PEDESTRIAN PLANNING IN THE CENTRAL AREA

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ABSTRACT: *Pedestrian circulation planning follows the same general procedures utilized in comprehensive land-use and transport planning. Key steps are: reconnaissance and inventory; analysis of characteristics; demand forecasting; concept and alternative developments; and plan formulation and appraisal. This paper discusses the first three steps. It summarises salient pedestrian travel behaviour and characteristics in central Perth. It outlines two different pedestrian demand models, a density model and a gravity type model, for the noon and evening peak periods. It discusses pedestrian planning standards and principles, determines some short-term circulation deficiencies, and recommends circulation improvements. The Perth Central Area Pedestrian Study, conducted for the Perth Metropolitan Region Planning Authority provided the basis for this paper.*

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THE PEDESTRIAN CHALLENGE

Perth is one of the major cities in the world where it is still pleasant to walk in the Central Area. Walking is enjoyed by thousands of people in the Hay Street Pedestrian Mall and through the numerous arcades during every working and shopping day of the week.

However, the walking person is being challenged for space and time by the vehicle. The demands of vehicular traffic are increasing rapidly and rational and humane solutions have to be found to serve all participants in the Central Area.

The Perth Metropolitan Region Planning Authority consequently commissioned a consultant to carry out the Perth Central Area Pedestrian Study. This paper therefore discusses pedestrian planning in the central area of Perth. The permission of the Metropolitan Region Planning Authority to draw from this Perth study is herewith acknowledged with gratitude.

INVENTORY OF THE EXISTING PEDESTRIAN SITUATION

Data relating to the pedestrian environment in the Perth Central Area is being monitored and collected by the relevant planning agencies on a periodic basis. However, it became necessary to conduct additional up-dating and expansion of the information so as to provide a sound basis for the pedestrian study.

Central Area urban development in regard to employment, parking and public transport are important inputs into the analysis of pedestrian circulation and were thus surveyed in detail.

Urban Development

The Central Area has developed along an east-west axis with significant office development along St. George's Terrace, and a concentration of retail and department stores on Hay and Murray Streets, particularly between William and Barrack Streets. (Figure 1).

Employment

Employment data by analysis zones was collected by the four categories of catering, department stores, other retail and office. The various categories have different effects on the pedestrian flows as will be seen later.

Office employment includes all people employed in establishments not included in the other three categories. It comprises predominantly people employed in Finance, Insurance, Real Estate and Business Services, Public Administration and Defence or Community Services.

The present employment of 60,248 within the Central Area (Table 1) has grown from 55,929 in 1971 and 49,318 in 1966. The growth from 1971 to 1975 was at a rate of 1.9 per cent compounded per year.

Public Transport

The Central Area is served by buses, trains and ferries which cater for many of the people entering and leaving the area each day. The surveys showed that during the evening peak hour, 15,000 people left the Central Area by public transport, representing 53 per cent of all people leaving the area during that period.

Table 1

1975 EMPLOYMENT BY CATEGORIES

EMPLOYMENT CATEGORIES	PERSONS EMPLOYED		
	South Of Railway Line	North Of Railway Line	Central Area
Catering	2,387	471	2,858
Department	3,570	-	3,570
Other Retail	8,759	976	9,735
Office	38,848	5,237	44,085
TOTAL	53,564	6,684	60,248

Parking

Car parking figures used in this study were taken from the 1975 Perth Central City Parking Study. A summary of parking spaces is shown in Table 2.

Table 2

1975 PARKING SUPPLY BY FACILITY TYPE

FACILITY TYPE	SOUTH OF RAILWAY LINE	NORTH OF RAILWAY LINE	STUDY AREA
Private	4,847	1,649	6,496
Short Term	3,169	834	4,003
Long Term	6,431	1,431	7,862
TOTAL	14,447	3,914	18,361

There is a deficiency in the amount of kerbside and off-street parking available to the general public, in that part of the study area south of the railway line.

Pedestrian Facilities

A detailed survey of existing pedestrian facilities was carried out.

Footpath Measurements

The study area contains over 32 kilometres of footpath, the majority (62 per cent) of which is between two and four metres wide. The density of obstructions was measured since it is more important than the absolute number of obstructions. With few exceptions, the study area is relatively flat - with a gradient of less than two per cent - and therefore ideal for pedestrians.

Pedestrian Counts

The numbers of pedestrians using the various pedestrian facilities within the study area were counted extensively during July and August, 1975. These counts were used to gain an understanding of the pedestrian circulation patterns; to identify periods of peak flow; to identify existing circulation problems; and to develop the demand forecasting models.

Counting Methodology

Three positions chosen as being representative of the area were used as eleven-hour counting stations for six days (Monday through Saturday). These counts were used to identify daily variations. Additional counts were made for only two-hour periods; i.e. noon counts and evening counts.

