asked if they thought the traffic travelled too fast for them to cross in safety and whether they would consider crossing away from the zebra crossings. The results are shown in Table II-19.

Table II-19 Perception of Speed and Crossability, Moss Vale and Parkes

	MOSS VALE per cent	PARKES per cent
Speed too great to cross safely		
agree	51	23
disagree	43	61
undecided	6	13
Would attempt to cross (jaywalk)		
yes	82	64
no	18	20
undecided	0	16

It is interesting to note that in Moss Vale 51 per cent thought that the speed was too great to cross safely, yet 82 per cent said that they would attempt to cross. The most frequently offered reasons for not jaywalking were, firstly, the traffic speed and volume, followed by the volume of trucks cited in Moss Vale. Other reasons were the responsiblity of children, and, in Parkes only, the illegality of jaywalking.

In both towns, the results suggest the need for more, or better located, pedestrian crossing facilities. They need to be visible and convenient. Vehicular traffic should approach the crossing at an appropriate but regular speed. To this end such factors as the need for crossings, vehicular perception of a shared main street through urban design, the monitored location of on and off street parking to regulate the evenness of traffic flow plus pedestrian and vehicle generation from parking areas and the future location of major pedestrian generators should all be factors in improving the situation in the main street.

Summary

The analysis shows that there are quite different problems in Moss Vale and Parkes. In Moss Vale the basic conflict arises from the dominance of vehicles, whereas in Parkes it is the dominance of pedestrians.

There are several serious conflict situations between pedestrians and vehicles in Moss Vale because of relatively high average vehicle speeds (43 km/h in the core), heavy jaywalking associated with important pedestrian generators (mainly the Post Office) and poor visibility. A high proportion of jaywalkers (20 per cent in the core) are running across the road. There are also a number of vehicle/vehicle conflict situations. Those occur at intersections where there are right hand turning movements and pedestrian flows across the intersection. Traffic volumes range between 750 - 1150 vph, and the proportion of heavy vehicles is also relatively high (about 6 per cent).

In Parkes, average traffic speeds are low in the core segment (about 20 km/h in the core), due to angle parking and a large amount of jaywalking and crossing at legal crossing. Traffic, at times, comes to a standstill. There are few heavy vehicles as there is a parallel road to which heavy vehicles are diverted. The main conflict situation arises from the side streets and vehicle manouevring associated with angle parking (which also produces fumes and noise on the footpath). There are turning movements at the intersections where there are also many pedestrians. Angle parking in Clarinda Street (the 'main street') creates a potential for accidents, particularly between vehicles, but the severity of such accidents may not be high because of the low speeds. Angle parking also reduces road space, but as traffic volumes are of the order of 300 - 500 veh/h, the situation is not critical in terms of congestion.

Another conflict situation exists at the junction between Welcome Street and Clarinda Street, where there are many turning movements and heavily used zebra crossings. This problem will be exacerbated when the new Post Office has been completed. This is an example of a land-use decision made without regard to the consequences for pedestrian movement and the conflict they create with vehicle movement.

SUGGESTIONS FOR REDUCING CONFLICT IN MOSS VALE AND PARKES

Moss Vale

The road/environment situation in Moss Vale is, typically, a Type II corridor. Both the road function and the frontage function are important, and the association creates a conflict situation, primarily between vehicles, moving at the rate of about 1000 vph at average speeds in excess of 40 km/h, and pedestrians crossing the road (about 800 per hour). mostly as jaywalkers, and many at points where visibility is poor.

Strategically the issues are whether there is an opportunity for diverting the highway or whether there is scope for shifting the cnetre away from the highway.

A fairly high proportion of traffic is through traffic, but most of it tends to stop in Moss Vale, while the through traffic branches out at Moss Vale into the regional routes. There is also a strong movement between Moss Vale and the communities of Bowral and Mittagong. For these reasons a by-pass does not appear to be practicable.

Major land-use change away from the highway does not appear to be practicable either. There is little pressure for development in Moss Vale, and it not possible to move existing establishments from the fringe areas to the core behind the highway frontage. The retail development of Moss Vale is in the form of ribbon development; there is a need to change the retail zoning, so that no further pedestrian generating development will occur at the perimeters along the highway and any future development occurs in the core behind the frontage.

The main problem in Moss Vale is the average vehicle speed and visibility upon entering the centre of the Main Street. There are plans to reconstruct the railway bridge, which should improve the visibility of the core by traffic from the south. But the imporvements may lead to even higher traffic speeds through the core. There are some potential conflict spots immediately North of the railway bridge and channelisation will become necessary.

There is a clear need to introduce the notion of a transition and centre zone, with the aim of reducing vehicle speed to what the environment can bear (Figure 2-7).

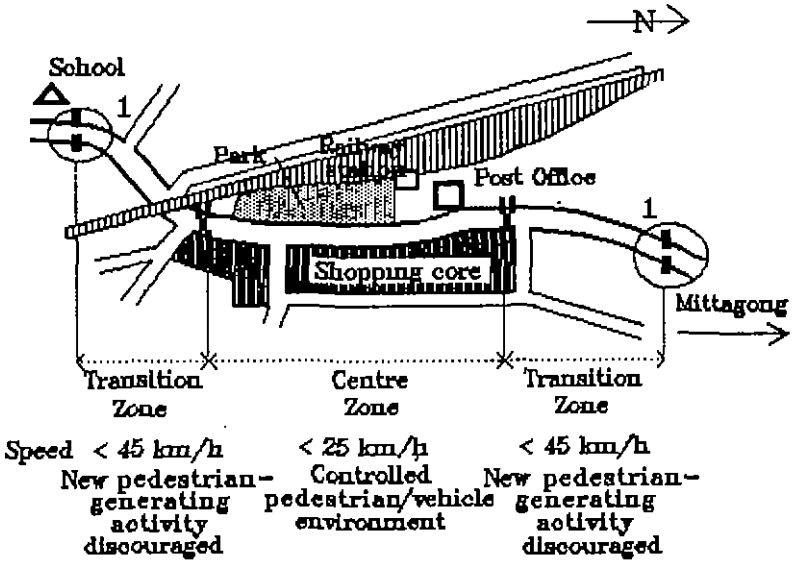


Figure 2-7 Options, Moss Vale

The active shopping frontage fronts the highway and this is unlikely to change. The footpath is of sufficient width for pedestrian flows, but there is an opportunity for widening it, and to improve the pedestrian environment. This option can be linked to other, operational, actions referred to below.

The principal planning actions are in the operational area. The major conflict concerns pedestrian crossing and jaywalking especially. One option would be to introduce a median so that pedestrians can cross in two stages. This may be feasible in the core area of the centre, where the road width is adequate. However, a median alone may not solve problems at particular points, such as the Post

Office. A pedestrian crossing seems essential, but would be dangerous with the current vehicle speed and visibility. Clearly, speeds should be reduced, and this can best be achieved through appropriate treatment of the entrance to the centre.

Some the options are: a narrowing of the carriageway north of the town, and at Spring Street south of the town with kerbs, identification sign and landscape treatment to reinforce the impression that the motorist enters a transition zone (figure 2-8). Other options could be splinter islands or roundabouts.

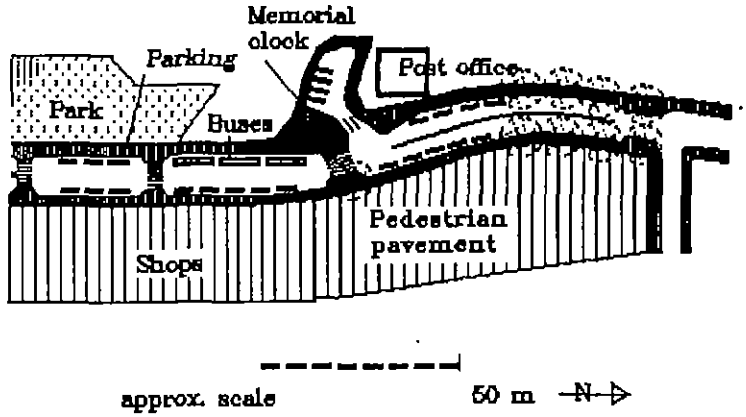


Figure 2-8 Options near the Post Office, Moss Vale

Within the core area, the carriage way could be narrowed at certain points (about 100m apart) so that the crossing distance for pedestrians is reduced and the attention of the motorist is focused on a narrow area of potential conflict (Figure 2-9). Parking bays can be maintained between such footpath pavement extensions. Another option is the construction of a median with low landscaping. Figure 2-10 and 2-11 illustrate the principles in perspective form.

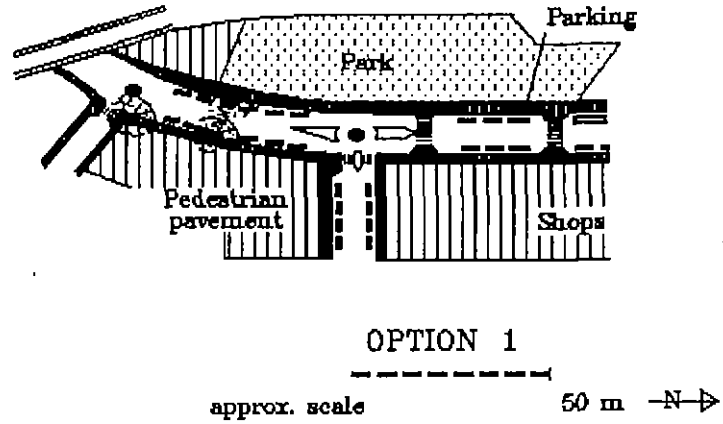
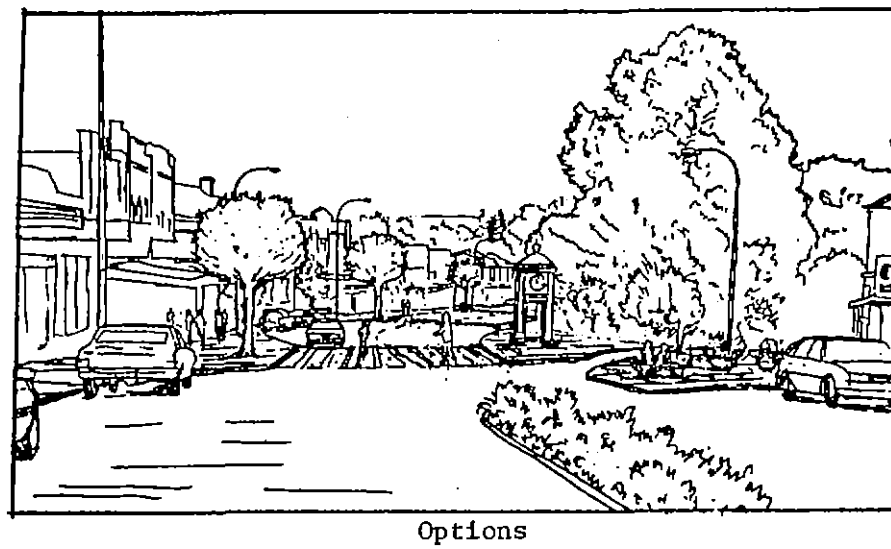


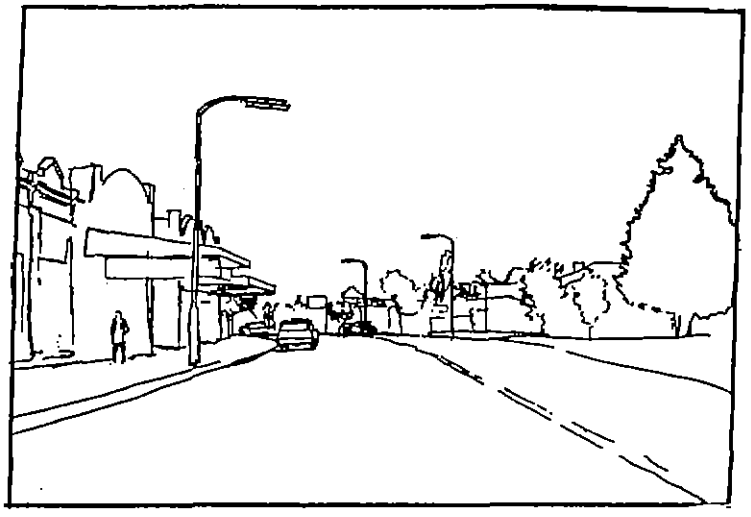
Figure 2-9 Options for the Shopping Core, Moss Vale

