EVALUATION OF THE SEVERANCE EFFECTS OF A PROPOSED RAPID TRANSIT CORRIDOR

M. BRADDOCK
Senior Teaching Fellow
Department of Architecture
The University of Adelaide.

ABSTRACT: *The paper describes a study of potential trip severance and disruption to the residential environment by a proposed rapid transit public transport route through suburbs in Adelaide. The study showed that physical severance can be avoided, and in some places access can be improved, if appropriate route crossings are provided. Evaluation of a number of research methods used in the study suggests that more consideration of the behaviour underlying trip-making will lead to better solutions than simple trip-counting procedures in this and perhaps in other aspects of transport planning. Study data on pedestrian movement around suburban areas have important implications for residential subdivision and associated transport planning.*

Background Paper for
Session 5

EVALUATION OF SEVERANCE

INTRODUCTION

This paper describes methods of studying the potential disruption of normal trip patterns and activities which may result from construction of new transportation corridors through residential areas. It is based on a study of potential severance by a proposed rapid transit system passing through the north eastern suburbs of Adelaide (NEAPTR). Although the paper concentrates on identification and prevention of severance, research methods which may be appropriate in other transport planning contexts, and the wider planning implications of data on pedestrian movement in the suburban environment are also discussed.

Severance may be associated with many new transportation proposals, but it has received little attention from researchers or transport planners in this country. Professional and public reaction to major transport proposals, such as those of the Metropolitan Adelaide Transportation Study and similar proposals in other Australian cities, has been most concerned with the effects of land and property acquisition and impacts on the amenity of the residential environment (Duigan, 1970). In the UK however:

> Much of the opposition to urban motorways, for instance, stems not just from destruction of people's homes and the inadequacy of the compensation or rehousing offered. It is rooted in fear of change, dislocation of the community, and disruption of people's lives and patterns of movement. Research [has shown] ... to most people's surprise that 'severance' was a bigger factor than traffic noise in people's worries about nearby major road building.
> (Tony Aldous, 1975:10.)

It is possible to distinguish between physical severance and 'psychological severance,' the latter occurring when despite the provision of crossings, people feel cut off from areas which were easily accessible before construction of a road or other barrier to movement (Urban Motorways Project Team, 1973). Lee et al. (1975), suggest that psychological severance causes people to adapt their perceptions of accessible neighbourhood and shift the centre of gravity of their trips away from the barrier, but no comparative studies of trips before and after barrier construction are available to confirm this hypothesis.

Studies elsewhere (Geelong Regional Planning Authority, 1975; Lassiere, 1976) have considered physical severance of pedestrian, cyclist and vehicle movement; physical and psychological severance of communities; and severance during construction of a transport facility. This study concentrated on physical severance of pedestrian and cyclist movement. The study area included middle and outer suburbs adjacent to the proposed route of the North East Area

Light Rail Line, which will consist of a protected right of way for high speed trams linking the City of Adelaide with Tea Tree Plaza, some 15 km north east of the City. The tram route follows the Modbury Transport Corridor designated in the Town Planning Committee Report of 1962; in the study area the majority of the corridor consists of a band of undeveloped land running through residential areas. Subdivisions have been designed around the existing corridor reserve, which has physically divided the community since development first started. Community severance or new psychological severance is therefore unlikely to occur. Current vehicle access across the corridor is limited, but all existing road crossings are to be maintained through grade separation or controlled level crossings. In addition to the roads however, pedestrians and cyclists use a number of informal and formed crossings for access to the other side. Potential severance of trips which use these crossings was the focus of the study.

EVALUATION OF SEVERANCE: PRINCIPLES

Physical severance of trips occurs when an impassable barrier is placed across an existing pathway. The degree of severance therefore depends upon existing patterns of trips in relation to the position of the barrier, and what the future pattern of trips might be in its absence. Points of severance depend on where people are travelling, their origins, destinations and pathways in relation to the proposed barrier. The amount of severance is the number of trips affected. The importance of severance in terms of social equity depends upon which people are affected, whether alternative destinations are available to them, and whether the extent of possible detours around the barrier will lead to trip suppression for the less mobile sectors of the population.