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It was then possible to identify the noon and evening peak hours as being from 12:45 P.M. to 1:45 P.M. and from 4:30 P.M. to 5:30 P.M. respectively.

Noon Footpath Counts

The numbers of pedestrians counted during the noon peak hour were in most cases, higher than the numbers counted at the same station during the evening peak hour.

The largest number of pedestrians passing any counting station during the noon hour peak was 11,400 in the Hay Street Mall. Outside the Central Area core, volumes decrease rapidly.

Evening Footpath Counts

The evening peak hour pedestrian volumes are generally much lower than the noon peak hour volumes, the only exceptions being the entrance to the Perth Central Bus Station, The Railway Station and on the footpaths leading to the two Perth City Council car parks.

The largest volumes were observed in the Hay Street Mall where 6,100 people were counted, indicating that a large number of shopping and social trips are still being made during the evening peak period.

Evening Terminal Counts

To determine pedestrian trip attractions and generations for later use in demand modelling, evening counts were made at the entrances to the railway station, at bus stops and car parks, and at exist from office buildings and shops.

ANALYSIS OF THE EXISTING PEDESTRIAN CIRCULATION

Following on from the inventory phase of recording and observing the existing pedestrian situation, the analytical tools for determining pedestrian circulation characteristics and estimating future pedestrian circulation were developed.

Pedestrian Characteristics

An understanding of pedestrian behaviour is necessary if planning for pedestrians is to be rational.

Trip Purpose

The origins and destinations of pedestrian trips can be grouped into the eight categories of; terminal (which are parking lots, bus stops and stations, and the railway station), work, employers business, personal business, shopping, eating, social/recreation, and school.

Unlike vehicular trips, the 64 possible pedestrian trip purpose combinations cannot be readily combined to a smaller number, since neither terminal-based or work-based pedestrian trips constitute the majority of all trips made during either the evening or the noon peak hours.

During the evening peak hour, which is the secondary peak during the day, terminal oriented trips constitute only about 24 per cent of all pedestrian trips. The remaining 76 per cent are made between places of employment, shops, and restaurants.

This is surprising when compared with other cities. It confirms the observation that pedestrian behaviour is not uniform over the world, and therefore pedestrian planning has to be strongly based on locally observed data.

Trip Generations and Attractions

Counts made during the study were used to establish generation and attraction rates for establishments with diff-erent types of employment and for the various types of car parks. Table 3 shows generation rates which are ratios of the number of people leaving an establishment during the evening peak hour compared to the number of people employed in that establishment.

The high rates for department stores and other retail and catering establishments are caused by shoppers who enter and leave several shops during the evening period and are included in each count.

Table 3

TRIP GENERATION RATES
Evening Peak Hour 4:30 P.M. to 5:30 P.M.

EMPLOYMENT CATEGORY	GENERATION RATE (1)
Department stores	3.48
Retail and catering stores	4.93
Offices	0.44

(1) Pedestrians per employee

Table 4 shows the attraction rates for car parks developed from counts made during the study. The attraction rate is the ratio of people entering a car park during the evening peak hour compared to the number of cars parked in that car park at 4:30 P.M.

Table 4

TRIP ATTRACTION RATES

Evening Peak Hour 4:30 P.M. to 5:30 P.M.

CAR PARK CATEGORY	ATTRACTION RATE [1]
P.C.C. Commuter Car Park	0.99
P.C.C. Business Car Park	0.86
Commercial Car Park	1.02

(1) Pedestrian per car parked at 4:30 P.M.

Walking Speeds, Densities and Flows

Basic information regarding pedestrian walking speeds, density and flows were collected. The most important characteristic is the walking speed of pedestrians. These speeds measured during the study at different locations are shown in Table 5.

A study made by Older (1968) on the relationship between the speed, density and flow of pedestrians on footpaths shows a straight line relationship between speed and density for densities of less than 2.6 pedestrians per square metre. Older developed the equation: SPEED = 4.72 - 1.21 x DENSITY, where speed is measured in kilometres per hour and density is measured in pedestrians per square metre.

Using the above equation, a flow curve can be developed with the equation: FLOW = (4720 - 1210 x DENSITY), x DENSITY, where flow is measured in pedestrians per metre width per hour.

TABLE 5

MEASURED WALKING SPEEDS

LOCATION	NOON PEAK HOUR (Km/hour)	P.M. PEAK HOUR (Km/hour)
Piccadilly Arcade	4.07	5.06
Plaza Arcade	3.84	5.09
City Arcade	3.87	4.60
Hay Street Mall	3.48	4.71
Murray Street (Between City & Plaza)	3.86	4.58
Barrack Street (Between Hay Street & St. George's Terrace)	4.01	4.06

The maximum capacity of a footpath is thus approximately 4,600 pedestrians per metre width per hour, occurring at a density of 1.94 pedestrians per square metre and an average walking speed of 2.38 kilometres per hour. At this density, the pedestrians using the footpath will have their movements restricted and will be forced to form lines from time to time.