Present view

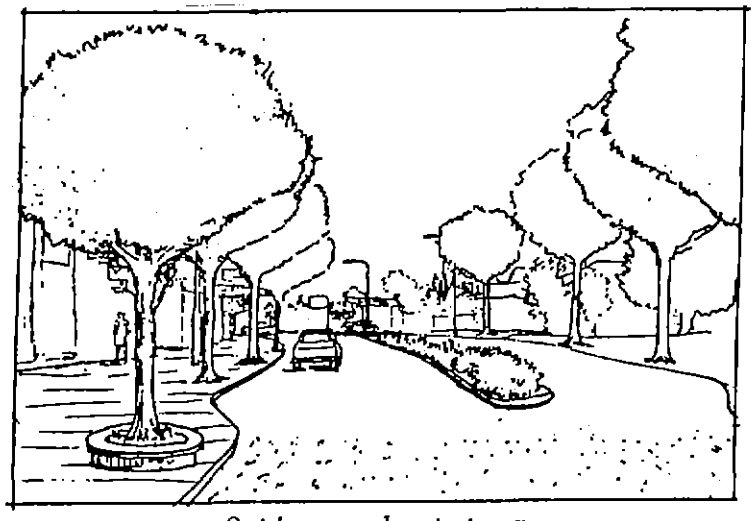


Options

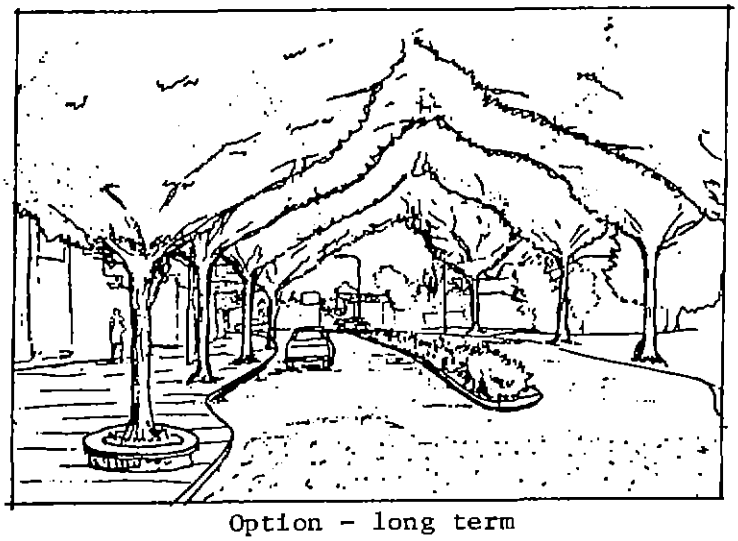
Figure 2-10 Moss Vale Centre



Present view



Option - short term



Option - long term

Figure 2-11 Moss Vale - entrance from North

Parkes

In Parkes, the road/environment situation is dominated, at least in the core, by pedestrians and cars parked at an angle. Traffic speed is low, traffic volumes are relatively low and pedestrian movements across the road are substantial. As a result the conflict between pedestrians and vehicles is not serious. Traffic speeds are higher in the adjoining segments and although jaywalking is about one third of what it is in the core, it is still substantial and in conflict with vehicular movement. The main problem in the core is between the manouevring of vehicles in association with angle parking and moving vehicles, and the tangle of pedestrians and vehicles at the junction of Welcome and Clarinda St.

Strategically, there is no option for the centre function of the Main Street, but to remain as it is. It is already compact and strongly established. However, diverting through traffic away from the 'Main Street' could be an option, if it was considered that the core section of centre should be a mall. The central shopping core is not dependent on passing through traffic to any major extent, and a by-pass for heavy vehicles already exists along Bogan Street. A by-pass outside the town would not seem to be justified as traffic volumes are relatively low, and the highway is not a major State highway. There are many other issues associated with the development oof a mall and it should mot be thought to be a simple option. However, on functional grounds and in strategic terms, it is clearly a possibility.

From a development planning perspective, there is a need to address the conflict between vehicles and pedestrians, and between vehicles and vehicles. The problem is not speed, at least in the core, it is the almost random manouevring which conflicts with moving vehicles and pedestrian. Disregarding the mall option, where there would be pedestrians only, there is an option to shift to parallel parking, extending the footpath at intervals of about 100m and narrowing the carriageway at such points to one lane in each direction, and paving the short distance between the extended footpath. With appropriate landscaping and street furniture, a more atttractive and safer environment can be created (Figure 2-12. A small roundabout will reduce conflict at intersections. However, this is feasible only in locations where pedestrian movements are few.

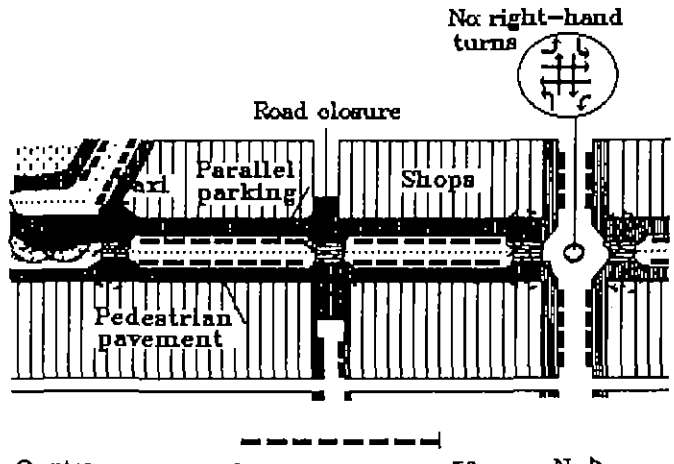


Figure 2-12 Options for the Centre, Parkes

One of the intersections where a roundabout may not be satisfactory is the junction of Welcome and Clarinda Streets, because the high level of pedestrian movements would interfere with vehicle movement. Traffic lights are difficult to justify on the grounds of costs. One of the options may be to block the connection between Welcome St and Clarinda Street. Another is to also block Dalton Street, so that Welcome and Dalton Streets provide for the continuity in movement and the conflict between pedestrians and turning movements is eliminated. The taxi stand can continue to function at its existing, convenient location (Figure 2-13).

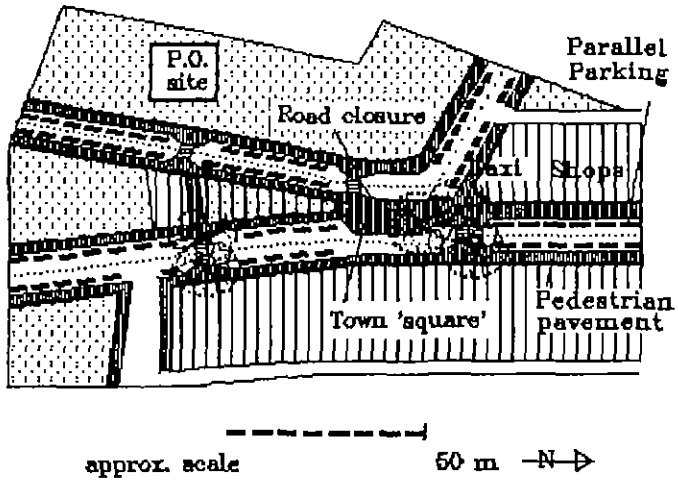


Figure 2-13 Options for the Centre II, Parkes

Operationally there is a need to make traffic aware that it is approaching a centre. The main approach from the east is Clarinda Street which through its design encourages speed. It is wide and straight, and speeds in excess of 80 km/h have been recorded. There are options to reduce these speeds by various means, such as roundabouts and splitter islands, but these can be justified only if there was an accident record. There was a serious accident some years ago, but there have been none since.

However, there is a case for roundabouts to regulate traffic movement at the fringes of the centre, and these may well be justified on traffic engineering grounds. Figure 2-14 shows some of the options for Parkes in a general way, while Figure 2-15 shows the principles in the form of a perspective.

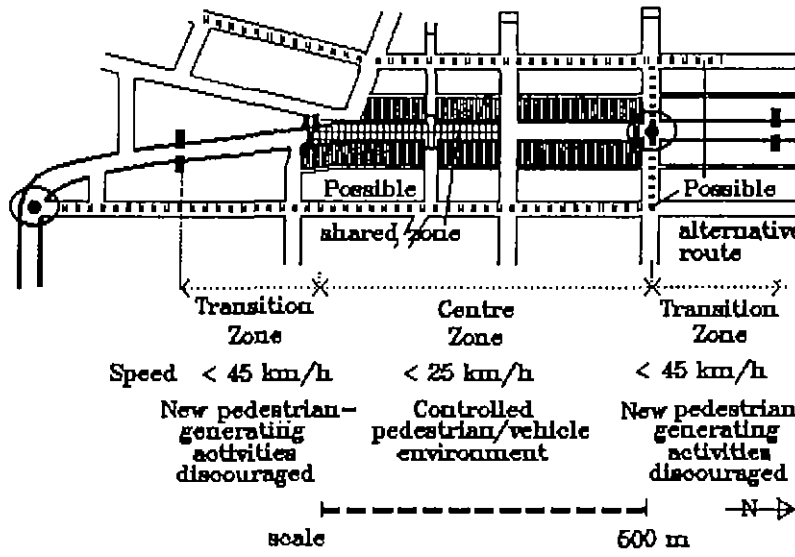


Figure 2-14 General Options for Parkes

Costs and benefits

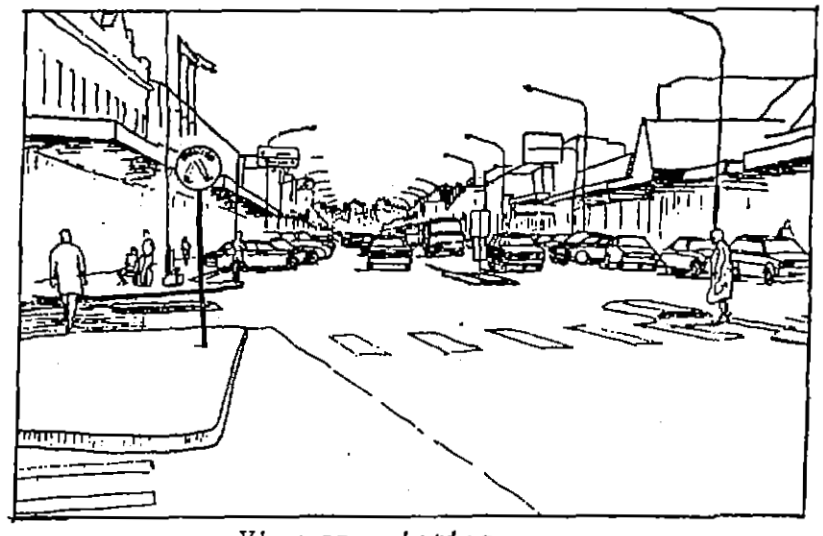
All measures have costs and benefits. Some costs and benefits can be clearly identified, such as the construction and operational costs and the savings of reduced accidents.

However, there are also hidden costs, such as an increase in travel time and the possible transfer of conflict elsewhere, while there are benefits, such as improvement in the quality of the environment through reduced air and noise pollution, which are very difficult to express in dollar terms.

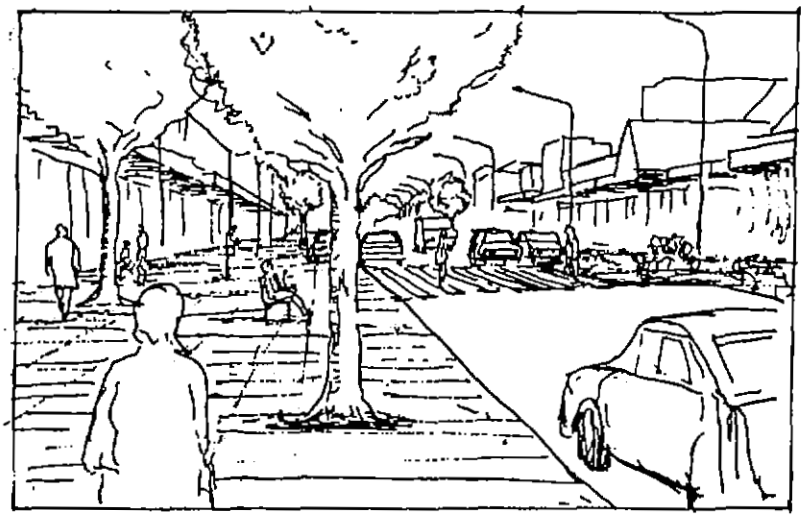
Conflict does not equate with accidents; it equates with risk and the potential of accidents. High risk and seriousness of an accident, if it does occur, are the primary variables. For instance, jaywalkers look for gaps in the traffic stream, and if traffic is not heavy and speeds are low, the risks are small and the seriousness of an accident is not likely to be as great (such as in the core area in Parkes), compared with jaywalking in Moss Vale, where the risks are much higher. It is not surprising that a high proportion of jaywalkers there run across the road.