It is possible to identify severance of current trips through simple observation of crossing points and counts of the number of users. However, such information is of limited value for prevention of trip disruption. It gives no indication of the reasons for trips, their origins and destinations, or pathways which people use; nor can it suggest what the future patterns of trips might be. To minimise disruption and to take account of future change, it is necessary to find out more about the reasons for trip-making, where people go for various activities, how far they travel and how frequently, which pathways they use, and which groups of people make various types of trips. This information can then be examined in specific locations to find out how trips are related to particular facilities and other destination points and where they cross the path of the proposed barrier. Probable future change in the population characteristics and the location of facilities which may affect the direction and frequency of trips can also be examined before means of minimising disruption are developed.

EVALUATION OF SEVERANCE: PRACTICE

Method

Since this study was intended to provide guidelines for future work on severance, a number of different research approaches were tested. Through these methods, it was possible to identify which characteristics of the resident population affect trip-making, the geographical size of the area likely to be affected by severance, and the range of local facilities which should be included in the analysis. Effective research methods for use in future studies could then be examined.

The location of existing facilities in the study area, existing barriers to movement, and existing route crossing points were identified prior to any field survey work. This familiarised the researchers with the area, and enabled construction of a preliminary list of possible destinations for walking and cycling trips. This list did not include destinations of informal trips such as visiting or walking for pleasure. Three approaches were then used to identify trips close to or crossing the proposed route. These were:

- Facility-based, examining the effect of the new barrier on facility catchments. This included surveys at local shops, playgrounds, child care centres and kindergartens and clubs (379 respondents) and surveys of all children attending local schools (3956 respondents).
- Resident-based, concentrating on movement patterns of residents close to the route. This method consisted of a household survey of 732 residents living within 150 km of the route.
- Route-based, counting the number of people actually crossing the route at various points.

Some of the survey results are described below[1]. Figures include both pedestrian and cyclist trips, since the majority of cycling trips were made by children, and had similar characteristics to the pedestrian trips in terms of destinations, frequencies and distances travelled.

How much Walking, to Where, and Why?

Trip purposes were divided into 10 categories, following an exploratory pilot test. These were:

- to the bus stop
- to shops
- strolling (includes walking for pleasure, walking dogs, going for a bike ride)
- visiting friends and relations
- to school
- taking children to school

---

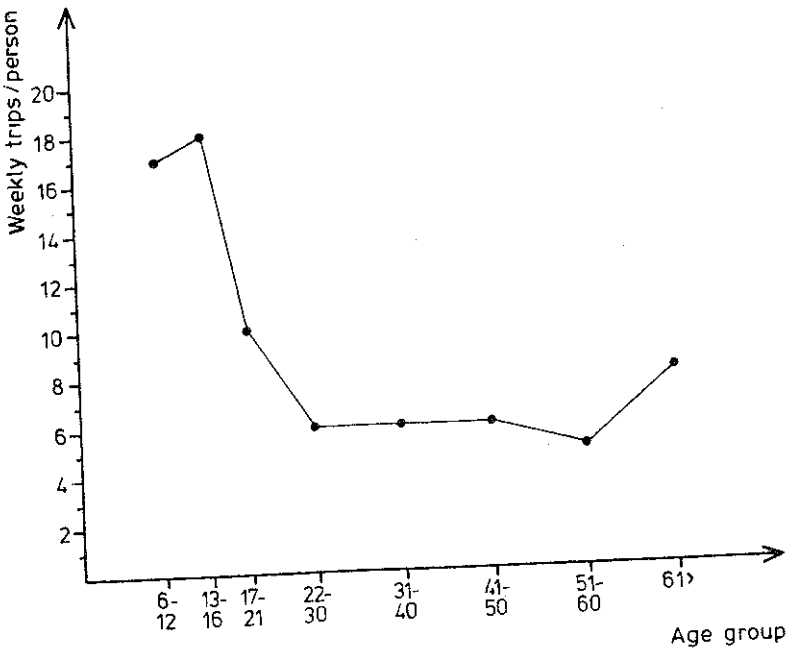
1 More information is available in the full study report (Braddock and Dixon, 1978).