Using the concept of risk and seriousness of a potential accident, there would appear to be stronger cost-benefit grounds for measures in Moss Vale than in Parkes. But that may distort the picture. The risks may be greater but the seriousness less in Parkes than in Moss Vale; in other words, ther emay be many more accidents which, although not so serious in themselves, collectively. deserve attention. A cost-benefit approach may well show that there is just as much ground for action there.

Clearly, reduction in risk and potential for accidents must be a major objective at all levels of planning. As the study has shown, there is potential for action in both communities. Planning can be



View as existing



Options

Figure 2-15 Parkes - Clarinda Street looking North

started at any time; action will follow when there is awareness and concern, and a willingness to commit funds for implementation.

Finally, it is worth noting that in both cases studied, measures designed to improve safety also create opportunities for improving the appearance of the Main Street. Safety and good urban design are closely interlinked. Hence, a narrow interpretation of costs and benefits may conceal the real issue: the overall improvement in the quality of the road and its environment.

PART III PRELIMINARY GUIDELINES

INTRODUCTION

When the highway runs through the Main Street there is an inevitable conflict between the through function of the highway and the retail, commercial and pedestrian functions of the main street sharing the same facility for a large part of the day and evening. This conflict may not necessarily manifest itself in accident statistics, but it represents a risk and a potential for accidents.

The nature of the risk and the severity of the conflict will depend on:

(a) the potential and realised friction which the road frontage activities generate, through pedestrian activity and behaviour, parking and unparking manouevres, access to and from sites, and intersection movements; and

(b) the impact of traffic volumes (particularly through traffic), the proportion of heavy vehicles, and vehicle speed on the safety and amenity of the visitors and businesses in the main street.

While each road/environment situation is different, there are general principles. Some of the associations have been the subject of research and enable a good measure of prediction to be applied. Some options have been implemented in different areas, and provide an indication on how successful they are. However, there is much more work to be done on all these areas.

Conflict can be removed given time and resources, but neither of these requirements can be generally met. For instance, the creation of a by-pass or the closure of the Main Street to traffic, may be, or may seem, attractive, but are simply not feasible in the short, or even longer term. Conflict will, for practical reasons, continue to exist and is not necessarily unacceptable. Conflict can range from unacceptable to acceptable, and it is important, therefore, that the conflict is managed to, at least, tolerable, and preferably, acceptable levels. However, this notion raises issues as to what is acceptable to whom: the road user; the visitor; or the business people in the Main Street.

Not all associations between traffic and activities in the Main Street are negative; some businesses derive trade from passing vehicles - and there is widespread concern surrounding the economic impacts of by-passes and traffic management schemes - whilst through travellers may welcome the opportunity for services and attractions which only the Main Street can offer.

The preliminary guidelines are intended to provide a basis for assessing the nature and extent of both negative and positive associations, and for developing and evaluating options for reducing conflict and re-inforcing positive associations. They do not contain recommendations on what decision to make as that will depend on particular circumstances, including the issue of responsibility for implementation. However, where there are specific research findings which bear on the consideration of options, these are incorporated in the guidelines.

The focus in the guidelines is on the vehicle/pedestrian and vehicle/vehicle conflict, but it needs to be understood that this is only one of the matters which deserve attention in addressing conflict in the Main Street. Traffic noise, economic impact, environmental protection and design are some of the other factors which should be part of a broader based approach. Furthermore, there are fun-

damental questions, such as whether or not a by-pass is justified , with all the practical ramifications arising from this, which are not considered here.

Finally, the preliminary guidelines are more concerned with the process than with the numerous detailed options and their possible impacts which the process may produce. That is a matter which deserves attention, but beyond the scope of this study.

GENERAL FINDINGS ARISING FROM THE CASE STUDIES

The process and its effectiveness

The process followed in the case studies has been critically reviewed and used in the development of the preliminary guidelines. The questions asked are the following.

Were all the data necessary?

Preliminary indications are that those identified with priority 1 were necessary; without them the picture is not complete. The data in priority 2 were less important for this project, but would be essential for a more broadly based study, while priority 3 data were not collected at all. They would also be needed for a more comprehensive study.

Should other data be collected?

This is probably not necessary, unless there are specific decisions involving expenditure to construct traffic improvements. The data collected provide a sufficient basis for identifying problems and indicating options to be considered. However, a more strategic oriented decision process would involve more detailed study, including the nature and growth of through traffic, the economic function of the town, and its probable future, and land use and transport in the town as a whole.

What sample size should be used for data collection?

About 70 interviews of visitors appeared to be adequate given the relatively small size of the communities surveyed. For larger communities, some 100 interviews may be necessary. All properties in the commercial area were part of the business survey; the response rate was about 50 per cent, which is adequate, but a higher response rate can be obtained if there is follow up.

A 10 per cent sample of all traffic, for the number plate survey is adequate, but the survey must be continuous. A check was made to verify whether the method used did represent a true 10 per cent sample, and this was found to be true. However, errors can easily creep in observations and recording, and the survey should not be regarded as being more than indicative.

The video camera is an easy method of obtaining a large amount of data. Once the camera has been set up, it needs little attention and observation can be continuous. However, whether all the data needs to be analysed is another question. It is possible to approach the analysis from different perspectives, such as continuous scanning of every frame for significant 'events' or selecting predetermined time periods only.

The manual observations, using the half hour on - half hour on approach, produce sufficient data for analysis and interpretation.

Is a low cost program feasible?

A low cost program is feasible. The program showed that two site visits were sufficient if there is support from the Council and the local community, the Chambers of Commerce, and the local High School. High School students proved very capable in assisting with most of the surveys, despite limited briefing. But there were some lessons learned on how to ensure that the data collection proceeds without a hitch, as problems can, and did, occur.

Is the data analysis time-consuming and requiring special skills?

The analysis of the data is not time-consuming with the exception of the video analysis. Special skills are needed for the numberplate analysis, but a computer program (using DBASE III+) has been developed by the School of Town Planning which simplifies analysis. Other programs are also available.

Is special skill required for interpretation of the analysis?

Interpretation does not require any special expertise beyond that which is normally available amongst Council staff.

Research interpretations

The primary purpose of this project was to examine the approach to conflict identification and reduction in the Main Street of country towns. However, the project is part of a longer term and broader research study of the relationship between roads and their environments, and the data obtained for this project were analysed and compared with the results from other studies.

The basic proposition of the longer term research study is that there is a relationship between crossing pedestrians, traffic volumes, traffic speed and road configuration. The behaviour of crossing pedestrians can be analysed by separating pedestrians who are crossing legally at a crossing facility from those who cross elsewhere or against the lights (defined here as 'jaywalkers'). While there are great differences in behaviour, jaywalking is an inherent characteristic of centres with high pedestrian activity. In another study (Black, Westerman and Kuiper), it was found that the vehicle flow has an influence on the proportion of jaywalkers, and that the number of jaywalkers seems to increase rapidly as the average vehicle speed decreases to about 25 km/h in areas without a median. In areas with a median the same pattern occurs but at the higher speed of about 35 km/h.

In the two case studies there were different levels of provision for legal crossing (little in Moss Vale, more in Parkes), but in both towns extensive jaywalking occurred. The amount of jaywalking in Parkes was very high, but traffic volumes were not high (about 600 v/h) and, more importantly, traffic speeds were very low (about 20 km/h), whereas the amount of jaywalking in Moss Vale was less than half of that in Parkes, traffic volumes were higher (about 1000 v/h) and traffic speeds were also higher (about 43 km/h). Although several other factors may play a role, these findings lend support to the proposition that jaywalking is a function of speed and volume. More significant, perhaps, was the fact that in Moss Vale, about 18 per cent of the jaywalkers were running across the road, compared with only 5 per cent in Parkes, despite the fact that the carriageway in Parkes is wider than in Moss Vale.

There is a correlation between the pedestrians density (including jaywalkers and legal crossers) and vehicle speed. As shown in Part II, the pedestrian crossing density decreases as vehicle speed increases.

The time that pedestrians and vehicles are using the same space for movement can be regarded as an index for the friction or a measure of the potential conflict in an area. Analysis of the data, using the space/time index, showed that there is a correlation between pedestrian density, vehicle density and vehicle speed. With a low vehicle speed, the pedestrian density and the vehicle density are relatively high, and an increase in pedestrian density with a constant vehicle density may lead to a decrease in the average vehicle speed. This finding is consistent with other studies (Black, Westerman and Kuiper, 1987).

Multiplication of the pedestrian and vehicle density indices is a measure for the number of pedestrians and vehicles which occupy the same road space and thus an indicator of potential conflict. The index should not be misconstrued; it should be regarded as no more than a rough measure of the behaviour of pedestrians and drivers.

The indices were related to vehicle speed and it was found that the limit of tolerance is much greater where vehicle speeds are low (i.e. a high conflict index). But vehicle speed may not be the only significant variable: the presence or absence of a median is another. There is no median in Moss Vale and Parkes, but a higher level of tolerance has been observed elsewhere where there is a median. The conflict may be better managed when there are medians and/or pedestrian crossing facilities.

The results confirms previous conclusions that in situations where the average speed is lower or equal to 25 km/h, a high conflict index seems to be readily accepted. If the speed increases to about 40 km/h the conflict index drops very quickly unless there is median.

One suspects that there is a point where the traffic flow and/or speed become so great that crossing is impeded. This situation did not arise in either of the centres studied, and seems to lie beyond the levels observed in this study. However, the high incidence of jaywalkers running across the road in Moss Vale suggests that the situation is not acceptable.

Measures to reduce conflict

The selection of the two case studies proved fortuitous in that they represented contrasting situations of potential conflict. In Moss Vale, the main problems appear to arise of the land-use configuration, and the speed and composition of the traffic. In Parkes, the main problems seem to be the turning movements at intersections (and the potential conflict they create with pedestrian movement) and the manouevring associated with angle parking.

Measures to reduce conflict must address these local problems, but while such measures will need to be targetted specifically, there are some general principles which underlie them, and that has become clear from the two case studies.

At the strategic level, there is always a need to consider the option of an external or internal by-pass. Changes may perhaps be to the traffic management system for the town as a whole, involving a different road hierarchy. There may also be land use changes beyond the confines of the Main Street, which can help to reduce the level of activity in the Main Street, but none of these were real options in the cases studied.

At the developmental and operational level there are options, and they are related to the management of the road environment, the management of traffic along the road, and the design and construction of the road space. One of the principles of general validity is the creation of 'portals' designed to make drivers aware that conditions in the road space are about to change and to elicit an appropriate driving behaviour. The notion of a transition zone to force drivers to slow down and a central zone to obtain vehicle speeds related to the pedestrian concentration in it, should be considered as options in any plan for reducing conflict in the Main Street. Similarly, pedestrian activity should be confined and no new major pedestrian generating activities should be permitted outside the central zone. Arcade development to the rear should be encouraged. Rear access should be sought in all major new developments in the Main Street.

There are many operational options in both cases, such as narrower carriageways, selective widening of the footpath to reduce the crossing distance, parking and unloading/loading bays, medians, roundabouts, turning bans, changes in the axis of the moving traffic to close the vista, changes in the pavement materials and colours, road markings, tree canopies, street lighting, signs and awnings, and street furniture. Some of these have been incorporated in the suggestions in Part II. However, careful study of such options is needed as they may reduce one form of conflict but create another. For instance, the use of roundabouts in a central zone will reduce traffic speed and may reduce the number of vehicle/vehicle conflict points, but may increase the pedestrian/vehicle conflict.

The case studies demonstrate, in our view, the need for conflict analysis and the scope for improvement in country towns, but also the need for a systems approach. This will be pursued in the following sections.

DATA NEEDS

Essential

There is a need to define the area of study. Generally, that section of the Main Street where there is intensive contiguous pedestrian activity must be covered. There may be areas of major commercial activity generating mostly vehicle traffic close by. These should be identified, but need not be picked up in detailed surveys. However, free-standing major pedestrian generators nearby, such as a high school, should be included.

Some data are needed for the section of the Main Street overall, but others need to be obtained for segments of it: traffic speed, jaywalking and legal crossing, as there may be significant variations in the section.

There are seven categories of data needs: function and role of the Main Street, the built environment, road space management, vehicle movement, pedestrian movement, conflict behaviour, and conflict perception. Table 3-1 lists essential data needs.

Table 3-1 Essential Data Needs

CATEGORY	DATA NEED	SOURCE
Function and role of the Main Street	Origin and number of visitors	Visitor survey
	type of business, extent of service, regional function	Business survey Local planning studies
	passing trade and economic significance.	
	Possible future changes	State Road Authority
	proposals for by-pass, or major developments.	Local Authority
Built environment	The road pattern and land-use structure of the town.	Local Authority
	Width and physical characteristics of the road space of the Main Street.	Local Authority and field survey
	Frontage development classifie by pedestrian and vehicle orientation.	Field survey
	Site access.	Field survey
Road space management	Road hierarchy	Local Authority
	Intersection control	Local Authority
	Kerb lane control	Local Authority
	Median control (if any)	Local Authority
	Parking duration	Local Authority
	Legal crossing	Local Authority
Vehicle Movements	Traffic volumes for a period of 6 hours from 9.30-15.30 on a normal Friday.	Number Plate survey
	Through traffic	Number Plate survey
	Heavy vehicles	Number Plate survey
	Traffic speed by segment	Stop watch survey Video observation
Pedestrian Movements	Pedestrians on footpaths by segment	Pedestrian count
	Legal crossers	Pedestrian count
	Jaywalkers by segment	Pedestrian count
Conflict behaviour	Delay caused by manouevring vehicles	Video observation
	Vehicle delay at legal crossings	Video observation Part of pedestrian count
	Jaywalker/vehicle conflict	Video observation
	Accidents	Accident statistics Local police and Traffic Committee
Conflict perception	Attitude of visitors	Visitor survey
	Attitude of business community	Business survey Community consultation

Desirable

There are other data which are desirable, but time-consuming, to obtain. Some would be essential for a broader-based study.

Table 3-2 Desirable Data needs

CATEGORY	DATA NEED	SOURCE
Function and role of the Main Street	No further data needs	
Built environment	Width and physical characteristics of the roads in the vicinity	Local Authority and field survey
	Floor space of land-use by pedestrian and vehicle orientation.	Field survey
	Off-street parking areas location, capacity. utilisation	Local Authority
Road space management	On-street parking in adjoining streets, capacity, utilisation	Local Authority
Vehicle Movements	Traffic counts	State and Local Authority
	Turning movements at ntersections	Field survey and Local Authority
Pedestrian	Stratification by age and sex	Field survey
Conflict behaviour	Site service access movements	Field survey
	Pedestrians waiting to cross	Field survey
	Jaywalking behaviour	Field survey
Conflict perception	Attitudes of motorists	Cordon questionnaire

Useful for a more broadly-based study

The preliminary guidelines are designed to serve as a simple and inexpensive process with a clear focus on the pedestrian/vehicle conflict. If a longer-term strategic approach is called for, or there is a need for a more broadly-based study, other data will be required (Table 3-3)

Table 3-3 Data Needs for a More Broadly-based Study

CATEGORY	DATA NEED	SOURCE
Function and role of the Main Street	Economic impact of tourism (if any)	Accommodation survey Tourist survey
Built environment	Heritage Street furniture Townscape	Field survey Field survey Field survey
	PlaPlanning and development control	Local Authority
Road space management	Overall parking demand & supply	Parking study Local Authority
Vehicle Movements	Traffic volumes in other streets	Field survey
Pedestrian Movements	Main pedestrian generators in the vicinity and pedestrian routes	Field survey
Conflict behaviour	Detailed study of accident type Traffic noise and pollution	Accident statistics Noise measurements
Conflict perception	Community views	The local press and community grousp

DATA COLLECTION

Day, time and location

A day when there is a high level of activity in the Main Street is preferred. However, it should be part of a normal pattern, recurring on a weekly basis, and not an unusual one-off event. In most country towns a Friday appears to be a suitable day.

The time of the surveys should be sufficient to get a pattern of interaction between pedestrians and vehicles. Ideally it should be from 9.30 am to 17.30 pm, but this may not be practicable because if high school students are assisting in the data collection. It was found that a period from 9.30 am to 15.30 pm is an acceptable compromise. As there are no major peaks in traffic arising from employment patterns in country towns, the morning and afternoon peak periods, which are so important in larger communities, are of less significance in the Main Street.

Climatic and weather conditions are important. It is preferable to choose a period in spring or autumn, and if the weather conditions are poor on the day of the field survey, it is best to defer it till the following week. A contingency date should be part of the basic planning of the survey.

It is essential that each observer be provided with a plan (A4) showing the location of all survey positions with letters and numbers as well as a full day schedule showing the observer where to be, at what time and for which survey. Prior instructions should be given about meeting times and places, dealing with questions, picking up and returning of forms and there should be a predetermined central point where the supervisor can be contacted at any time.

Sufficient time should be set aside for a prior briefing of all the observers, in particular, for surveys involving the use of high school students. Ideally this should be conducted a few days prior to the survey date and briefly recapped before the survey commences. It is possible to conduct the briefing on the day but this should take about 45 minutes and requires a central location with shade and a minimum of traffic noise.

It is also recommended that a letter be prepared well in advance of the field surveys, which the School can send out to the parents of the children who will be undertaking the surveys. This makes the survey (and the reasons for it) a matter of community interest. It also gives the opportunity of setting down what the students will need to take with them (mainly a watch), what will be provided by the School (clipboard and pencils), and what to do in case of doubt about the weather.

A sample of a schedule is shown Appendix 1.

Number plate survey

A number plate survey is essential in order to establish the nature and amount of through traffic in the Main Street. However, it can do a great deal more: it shows the number of vehicles entering and leaving the town during the day and the points where it occurs, the length of stay of vehicles coming into the Main Street area, vehicle accumulation (an indication of the parking demand), and the proportion of heavy vehicles.

The period of the survey should be, at least, from 9.30 am - 15.30 pm, and the survey must be continuous. A cordon must be set up on the approach routes to the centre, so that incoming and outgoing traffic can be recorded. *Ideally, all routes to the centre should be observed, but this is often* not practicable because of the large number of roads involved and the limited number of observers available. Experience suggests that the main regional routes should be observed, and, if possible, other regional routes, but not local streets. A number of cordon points should, preferably, not exceed four. The survey points should be outside the shopping area, but not so far out that it takes longer than five minutes to walk from the cordon point (called 'PORT') to the centre of the town, as observers have to be relieved after one hour and are given other survey tasks.

There are several points to watch when undertaking these surveys:

- Good visibility and shade are important in selecting the cordon locations.
- Watches should be synchronised prior to the commencement of any surveys.
- The necessity for accurate and clear writing should be emphasised.
- The importance of recording every commercial and heavy vehicle should be stressed.
- Instructions to remain on the job until there is an available relief are essential for a continuous record.
- Also, the procedure for handing on sheets to the next observer should be clearly explained.

The numberplate survey can be conducted with a ten per cent sample. Every vehicle with a 0 as the last digit is picked up and the first three characters of the numberplate are recorded, together

with the time in minutes, the direction of travel and whether the vehicle is a heavy vehicle. Watches are synchronised beforehand.

Where vehicle flows exceed about 600 vph (combined directions), two observers are required at each port. Flows lesser than about 600 can be handled by one observer.

Points to watch: selecting cordon locations in the shade and with good visibility, synchronisation of watches beforehand, accurate and clear writing, not forgetting to record a heavy vehicle, instruction to stay on the job till there is a relief, handing over of record sheets to the next observer.

A sample of the survey form is shown in Appendix 2.

Speed observations

Speed observations are made for segments of about 130 - 180 metres with stop watches. A vehicle passing the observer is picked up by activating the stop watch and clicked out when it passes a predetermined point downstream. Then the next vehicle is observed. Observations are made for periods of 30 minutes with intervals of 30 minutes in between.

The distance between the observation point and the downstream is measured in advance. It is essential to select a downstream screen line which is clearly visible. It has been found that a pole of a street light or traffic sign is suitable. Where the vehicle is obscured by high vehicles in between the observer and the downstream screen line, the observation is discarded.

Points to watch in carrying out such a survey:

- clear instruction on exact position of observer,
- the starting and exit screen lines,
- the point at which the stopwatch is activated (when the rear of the vehicle passes the entry screen line at a right angle to the direction of movement), and
- what to do in case traffic comes to a halt (record the duration and cause of such an event).

Pedestrian counts

Pedestrian are observed on the footpath, on legal crossings, and as jaywalkers for periods of 30 minutes with intervals of 30 minutes in between. Continuity would be desirable if resources are available (and can be achieved in areas where a video recording is made), but a 50 percent sample can provide sufficient information of the magnitude and variations during the day. The area where jaywalking occurs should be the same as that for which speed observations are made.

The pedestrians on each footpath are recorded mid-block, in both directions, and observed from the opposite side, crossing an imaginary line between the observer and the building facade.

Pedestrians at legal crossings (e.g. a zebra crossing) are recorded in both directions and a record is kept on whether a crossing pedestrian forces a vehicle to stop.

Jaywalking is recorded for a segment of not longer than 180 metres, and a record is kept of whether the jaywalkers are walking or running.

Video observations

It is usually not practicable to make a video recording from more than one position, but that position is of great importance. The most active segment of the Main Street should be surveyed from an elevated position, preferably not less than 4 meters above the ground. Visibility of the movements in the street space should be unimpeded, and the location should be identified during the first, exploratory visit. Suitable locations are above an awning and the roof of a building on a corner, but arrangements for access have to be made in advance.

The distance covered by the video recording depends greatly on the quality of the video camera, but with the present level of technology, a distance of 300 metres would be considered the maximum. It should also be remembered that the quality of the playback VCR and monitor used in the analysis will also affect the distance that may be effectively studied.

It is also important to note that while a camera may be capable of covering a distance of 300 metres, a distance between 100 and 200 metres should be clearly visible for the analysis. A longer distance will affect the clarity of each vehicle; a shorter distance, particularly incorporating a major traffic conflict area such as a zebra crossing, will bias the survey towards unusually low vehicle speeds.

The video recording should show the precise time on each frame, and the distance of the camera from a close and a distant screen line should be measured, as one of the data sets which the video recording should produce is the time each vehicle takes to travel the distance between the two lines. The screen lines should be clearly visible subsequently when the recorded frames are analysed.

The video recording must be made for at least the same period as the other surveys, but it is possible to extend it without much effort to, say, 17.30 hr so that the patterns after 15.30 hr can be observed.

The use of a video recorder permits considerable detailed analysis that would not otherwise be possible as it records a complete picture of the activity in a particular section of the street for a particular day. It has the capacity to record not only incidents but the environmental factors that led to them as well as their particular characteristics which would otherwise have been surveyed in isolation. For example, although it is possible in the field to count the number of jay walkers and to observe whether they were hurried or stopped in the middle of the road, it may not be possible to learn that a large percentage of the jaywalkers were generated by particular locations of on-street parking and pedestrian-orientated land uses. Yet such information may become evident during the video analysis, particularly if it covers a longer survey period than the in-field surveys.

For this reason the video is an ideal tool for specific conflict analysis to develop and support the observations of the trained researcher in the field. Incidences of conflict may be isolated and specifically examined which may add greatly to the overall identification and study of conflicts.

The video also has a role in checking the accuracy of data obtained in the field. For example, with regard to vehicle speeds, this can be easily accomplished using a five to ten minute sample of each half hour recorded (a sample size of 1:6 or 1:5).

It is important, however, that the video should not be used as a substitute for data best collected in the field as even a routine analysis of video data is time-consuming nature. In the long run it is likely to be more cost-effective to employ additional field interviewers for one day than to attempt to analyse several hours of videotape after the event, particularly where the additional data obtained does

not substantially improve on the knowledge gained from sample observation in the field. The video recording can not be a substitute for the numberplate survey, which is essential in any event.

Routine video analysis for the purpose of gaining samples of vehicles speeds, for example, does not require specific skills other than concentration and attention to detail, for, in spite of, the capacity for checking data, there is an inherent difficulty in accurately measuring the exact distance covered by the vehicle survey. This definition of distance generally involves the researcher defining a clearly visible area on the screen by means of placing artificial lines on a transparency covering the area of the survey from a vantage point several metres above street level. It must also be noted that if the camera is moved or its focal length altered at any point during the day, the measure of distance would have to be recalculated for that period.