- to work
- to recreation facilities, clubs, churches, pools, playgrounds
- to post or phone box
- to clinics, surgeries, child care facilities

Of these trip types, five (to shops, bus stops, schools, visiting friends and walking for pleasure) occurred most frequently in all parts of the study area, but the actual number of trips per head per week varied in different locations[1]. Differences in trip frequency were found to be attributable to:

- the age structure of the population;
- the accessibility of facilities and other destinations;
- the quality of the pedestrian and cyclist environment, including provision of formed pathways.

Fig. 1 Average number of walking and cycling trips per person per week by age group



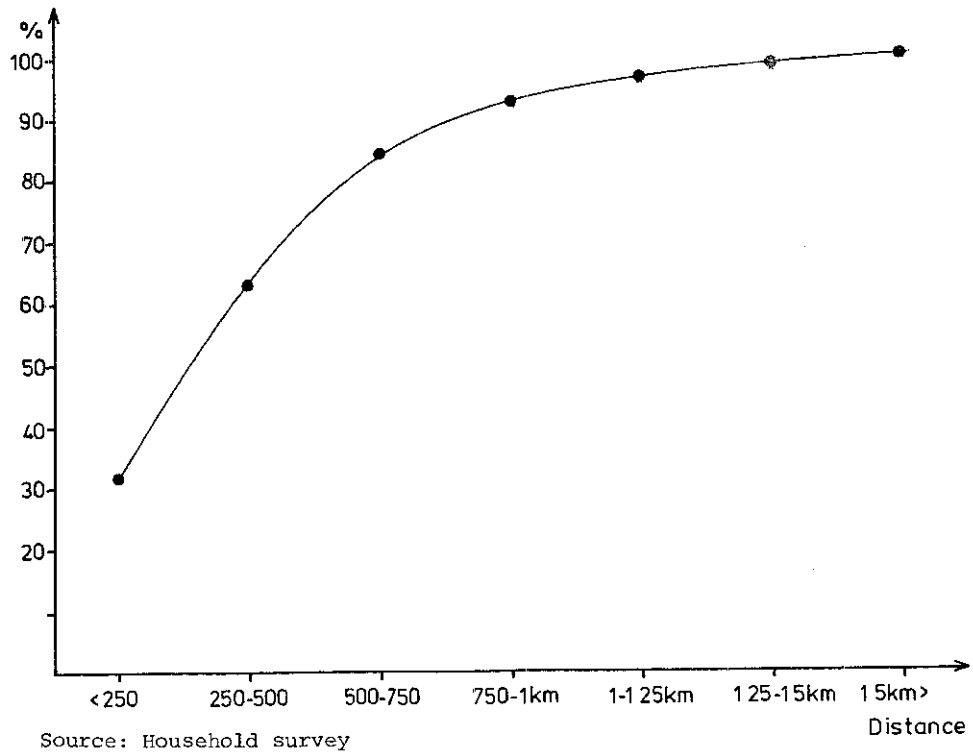
Source: Household survey and Schools survey

1 The study area was divided into a number of sectors for detailed analysis.

Figure 1 shows the variation of trip frequency with age. As might be expected, the most active age group are children under 16 years, who do not have the use of a car. Young adults aged 17 to 21 years and the aged are the next most active, and similarly are less likely to have ready access to a car of their own than the middle aged groups. The data also indicated that young couples in the 22 to 30 age group without children commonly do not walk at all around the residential area. It seems likely that for such couples, both partners work and are unlikely to spend much time in the neighbourhood during the week.

The accessibility of facilities is a function of distance, the availability of suitable routes from origin to destination, and the personal mobility of users. Figure 2 illustrates the decrease in trip frequency with increasing airline distance for all trip types. Over 60 percent of pedestrian and cyclist trips recorded in the household survey covered an airline distance of less than 500m, 85 percent being less than 750m. Table 1 shows the distances associated with different trip purposes. People are clearly prepared to walk further for some purposes than others. The figures for playgrounds illustrate the effects of personal mobility on trip length; 74 percent of users were less than 12 years old, and their trip range was limited by parental restrictions.