Specific conflict analysis from the video for the purpose of adding to knowledge of the nature and causes of conflict should be carried out by a trained researcher. In this way further detail can be discovered and analysed and theories developed and explored throughout the process.

Visitor Interviews

The visitor survey is undertaken in order to achieve two objectives: to obtain information about people who visit the centre, and to get a subjective view about the conflict in the Main Street.

A dominant consideration is the ease and speed with which the in-street interview can be conducted; the preferred time being no longer than two minutes, and the number of questions being no more than ten. Ideally, these should all fit on the one side of this paper. A sample of 70 interviews for a poluation of less than 10,000 has been found to be adequate for the type of information sought in small towns without a major tourist function; more interviews should be conducted, and further information should be sought where there is a major tourist or holiday destination function. The surveys should not be conducted from the same position; the interviewers should cover the full survey area and spread the interviews over the entire period between 10:00 and 15:00 hours.

The questions relate to place of residence, frequency of visits, purpose of the visit, number of establishments visited, length of stay, mode of transport, where parked, perception of conflict, and ideas about reducing it. A sample questionnaire is shown in Appendix 3.

The survey can be conducted by people who are not specially trained, but more can be gained if the interviewer is involved in the analysis of the project. It is not only what people say (which can be recorded by untrained persons), but how they say it. A skilled person may also be able to follow up the set questions with some further questions if the person interviewed has interesting ideas.

Business questionnaire

The purpose of the business survey is to obtain information about trade in the Main Street and the perception of the Main Street by the local business community. The information sought needs to include the nature of the trade, its market orientation, in particular, the degree to which it is aimed towards passing traffic, the kind of turnover involved which indicates the strength of the centre, attitudes towards any perceived vehicle/pedestrian and vehicle/vehicle conflict in the centre, and suggestions as to how such conflicts may be addressed. There are considerable advantages in obtaining the assistance and support of the local Chamber of Commerce. However, this carries an obligation to discuss the issues after the results have been analysed.

The design of a questionnaire that is intended to be filled out at the convenience of the respondent without the presence of the interviewer must follow very different guidelines to those inherent in designing the on-street interviews. There, the emphasis was on speed and ease of execution with the minimum of questions needed to gain the basic information. A self-completion questionnaire can afford to be more detailed. Indeed, it needs to be as each question must be clearly self-explanatory; there is no interviewer present to answer queries.

The most important points to note are that questions should be broken down to their simplest form. Each sentence should require only one answer to be located in the space provided. A change in the format of answers, for example from a numerical answer to a logical (yes/no) answer, should form a new question. Where there are totals required a new question should be asked in full i.e. And what is the total number of employees? And, lastly, additional instructions may be added to the end of questions e.g. PLEASE MAKE SURE YOUR ANSWERS ADD UP TO 100% and PLEASE CHECK AND MAKE SURE YOU HAVE ANSWERED EVERY QUESTION.

It should also be noted that it is always difficult to obtain personal or financial data. The survey should be treated, and be seen to be treated, in confidence. An introductory letter should be included with the questionnaire which explains the purpose of the survey, stresses the importance of the data and unequivocally states that the data provided will be treated as strictly confidential. Ideally, each questionnaire should be collected by a researcher who will be able to check, on the spot, that it has been accurately completed. If this is not possible and the questionnaires are to be collected by proxy, envelopes should be provided when the survey is distributed to ensure the confidentiality of the information provided.

It is also important that the questionnaires are collected within a reasonable period of time, generally between four and seven days after distribution. If the period is too short a large number of the questionnaires may not be completed; if too long respondents may be tempted to discard the questionnaires.

ANALYSIS AND INTERPRETATION

Through traffic function

The through traffic function is determined by analysing the data from the number plate survey. The data should first be entered into a DBASE file (using DBASE III+ or DBASE IV). It is important to make sure that the hour and the minutes are entered in a separate 'field', so that the time can be converted to digital time (e.g. 10.37 becomes 10x60 + 37 = 637) and the time lapse between IN and OUT can be calculated later. The IN data are entered on a file PORT_IN, and the OUT data on a file PORT_OUT.

A program has been written (available from the School of Town Planning) which first calculates the time of entry and exit, and then sorts the data. The program then finds the matching number plates and dumps them in a new file. This file can then be sorted by port of origin and port of destination. It is then possible to construct a spreadsheet with Origin & Destination data (using any of the spreadsheet software).

The Origin & Destination data can be further analysed by examining the time lapse of vehicles between each pair or ports. Where the time lapse is negative, a vehicle commenced the trip in the town and returned later. This is an indication of the regional function of the centre. Where the time

lapse has a positive value, the data can be further sorted by duration of time lapse. Where the time lapse is less than 10 minutes, it can be assumed that the trip is a through, non-stopping, trip. Trips which enter and leave through the same port, should be excluded as through trips. For a more detailed analysis, the through movements of heavy vehicles can be analysed.

It is also possible to sort on trips IN and OUT for specific time periods and for each PORT. In this way, the number of vehicles per hour on each road can be calculated. When the whole period is taken, it is possible to relate the figures to previous counts and check whether the survey produces results of the correct order of magnitude. A period of 9.30 am to 15.30 pm should account for about 40 per cent of the AADT in country towns. The same data set can be used to find the variations in flows during the survey period, and the accumulation of vehicles (which is an indication of the parking demand).

It should be noted that there are limitations in the use and interpretation of number plate surveys. While a sample of 10 per cent is sufficient for a general indication of the traffic pattern, errors can easily occur, and trips which enter or leave the town before or after the survey period are can not be matched. Hence, the proportion of matched/unmatched vehicles is approximate only.

Pedestrian/vehicle conflict

An indication of the pedestrian/vehicle conflict can be obtained by direct and indirect relationships. The direct relationship can be studied by obtaining and examining accident records over the last three to five years, and analyse those records involving pedestrians. Discussion with the local police and traffic committee offers a further opportunity, whilst the visitor survey and the business survey give an indication of the perception of the conflict. Care should be taken in the weight which is attached to the perception of conflict, as the objective situation (the factual situation) is likely to vary from the perceptual situation, except perhaps in respect of the seriousness of conflict.

Indirect relationships involve an analysis of the number of pedestrians that cross - jay-walking or legally - the width of the area to be crossed, the speed of the vehicles and traffic flow. There are various ways in which these variables can be combined, as is shown in Part II.

A simple approach is to determine the number of jay-walkers per time period per segment, 'normalise' the length of the segment by determining the equivalent number per 100 metres, and relate that number to the average vehicle speed for the segment. A refinement is to determine the proportion of jay-walkers running (as opposed to walking) across the road.

Another simple measure is to determine the total number of pedestrians crossing in a segment, and relate this to average vehicle speed. These provide rough measures, but useful for indicative and comparison purposes.

A more complex measure involves the calculation of pedestrian and vehicle densities, which are indications of the number of pedestrians and vehicles using the same road space at the same time, and then relate the two values to each other. This provides an index, which can then be related to vehicle speed and can be used as a measure of conflict.

The space/time index for crossing pedestrians can be defined as the number of crossers per segment of road ('normalised' to 10 m of road length) per unit of time (e.g. 20 minutes), multiplied by the average time of crossing (at the rate of 1.65m/s) of that part of the carriageway which is used for moving vehicles. The space/time index for vehicles can be defined as the number of vehicles pass-

ing through the segment per 20 minutes, multiplied by the average time it took them to travel the segment (again normalised to 10 meters), divided by 10 (to produce a more useful index for graphic purposes). By way of comparison, the pedestrian 'density' and vehicle 'density' are 86 and 35 for Moss Vale and 120 and 45 for Parkes.

Another complex measure is obtained by multiplying the pedestrian and vehicle density indices. The index which results can be regarded as a 'road space activity' index should not be misconstrued. A high index does not mean an intolerable conflict, but indicates a behavioural situation of pedestrians and vehicles using the same space at the same time. For comparison, the index is 2980 for Moss Vale and 5360 for Parkes.

The index should be related to vehicle speed. Generally, where average speeds are low (25 km/h or less), conflict indices are indicative of a high potential, but not serious conflict, whereas average speeds are high (40 km/h and more), the conflict potential is lower, but more serious.

The conflict situation can be more accurately assessed by video observation, but this is time-consuming. The question, which needs to be addressed in undertaking a study of this kind, is whether there is a need for a broad indicative approach, or a more accurate assessment. In case of the latter, the video analysis is essential.

Vehicle/vehicle conflict

The video recording is literally a photographic record of the actions and interactions that occurred in the street during the day of the survey. Its systematic analysis reveals much about the nature of the existing conflict. The video has the advantage over field observations of being able to cover all of the activity occurring within a specific area of space.

While the video is useful for analysing pedestrian behaviour and driver reposnses to it, it is particularly valuable for analysing vehicle/vehicle conflict. Data may also be obtained from the video in respect of vehicle movements and manoeuvres. It is possible to time the duration of the period for which a reverse parking vehicle halts or slows the traffic as well as to count the number of vehicles thus affected. This may be useful where there is an option to alter the design of the on-street parking from angle to parallel parking or to remove it entirely.

In the same way it is possible to trace the path of each vehicle, or selected vehicles, individually to determine the number of times normal flow is affected and why it happens. This also allows the researcher to determine the average speed of the interrupted vehicles as opposed to free-flow vehicles.

The video analysis may also be used to determine the number of commercial and heavy vehicles as a proportion of the total. This is significant as both a safety factor and in terms of the retail environment in the main street. The former relates chiefly to the probability that heavy vehicles travelling long distances may be less likely to reduce speed and prepare to stop, even in busy retail streets, than other vehicles. Double-parking delivery vehicles may be adding to the breakdown of traffic flow in the main street, and the presence of a large number of heavy vehicles will have a detrimental effect on the environment of the regional centre as a whole.

As a medium for cross-checking the results of field surveys and information obtained from other sources, the video may be used for pilots of vehicle speeds and volumes over a selected period of time to be compared against stop-watch counts or, perhaps, the AADT figures for the road. In conjunction with road accident information it is possible to identify or confirm other areas of potentially

dangerous conflict if, for example, a high proportion of the accidents involve cross traffic, rear-end collisions or cause injury to pedestrians. And in conjunction with business and instreet interviews it is possible to gain a greater understanding of the perceptions of the local community.

Friction and Impact

Friction is caused by factors identified in Part I. The friction caused by pedestrians and manouevring vehicles has already been mentioned in previous sections. Where there is a clear need to continue with a Type II situation, a certain amount of friction is unavoidable and the aim of any action is to manage it within acceptable limits. The view is taken in this study that safety is paramount, and that some modification of driver pedestrian behaviour is necessary, even if it means some delay in through traffic along the Main Street.

There are other factors of friction, such as the absence of rear or side access to frontage activities, leading, in the worst case, to double parking of delivery vehicles, frequent intersections, and heavy turning movements. Site access details are collected during the land-use survey, while the incidence of double parking can be observed by video analysis. An indication of the frequency of intersections and turning movements can be obtained from observation and discussion with the Council Engineer.

Impact relates to factors such as site access problems (the reverse viewpoint where traffic impedes services to the site), pedestrian safety (from the pedestrian viewpoint), traffic noise and pollution, social and economic impact. Analysis of traffic noise is outside the scope of this study, but can be undertaken when data on traffic volumes and physical characteristics are utilised. Social impact can be very significant, especially where school children or elderly people have to cross a major traffic route, but is treated here as a safety issue, which is fundamental to the approach followed in this study in any event.

There is one important positive impact of traffic on road frontage: the economic impact of the passing trade on the business community. The business survey provides an indication. A sort is made of the businesses for a dependence on the passing trade and the estimated proportion of the trade related to passing traffic is converted to turnover. This is then related to the total turnover. The nature of the businesses who depend on passing trade is further analysed, and this is related to the through traffic data from the number plate survey. Generally, the passing trade is more important to vehicle-oriented uses, such as service stations and motels, which are normally located in the fringe and not in the core.

Perception

There are two data sets: the business survey and the visitor survey. The analysis is best carried out inductively by examining the returns and sensing response patterns. It is then possible to classify and sort the material. As there is no set procedure, or format, of analysis, and the interpretation is highly dependent on local conditions, there is no need for any further elaboration here.

GENERATING AND EVALUATING OPTIONS

Introduction

The fundamental problem is the conflict between the through function of an arterial road and the activity function of the Main Street. In essence, this is a Type II road/environment situation, producing a conflict between pedestrians and vehicles, and between moving and manouevring or parked vehicles (as well as other impact- and friction-type conflicts). The analysis and interpretation described in the previous sections will have identified the problem in a specific, local context.