Fig. 2 Cumulative percentage of trips by distance



Source: Household survey

Table 1: Cumulative Percent of Pedestrian Users by Distance and Trip Type

Airline Distance	Trip Types						
	To Bus	To Shops	Strolling	Visiting	Play-grounds	To Primary School	To High School
Under 250m	49%	49%	28%	30%	74%	24%	8%
250 - 500m	80%	73%	59%	60%	93%	60%	21%
500 - 750m	98%	91%	82%	83%	45%	86%	46%
750m - 1km	100%	100%	87%	92%	100%	96%	56%
1km - 1.24km			91%	100%		100%	76%
1.25km - 1.5km			93%				86%
Over 1.5km			100%				100%

Source: Surveys at schools, shopping centres, playgrounds and household survey.

The effect of pathway availability was noted in comparison of figures for different parts of the study area. In places where facilities were distant from dwellings, or where ground distances were considerably greater than airline distances due to the street layout, few walking trips to facilities were recorded.

The effect of the quality of the pedestrian environment on trip making was clear in comparisons of the frequency of walking for pleasure, strolling and visiting friends in different parts of the study area. Few such trips occurred in areas where the environment was barren or where there were no formed footpaths on or away from the roads, whilst more occurred where the environment was well-treed and attractive.

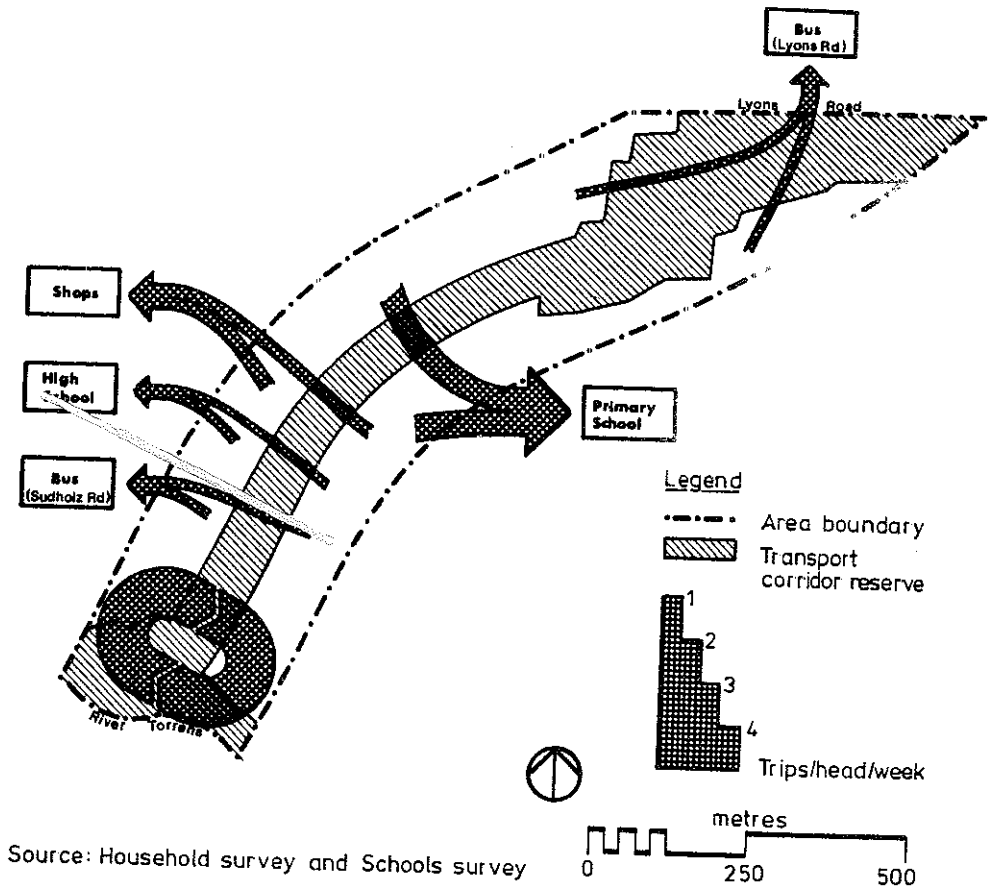
How are Trips Affected by the Proposed Barrier? An Example of the Method of Severance Assessment

The data above illustrates that the most active population groups in terms of pedestrian and cyclist trips are young people and the aged; the most common trip types are to shops, bus stops, schools, strolling and visiting. And the distances which people are typically prepared to travel are tabulated. With this information it is possible to focus attention on those facilities whose catchments extend beyond the proposed barrier, and those people living in the vicinity of the barrier whose trips are likely to be affected. The routes of affected trips can then be examined in relation to the path of the proposed barrier, and actual destinations and crossing points can be identified; the method is illustrated below.

Figure 3 shows the major destinations of pedestrian and cyclist trips in one part of the study area. Residents on the western side of the transport corridor reserve cross it to visit friends and when strolling, and all primary school children on the west cross to go to school. Residents east of the corridor must cross it to reach all local facilities except the primary school. The reserve is hard to cross

in this area since the terrain is steep, and follows the path of a creek. There are a number of informal crossings, which are used mainly by children. Actual crossing points used by residents are shown in Figure 4. Due to the terrain, many people detour around the reserve, using the road crossings at the northern and southern points of the diagram.

Fig.3 Major destinations of walking and cycling trips



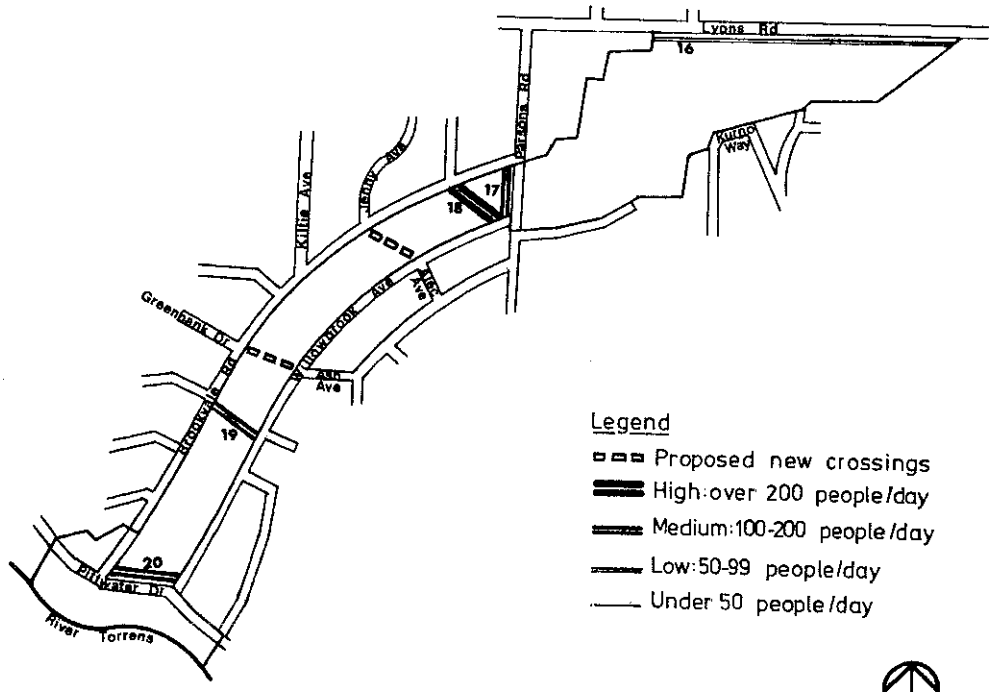
Source: Household survey and Schools survey

Future change in patterns of pedestrian trips may be caused by changes in the number of residents and their age structure, changes in car ownership, changes in the provision or location of facilities, and changes in the quality of the pedestrian environment. In newer areas which are not fully developed, additional incoming residents will increase the total number of pedestrian trips. Aging of the population may lead to increases or decreases in the age groups who constitute the majority of pedestrians, and hence affect overall trip frequencies. Changes in car ownership are unlikely to affect trip patterns, the most active groups being those who are unlikely to have personal use of a car due to their age. Where new facilities are to be developed, their catchments and probable access routes must be examined. And proposed changes in the quality of open space, provision of cyclist and pedestrian paths, or road access must also be taken into account.