Understanding of the problems and their context is necessary in order to generate options for dealing with them. A framework can be developed as a checklist of options for consideration. The framework consists of three levels of planning action: strategic, developmental and operational options. Options at each planning level need to be considered for two broad categories: transport and traffic management options, and land-use and road environment options.

Presenting options, however, without evaluation (or a basis for evaluation) is of little value. Evaluation criteria and measures of evaluation need to be defined. It is beyond the scope of this study to develop such criteria and measures, and only passing reference will be made to them in the following sections. An obvious criterion is that of safety; other criteria could be costs, benefits, economic impact, and practicality (e.g. funding feasibility). Measures of evaluation for safety could be reduction in accidents, reduction in the seriousness of the conflict. For economic impact, they could be real (or percentage) loss/gain in trade measure by land-use category.

There are advantages in considering options within different problem contexts, as some options may otherwise be overlooked. At the strategic level, the problem is that of through traffic penetrating the centre of a country town and the centre impeding the traffic. At the development level, it is the physical configuration of the road, affecting traffic performance, and the nature and extent of development causing friction along it. At the operational level, the problem is that of managing vehicles and pedestrians so that risks are minimised.

Table 3-4 Framework for Problem Identification, Developing Options and Evaluation

PROBLEM		OPTIONS	EVALUATION
Type	Ttansport related	Land-use and road environment related	Criteria and measures
S-A S-B S-C S-D		STRATEGIC OPTIONS	
D-A D-B D-C D-D		DEVELOPMENTAL OPTIONS	
O-A O-B O-C O-D		OPERATIONAL OPTIONS	

Note: S, D and O represent Strategic, Developmental and Operational Options, respectively

Strategic options

Strategic options must be considered within the problem context. Table 3-5 gives an indication of the kind of options which may be available. It must be stressed that only four contrasting problem situations have been set out; in practice there will be more variations in problem situations (such as seasonal variations due to tourism). This should not lead to other basic options but will affect the evaluation.

Table III-5 Strategic Problems, Options and Evaluation

STRATEGIC PROBLEM	TRANSPORT NETWORK OPTIONS	LAND USE STRUCTURE OPTIONS	EVALUATION
Type S/A:			
Dominant through function High traffic volumes; Strong centre	S1 outer by-pass	(may create op-tion for a mall)	cost/benefit funding effect on trade
	S2 inner by-pass	(may create op-tion for a mall)	feasibility social and phy-sical barrier traffic noise
	S3 convert to Type I Road/Environment	S3 shift activity centre locus	probability in time scale redevelopment costs responsibility
	S4 maintain as Type II road but modify	S4 frontage adaptation	GO TO DEVELOPMENT OPTIONS
Type S/B:			
Limited through function; Strong centre	S2 inner by-pass	(may create op-tion for a mall)	feasibility social and physical barrier traffic noise
	S4 maintain as Type II road but modify	S4 frontage adaptation	GO TO DEVELOPMENT OPTIONS
Type S/C:			
Dominant through function High traffic volumes; Small centre	S1 outer by-pass	(may create op-tion for a pedestrian envlroment)	cost/benefit funding effect on trade
	S3 convert to Type I Road/Environment	S3 shift activity centre locus	probability in time scale redevelopment costs responsibility
	S4 maintain as Type II road but modify	S4 frontage adaptation	GO TO DEVELOPMENT OPTIONS
Type S/D:			
Limited through function; Small centre	S4 maintain as Type II road but modify	S4 frontage adaptation	GO TO DEVELOPMENT OPTIONS

It is possible to identify the strategic problem context for towns with different centre and highway functions in a generalised way. Figure 3-1 illustrates this and shows the situation for Moss Vale and Parkes.

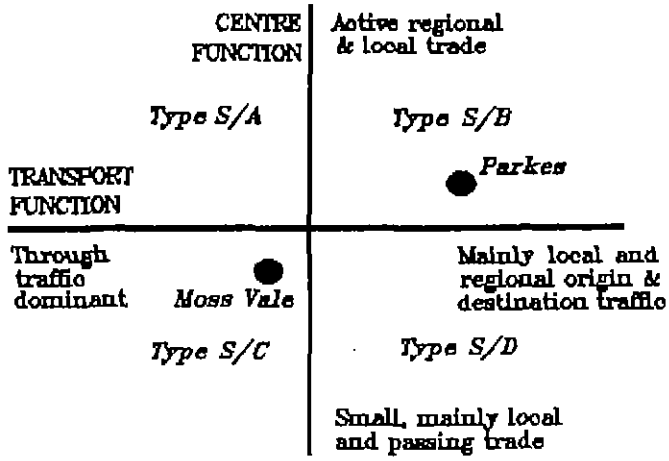


Figure 3-1 Strategic context of problem situation

Some of the strategic options which may need consideration are shown in Figure 3-2.

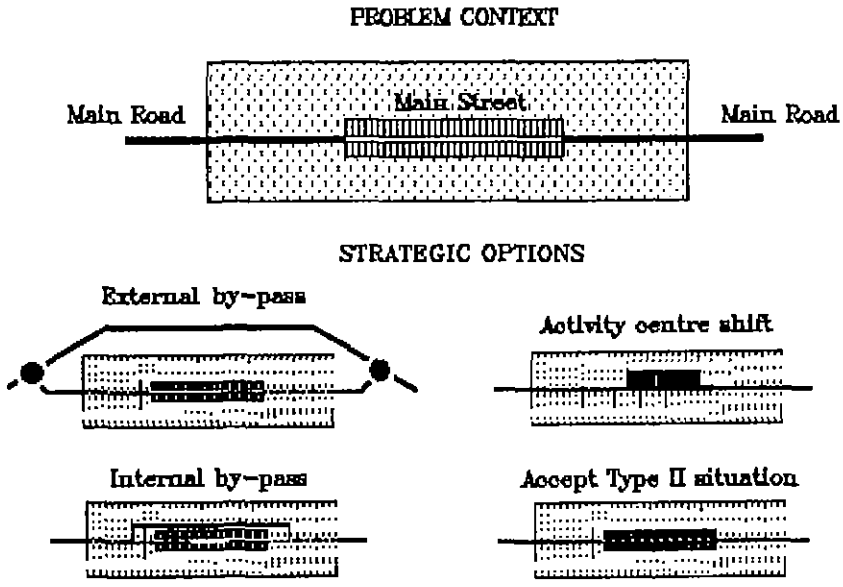


Figure 3-2 Strategic options

Development options

Developmental options also flow from the problem context. The assumption is made that the road/environment situation is Type II, which means that both traffic and centre function have to continue, but require adaptation to reduce conflict. The problem context, options and evaluation criteria are set out in Table III-6, again in a simplified form.

Table III-6 Developmental Problems, Options and Evaluation

DEVELOPMENTAL PROBLEM	*ROAD SITUATION OPTIONS*	*ROAD FRONTAGE SITUATION*	*EVALUATION OPTIONS*
Type D/A:			
Adequate traffic capacity; Extensive friction from frontage	D1 speed reduction through reconstruction of road space, footpath widening and other developmental actions	D2 rezoning to confine pedestrian activity D3 alternative access D4 off-street parking	feasibility traffic per-formance responsibility costs
Type D/B:			
Constrained traffic capacity; Extensive friction from frontage	D5 reduce intersections D6 reduce turning movements D7 eliminate angle parking D1 speed reduction	D2 rezoning to confine pedestrian activity D3 alternative access *D4 off-street parking*	*feasibility* traffic performance responsibility costs effect on road hierarchy effect on local movements
Type D/C:			
Adequate traffic capacity; *Concentrated friction* from frontage	D1 speed reduction through reconstruction of road space footpath widening and other developmental actions	D8 zoning to distinguish between pedestrian and vehicle-oriented development D9 arcades to rear	traffic per-formance responsibility costs development opportunity
Type D/:			
Constrained traffic capacity Concentrated friction from frontage	D5 reduce intersections D6 reduce turning movements D7 eliminate angle parking	D8 zoning to distinguish between pedestrian and vehicle-oriented development D9 arcades to rear	feasibility traffic per-formance road hierarchy effect on local movements development opportunity

It is, again, possible to classify towns according to the context of the developmental situation. While some generalisation is inevitable, there is a basic pattern in the problem context. This shown in *Figure 3-3. The situation in Moss Vale and Parkes is identified.*

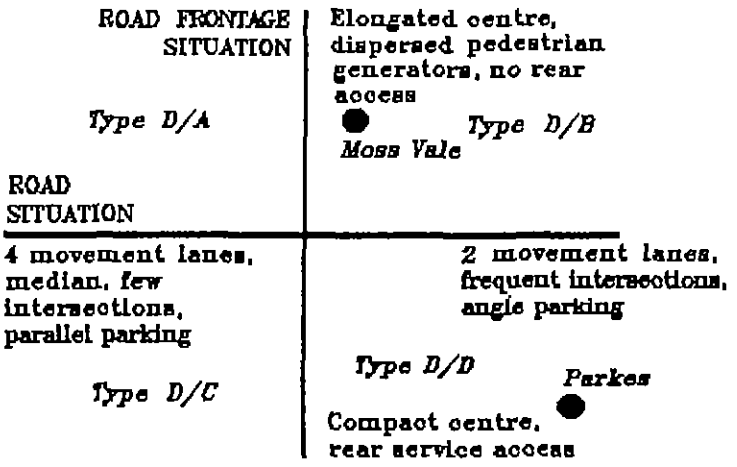


Figure 3-3 Developmental context of problem situation

Some of the developmental options which may be considered are shown in Figures 3-4 and 3-5.

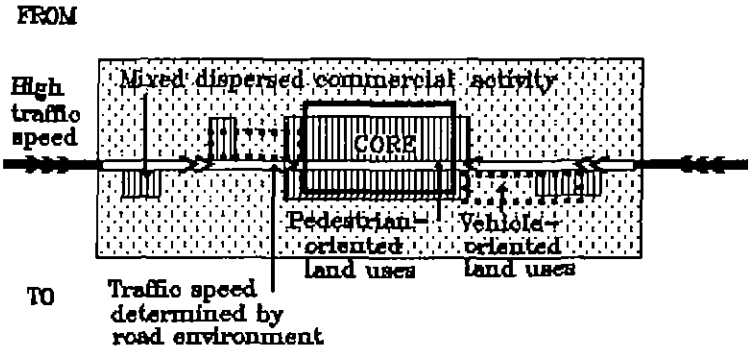


Figure 3-4 Developmental Options 1

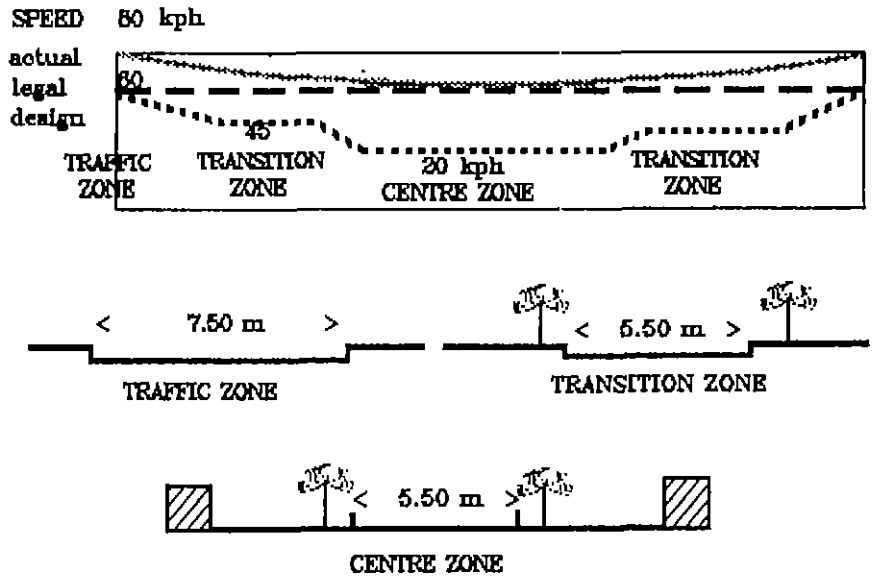


Figure 3-5 Developmental Options 2

Operational options

Operational problems are diverse and highly localised, and it is difficult therefore to state them in general terms. However, there are some basic patterns, which relate to vehicle speed, volume andOp presence of heavy vehicles on the one hand, and to the incidence of pedestrian crossing and vehicle manouevring on the other.