In the example above, future change is most likely to be manifest in a decrease in the overall level of pedestrian trips due to the age structure of the population, which currently includes a high proportion of children. No new facilities which will attract pedestrian and cyclist trips are proposed. Although construction of footpaths along existing residential streets is most unlikely, there will be significant changes in the quality of open space after construction of the new transport facility, since the existing transport corridor reserve is a popular destination for informal recreation and walking trips. Effects on these trips must be considered in the analysis.

This information can now be used to choose the most appropriate means of preventing trip severance in this area. The existing street pattern tends to channel people towards the reserve, which is hard to cross because of the terrain and lack of formed footpaths. People therefore detour around the reserve for access to the shops and other facilities from the east, and for access to the primary school from the west. Access to the facilities can thus be improved through construction of crossings at the points indicated in the diagram, together with retention of the existing crossing 19. These new crossings will reduce use of crossing 18, but access along the road to the primary school will still be required. In view of the age of users and relatively high traffic volumes, separate rights of way for pedestrians and cyclists on the road crossing were recommended. High usage of the corridor reserve as a recreation area led to proposals for maintaining the quality of open space and improving the pedestrian environment through construction of a linear path along the corridor to link with open space at the River Torrens to the south.

Fig.4 Current use of crossing points



Source: Household survey, Schools survey and traffic counts

METHODS FOR FUTURE STUDIES

The example above illustrates that an examination of existing movements, barriers and pathways around a local area and consideration of future changes in trip patterns can be used to devise methods of preventing physical severance, and in some cases of improving current access to facilities. Is such detailed work necessary in all instances, and how should severance assessment be carried out in future studies?

This study concentrated on physical severance of pedestrian and cyclist trips due to the particular characteristics of the study area described in the introduction. It can be assumed that disruption to pedestrian and cyclist trips will be more important than disruption of vehicle trips in most instances. Whilst detour around a barrier may add some minutes to driving time, it is unlikely to lead to suppression of a vehicle trip. For pedestrians and cyclists however, additional distance around a barrier may inhibit or reduce the

frequency of trip-making. Patterns of pedestrian movement and catchment areas of facilities which have emerged in this study and those reported elsewhere suggest that it is possible to make some general assumptions about:

- the effect of age on pedestrian trip-making;
- acceptable walking distances to facilities of various types;
- the effect of available alternative facilities on the need to maintain pedestrian access.

The most frequent trip types for pedestrians and cyclists identified in this study were trips to shops, schools, bus stops, walking for pleasure and visiting friends. Other trip types occurred only infrequently. The likely destinations for trips to shops, schools and bus stops are easily identified, since the majority of people use the closest facility. Walking for pleasure occurs most frequently where the pedestrian environment is attractive, in locations such as creeks, reserves and open spaces, which can also be identified. Destinations for visiting trips depend on the location of friends, and follow no general pattern; but the majority are within 500m of the dwelling, and most trips are made by children. Airline distances for various trip types found in this study were given in Table 1.

With this information, a study of location of facilities, existing pathways and age structure of residents can be used to estimate likely volumes of pedestrian traffic, catchment areas for facilities, and route patterns of pedestrians and cyclists in an area. Any special local characteristics, such as existing barriers to movement, or particularly attractive facilities must be taken into account. These patterns can then be examined in relation to the path of the planned transportation route to give an estimate of severance.

Short cut methods based on such rules of thumb may be appropriate in some instances, such as the initial evaluation of options for transportation routes. It is likely however that preliminary work will indicate a need for more detailed study either at that stage (for example, if existing communities lie in the path of the transport route) or at the design stage, when needs for crossing points and paths must be specified in greater detail.