In Table III- 7 a simple classification is made; in practice there are many more variations, such as the combination of high volumes and low speeds, and low volumes and high speeds. Generally, speeds are the determining factor for a conflict situation, and this is reflected in the options which are listed.

Table III-7 Operational Problems, Options and Evaluation

OPERATIONAL PROBLEM	TRAFFIC SITUATION OPTIONS	ROAD ENVIRONMENT SITUATION OPTIONS	EVALUATION
Type O/A:			
Traffic volumes >600 vph*	O1 speed reduction at fringe entry points (1)	O1 create 'portal' effect (2)	Reduction in frequency of serious conflict
Average speeds >25 km/h*	O2 speed reduction near and within core (3)	O2 legal crossing where pedestrian movement and channelling of edestrians	Reduction in accidents
Heavy vehicles >6%*	O3 median	O5 longer term on-street parking	Costs
Extensive jay-walking	O4 re-routing heavy vehicles	O6 development control to relate pedestrian activity to core and vehicle activity to fringe	Responsibility
Frequent parking manouevring		O7 street furniture and planting in core	Development control
Type O/B:			
Traffic volumes <600 vph	O8 partial or complete street closure in core	O1 create 'portal' effect (2)	Effect on traffic redistribution
Average speed < 25 km/h	O10 shared road space	O9 selective widening of footpath	Impact on trade
Heavy vehicles <5%		O6 development control to relate pedestrian activity to core and vehicle activity to fringe	Reduction in frequency of serious conflict
Extensive jay-walking		O7 street furniture and planting in core	Reduction in accidents
Frequent parking manouevring			Costs
			Responsibility
			Developmen control
Type O/C:			
Traffic volumes >600 vph	O1 speed reduction at fringe entry points (1)	O1 create 'portal' effect (2)	Reduction in frequency of serious conflict
Average speeds >25 km/h*	O2 speed reduction near and within core (3)	O2 legal crossing where pedestrian movement and channelling of pedestrians	Reduction in accidents
heavy vehicles >8 %	O3 median	O9 selective widening of f ootpath	Costs
Limited pedestrian crossing and parking friction			Responsibility
			Development control
Type O/D:			
Traffic volumes < 600 vph	O3 median	O1 create 'portal' effect	Reduction in frequency of serious conflict
Average speeds <25 km/h		O2 legal crossingwhere pedestrian movement and channelling of pedestrians	Reduction in accidents
Heavy vehicles <5%		O9 selective widening of footpath	Costs
Limited pedestrian crossing and parking friction			Responsibility

* Note: the figures are empirical and based on the interpretation of the case studies; further work is necessary to verify or refine them.

An indicative categorisation of problem situations in towns is shown in Figure 3-6.

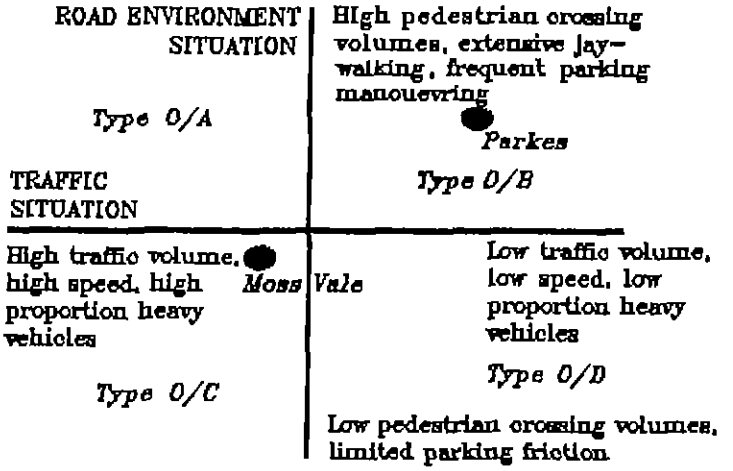


Figure 3-6 Operational context of problem situation

A distinction must be made between measures to reduce speed behaviour at the fringe of the 'Main Street', and those near and within the core. At the fringe there are sub-options, such as a the development of a splinter island, narrowing of pavement, clear kerb lines, pavement change, and tree planting, symbolic identification structure at the side of the road, and building line changes (Figure 3-7)..

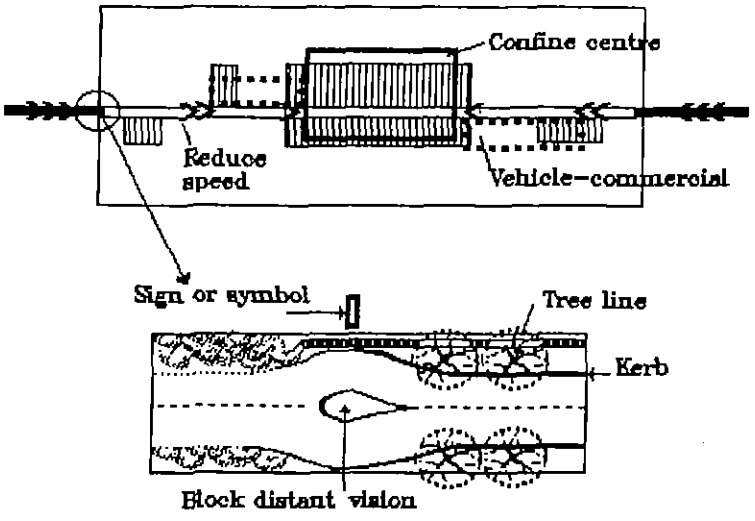


Figure 3-7 Portal Preatment

In and near the core, there are other sub-options such as roundabouts (but not where there are significant pedestrian movements), changes in the centreline, raised entry points, selective road narrowings, pavement changes, medians (raised or painted).

One of the conflicts in many country towns is that of angle parking. Parallel parking and narrowing of the carriageway, perhaps combined with a median, can reduce such a conflict.

However, there is a need to return to the basic premise of this study: road safety must be viewed in a broader context than the real and potential conflicts between pedestrians and vehicles, and between vehicle and vehicles in the road space. They are the result of many factors, including the managmenent of the road environment. The problem needs to be addressed in a holistic way.(Figure 3-8).

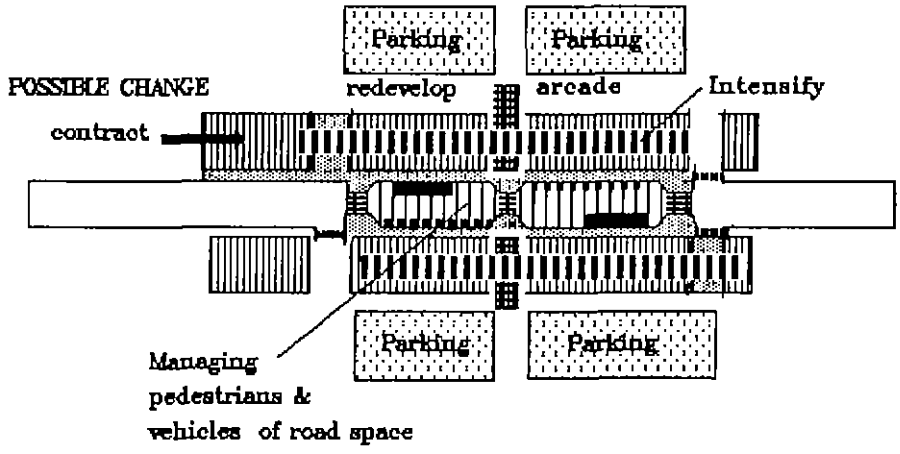


Figure 3-8 Road Space and Environmental Management

Consultation

Consultation is essential in any evaluation. There is a need to consult with the Road and Traffic Authorities in the State and the Local Authority on the technical aspects, and on the question of responsibility and cost.

The Main Street is a matter of great local importance and the views of the business community and the users of the Main Street must be sought, not only at the problem formulation stage, but also when options are being developed and evaluated. Special attention should be given to the people who participated in the data collection. A talk to the High School students showing the result of their contribution, and a discussion with the Chamber of Commerce should be high on the agenda.

Finally, there is a need to establish a working relationship with the decision-makers, who have a better understanding of what is, and what is not, feasible. For this reason it is sensible to develop a range of options (with the possible impacts), so that an informed discussion can take place.

PART IV SUMMARY

This report presents the results of an explanatory investigation into the factors influencing road safety on the 'main street' of country towns and how road safety may be improved. The objectives of the research were to develop a simple process of analysis and generating options for country towns, to test alternative techniques of data collection and analysis and to add to knowledge about pedestrian and vehicle conflict in country towns. The approach adopted was to explain "conflict" in its wider context and to derive a conceptual framework for the research study (Part I), to test the framework with data drawn from two case studies (Part II), and, based on the general findings arising from those case studies, to formulate preliminary guidelines for data collection, for analysis and interpretation, and for the generation and evaluation of options (Part III).

Part I has placed pedestrian/vehicle conflict in a broader context of local, regional and through traffic. The different conflict situations on the road space have been identified (Figure 1-4) and this conflict has been considered from two perspectives: vehicle traffic has an impact on the road environment, including the safety of pedestrians which frontage development attracts, while the activities generated by the road environment affect the performance along the road, including the safety of drivers. Because conflict is the outcome of many interactions it needs to be measured accurately and this is summarised in terms of friction and impact (pp 1-6 to 1-9). The conceptual research framework adopted in this project is based on a typology of road/environments and related research that leads to the delinlation of the scope of the research (Figure 1-12).

Part II presents the results of the research aimed at testing the conceptual framework in country towns. In view of the limited budget for data collection, a case study approach was adopted and two country towns in New South Wales were selected - Moss Vale and Parkes. The selection criteria are set out (pp 2-1 to 2-2) which include accidents involving vehicles in country towns. The basic surveys - vehicle numberplates, speeds, pedestrian movements, video observations, interviews of businesses and visitors, land use and transport and traffic management facilities - are outlined (pp 2-3 to 2-5). After describing the essential characteristics of the two case study towns the remainder of Part II presents the results of the surveys. Finally, some suggestions for reducing conflict in Moss Vale and Parkes are made (pp 2-25 to 2-27).

When the highway runs through the Main Street there is an inevitable conflict between the through function of the highway and the retail, commercial and pedestrian functions of the main street. This conflict may not necessarily manifest itself in accident statistics, but it does represent a risk and a potential for accidents. Not all associations between traffic and activities in the Main Street are negative. The preliminary guidelines offered in Part III are intended to provide a basis for assessing the nature and extent of both negative and positive associations, and for developing and evaluating options for reducing conflict and reinforcing positive associations. They are intended for correlation and comment, and are clearly only preliminary ideas for further refinement. They do not, for example, contain recommendations on what decisions to make as that will depend on particular, and local, circumstances, including the issue of responsibility for implementation. However, where there are specific research findings which bear on the consideration of these options, these are incorporated in the guidelines.

ACKNOWLEDGEMENT

Initial ideas for the project were discussed with Mr P. Croft of the (then) Traffic Authority of New South Wales, Dr A. Fisher and Mr T. ten Brummelaar, Senior Lecturers at the Department of Transport Engineering, University of New South Wales. Data collection and analysis were carried out with the assistance of Ms Julie Wells and Ms Kate Paterson, research assistants, and Mr V. Pipal, senior technical officer, who was responsible for the video recording with case studies and assisted with the video analysis. The perspective sketches of Moss Vale and Parkes were drawn by Elias Duek Cohen, formerly Associate Professor at the School of Town Planning.

The Accident Research Unit of the Traffic Authority of New South Wales made data available on accidents in country towns. Mr T. Morrissey, Shire Engineer, Parkes, and Mr I. Sinclair, Town Planner, Wingacarribee Shire Council, provided basic data and advice on local conditions. Students of the Moss Vale and Parkes High Schools, supported by their teachers, Mr Gary Sutton, assisted with the field data collection. Mr Bernie Crowe of the Chamber of Commerce in Parkes and Mr Owen Edwards of the Chamber of Commerce in Moss Vale, and the members of the Chambers in each town assisted in obtaining the data for the business survey.

The authors wish to thank all those people and the people from the communities of Moss Vale and Parkes who willingly responded to the questionnaires and surveys. Without all this support it would have been impossible to undertake and complete this project.