Of the more detailed methods used in this study, the household survey was the most cost-effective in terms of the quality of information produced. All trips, whether or not they are directed to a specific facility, can be identified. More importantly, trip purposes, origins and destinations can be examined. A simple survey of the type used in this study is readily adaptable for situations where community severance or vehicle severance must be considered.

Counting of people on existing crossing points was used mainly as a check on the validity of other survey results in this study, and as such was a useful method to follow. Unfortunately, counting of trips or traffic has been frequently used in the past as the sole method of research for severance

and other types of transport planning studies. As discussed, counting indicates only how many people actually cross a point, and can provide no information on reasons for trips, origins or destinations. It cannot therefore be used as a means of identifying the optimum location of crossings to maintain or improve accessibility. It may be possible to interview people at crossing points, but the experience of this study suggests that practical problems would arise through bunching of usage at peak hours. Further, the cost of counts spread over a number of days is very comparable with the cost of a household survey.

Optimum location of crossings will not in itself determine whether people will use them. Safety criteria suggest that, particularly in areas where the majority of users are children, grade separated crossings are the most effective. However, people are loath to make any additional effort which may be involved in using a bridge, particularly if they have to detour from their usual route. And subways are often avoided by pedestrians:

> Instead of the quiet though perhaps tatty little footpath or lane between gardens that granny used to follow to the shops, she now finds the civil engineers expect her to use a subway that is little better than a dark and smelly drain.
> (Aldous, 1975:10.)

The design of attractive crossings and the provision of sufficient space for both pedestrian and cyclist users is clearly an important part of the latter stages of severance studies.

CONCLUSION

This paper has described methods for assessing severance, and illustrated how information on current trip patterns can be used to work out means of minimising trip disruption in the future. One conclusion which emerges from the paper is that counting of the number of people and trips affected is of little use if it is intended to do anything to prevent severance. For the latter, it is necessary to look behind the numbers and study the reasons why trips are made, and how accessibility to destinations can be maintained. This conclusion may have implications in other transport planning contexts.

More generally, the study showed that the geographical location of people's dwellings relative to the facilities which they need to use is most important. If facilities are accessible, many people, particularly children, will make trips to school, shops, bus stops, friends' houses and walk for pleasure within the local area. Good contemporary neighbourhood design is based on principles of pedestrian access to local facilities, but some of the results of this study suggest that more research into currently accepted catchment area standards may be required. Pedestrians are an important element

of the transport network, and it is important that the transport planner and land use planner cooperate to insure that local facilities are accessible by foot or cycle. Trips which cannot be made within the local area will lead to additional demands on other parts of the transport system if people have to use their cars or public transport as alternatives to their feet.

REFERENCES

Aldous, Tony. (1975). Goodbye Britain? London: Sidgwick and Jackson.

Braddock, M. and Dixon, H. (1978). North East Area Light Rail Line: Severance? Report prepared for the S.A. Director-General of Transport, Adelaide.

Duigan, M.G. (1970). "The politics of urban transportation: an analysis of the conflicting interests in the debate over the Metropolitan Adelaide Transportation Study." Thesis presented as part requirement for the Honours Degree of Bachelor of Arts in the University of Adelaide.

Geelong Regional Planning Authority. (1975). Geelong: A Road Strategy: Geelong Transportation Plan: Environmental and Social Benefits and Costs Study, Final Report. Prepared by John Paterson Urban Systems Pty. Ltd. Geelong: Geelong Regional Planning Authority.

Lassiere, A. (1976). The Environmental Evaluation of Transport Plans. London: Department of the Environment.

Lee, T.R., Tagg, S.K. and Abbott, D.J. (1975). "Social Severance by Urban Roads and Motorways." Paper delivered at the PATRAC Symposium on Environmental Evaluation, September.

Urban Motorways Project Team. (1973). Report of the Urban Motorways Team to the Urban Motorways Committee. London: HMSO/Department of Environment.