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APPENDICES

PARKES
BUSINESS ACTIVITY SURVEY

1. Type of business? (Please state as accurately as possible.)

_____

2. Address of business?

_____

_____

3. What is the number of (a) full-time employees? ☐
(b) part-time employees? ☐
(c) immediate family employees? ☐
(d) self employed? Yes ☐ No ☐

TOTAL ☐

4. Does this business provide the sole income for your household?

Yes ☐ No ☐ (Please tick appropriate box)

5. Do you:

(a) own the property from which the business is conducted ☐
(b) own the business ☐
(c) manage the business ☐

(Please tick appropriate box(es))

6a. **If you rent** the premises is the rental range:

(a) less than $100 per week

(b) between $100 and $200 per week

(c) between $200 and $300 per week

(d) more than $300 per week

(Please tick appropriate box)

6b Has the rental increased over the year by:

Less than 10%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	More than 100%

(Please tick relevant category)

7. How long have **you** been operating this business in these premises?

_____

8. When would the majority of your business be done?

Mon	Tue	Wed	Thu	Fri	Sat	Sun

(Please tick relevant category)

9. Does your turnover vary markedly throughout the year?

Yes ☐ No ☐

9a. **If yes,** what are the high periods?

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(Please tick relevant category)

What are the low periods?

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(Please tick relevant category)

10. What proportion of your trade would be related to traffic passing through town on the **Newell** Highway?

Less than 10%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	More than 100%

(Please tick relevant category)

11. Please estimate your average weekly turnover

$ _____ per week

(This information will be treated as confidential)

12. Is this business part of a chain of stores?

Yes ☐ No ☐

13. What proportion of your customers live in

	%
Parkes	
Forbes	
Brolgan	
Tichborne	
Cokkamidgera	
Alectown	
Other parts of the district	
Are passing trade	
Other trade	

14. If **your business advertises:**

(a) What are the areas you target?

Parkes	
Forbes	
Brolgan	
Tichborne	
Cokkamidgera	
Alectown	
Other parts of the district	
Are passing trade	
Other trade	

(Please tick appropriate boxes)

(b) What advertising means do you use?

Pamphlets in letterboxes	☐
Newspaper	☐
Radio	☐
Television	☐
No advertising	☐

(Please tick appropriate box(es))

15. Do you have plans for improving or expanding your premises?

Yes ☐ No ☐

(please tick appropriate box)

16. Are you aware of a demand for a particular business activity which is not being met? If so, what?

_____

_____

17. Are there problems in the shopping centre related to the conflict between vehicles and pedestrians?

Major Problems ☐ Minor Problems ☐ No Problems ☐

17a. If yes, what are these problems?

_____

_____

_____

_____

17b. How do you think these problems can be alleviated?

_____

_____

18. In particular, what do you think can be done to make the shopping centre safer for pedestrians?

19. If there is any other information you would like to contribute in relation to the shopping environment please do so here.

ALL THE ANSWERS YOU GIVE WILL BE STRICLTLY CONFIDENTIAL AND WILL BE USED ONLY IN STATISTICAL TABLES WHERE THEY CAN IN NO WAY BE ASSOCIATED WITH YOUR ANSWERS.

THAN YOU FOR YOUR ASSISTANCE

(17)

PEDESTRIAN SURVEY

Location: (1)

Time: 10.20 (20-30)F.

Interviewer: J.

1. In which town do you live?

   Parkes

2. How did you arrive here today? Did you travel by:

   (a) car as a driver
   (b) car as a passenger
   (c) bus
   (d) motorcycle
   (e) bicycle
   (f) train
   (h) taxi
   (i) other please specify
   or
   (h) walk

3. If you came by car/motorcycle. Where did you park?

   Main St.

4. What was the main reason for you coming here today?

   (a) shopping/personal visit (b) work (c) other;

   (please specify)_____

5. How often do you visit this shopping centre?

   2-3 times/wk.

6. How long do you think you will stay at this shopping centre today?

   1½ hours.

7. How many establishments are you likely to vist today?

   10

8. How busy do you think the traffic on this street is just now?

(a) very busy (b) busy (c) moderately busy (d) Not very busy

(e) not busy

9. Would you cross this street away from the pedestrian crossings?

(a) Yes (go directly to question 11) (b) No (c) other;

please specify _____

10. Why do you think it is unsafe to cross this street away from the pedestrian crossings?_____

_____

11. Would you still come to this shopping centre if there was more traffic using this street?

(a) Yes (b) No (c) other; (please specify;_____

_____

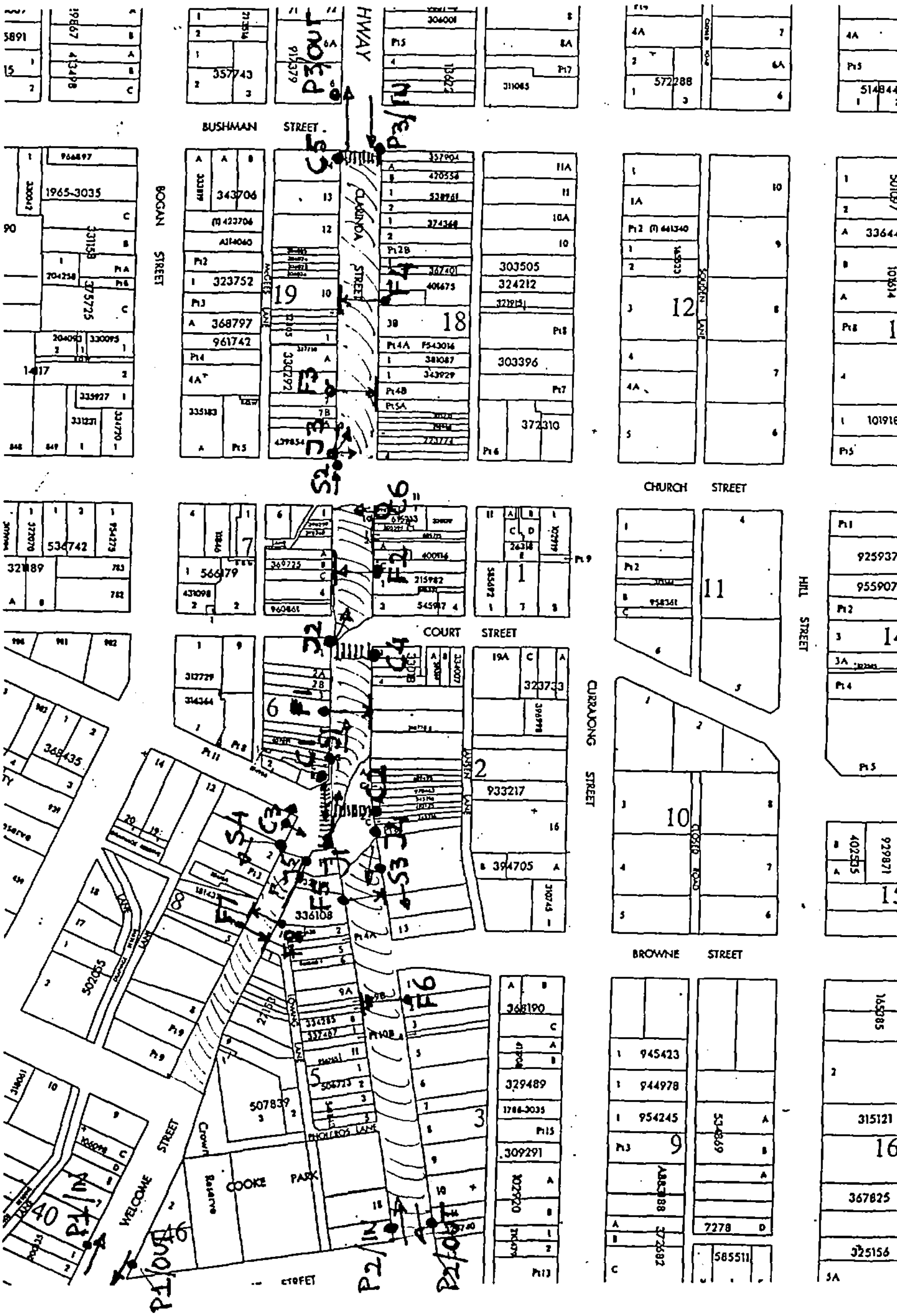
12. Do you think the traffic travels too fast on this street for you to cross it safely?

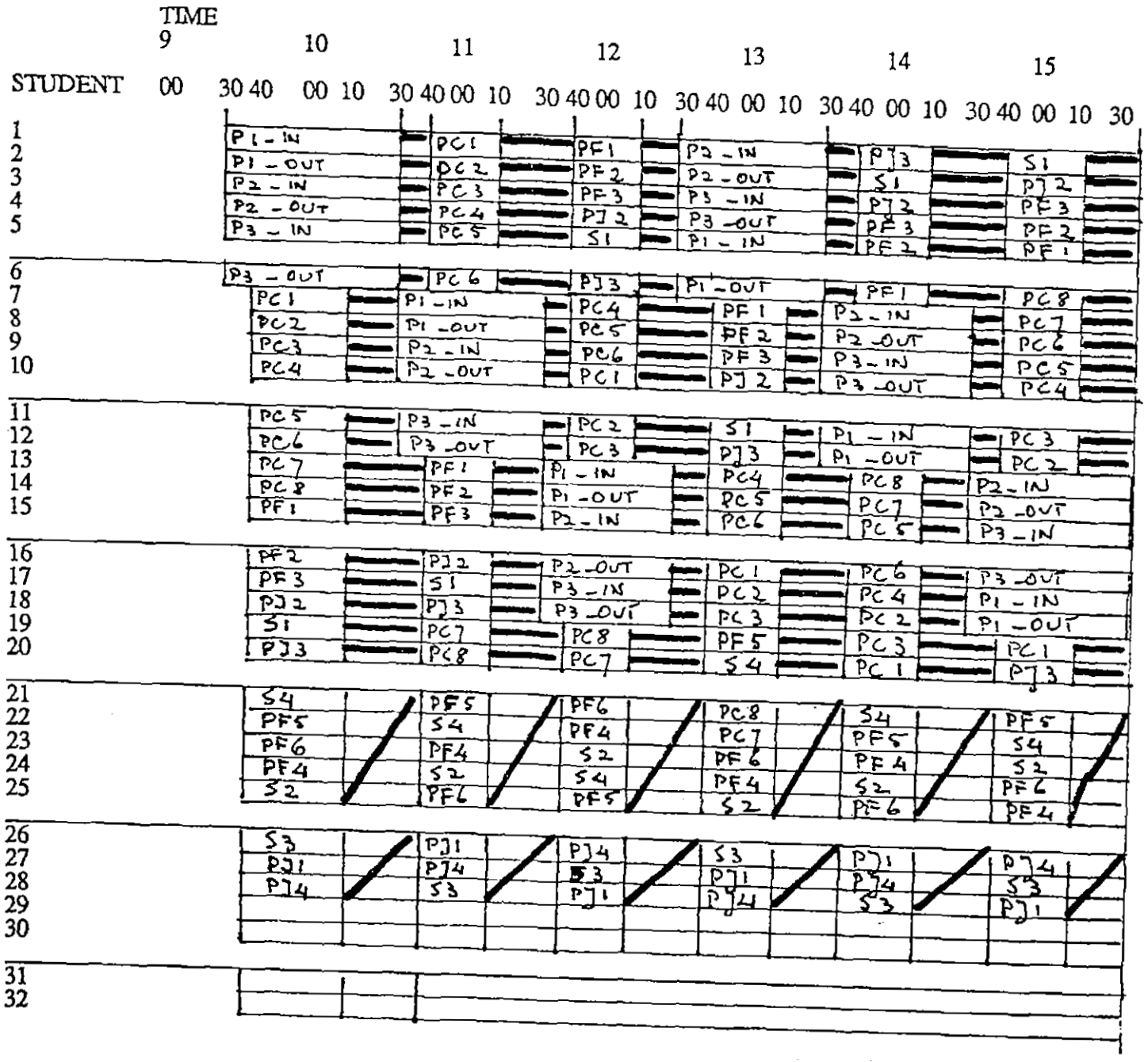
(a) Yes (b) No (c) other; (please specify;_____

Sometimes.

13. What do you think could be done to make this street safer for pedestrians?

DON'T KNOW.


BUSHMAN STREET
BOGAN STREET
CLARINDA STREET
CHURCH STREET
COURT STREET
CURRAJONG STREET
HILL STREET
BROWNE STREET
WELCOME STREET
COOKE PARK
Crown Reserve
P3/OUT
P3/IN
P1/IN
P1/OUT
P2/IN
P2/OUT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