Table 6 shows pedestrian densities measured in the Central Area of Perth.

Pedestrian Demand

The number of pedestrians using a footpath varies throughout each year, week, day and hour.

Table 6

1975 PEDESTRIAN NOON PEAK HOUR DENSITIES

LOCATION	DENSITY (Pedestrians per square metre)
Piccadilly Arcade	0.23
Plaza Arcade	0.61
City Arcade	0.56
Murray Street (South Side) between City and Plaza Arcades	0.43
Barrack Street (West Side) between Hay Street and St. George's Terrace	0.31
Barrack Street (West Side) between Hay and Murray Streets	0.57
Hay Street Mall	0.36

Temporal Variation

The variations in pedestrian volumes with time reflect the economic and social demands of the individual pedestrian. These trip-making desires are cyclical and reflect the seasonal, daily and hourly patterns of living of the persons in the area.

Seasonal Variation

Noon hour pedestrian flows are highly seasonal with the pre-Christmas period representing the peak period. Since the inventory phase of the study was conducted only over a two-month period, i.e. July and August, it was not possible to measure the seasonal variation directly. However, since most of the pedestrian activity during the noon peak period is strongly shopping oriented, the seasonal variation was equated to the variation in the number of retail sales transactions in the major stores in the study area.

Daily Variation

Ratios were developed by which noon hour counts of any day of the week during different conditions could adjusted to the equivalent fine weather Friday count. These ratios are shown in Table 7.

Table 7

DAILY VARIATION OF PEDESTRIAN VOLUMES

	FINE WEATHER	POOR WEATHER
Monday	0.87	0.75
Tuesday	0.85	0.74
Wednesday	0.90	0.79
Thursday	0.95	0.84
Friday	1.00	0.88

Hourly Variation

Pedestrian flows varied greatly throughout each day with peaks corresponding to the trip to work, the lunch hour, and the trip home from work.

Design Hour Volume

A certain level of pedestrian activity has to be selected as the design hour volume on which facility design will be based.

The factors in Table 7 were used to equate noon hour counts made during any day to that count which could be expected at the same position on a fine Friday. The Friday of the fourth highest week was chosen as the design day, with the noon peak hour on this same day being the design hour volume or pedestrian demand. This design hour will be exceeded approximately six days each year. The average annual Friday noon peak hour corresponds to a sales index of 100 while the index of the Fridays counted is 91. The ratio of the design hourly volume to the average Friday volume is 1.27.

The evening peak hour model only describes trips which end at transport terminals during the evening peak hour. No adjustments were made to the counted flows.

Peak Hour Demand

The highest pedestrian demands are concentrated around the areas of retail shopping. The Hay Street Mall and Murray Street between William and Barrack Streets have pedestrian demands of 15,960 and 11,620 pedestrians per hour respectively.

The demand along Hay Street drops with increasing distance from the Mall to 2,430 pedestrians per hour on both footpaths west of Mt. Newman House and 2,900 pedestrians per hour on both footpaths east of Irwin Street.

Pedestrian Demand Models

The relationships between the variables of a system, expressed in equations or formulae, commonly called models, highlight the basic structure of the system, and enable the planner to understand and thus purposefully influence the development of pedestrian systems, with good expectations of success.

However, with the increasing complexity and sophis-tications of models, the underlying form of the pedestrian system becomes less and less understandable, which is a genuine criticism from the planning profession.

For the evening peak period, a conventional urban transportation study approach has been used to analyse and forecast pedestrian movements. The assumption is that pedes-trian movements are as regular, purposeful and direct as peak hour motor vehicle traffic, but this is only true to a limited extent for the morning and evening pedestrian peak periods.

A second model, the pedestrian density model, was specifically developed to exploit the relationships between pedestrian densities and adjacent land uses. This model has been used for the noon peak period in a number of cities.

Footway Network

For both the noon hour and the evening peak hour analysis, it was necessary to derive walking times between all pairs of analysis zones. Because of the grid lay-out of pedes-trian routes in the Central Area as well as the delays caused to pedestrians at road crossings, a simple measure of the zone-to-zone airline distance and consequent conversions to time could not be used. Instead, the footpath network as it exists in Central Perth was simulated for computer processing.

Noon Peak Period Model

For the Perth noon peak period analysis, it was decided to use the concept of pedestrian density. The complex pattern of noon peak hour trips is seen as a function of land use and environmental factors. Pedestrian density, expressed as persons per hour walking past a specific point in the study area, is thus a function of specific characteristics within a specific distance from that point. The density model therefore does not predict from where to where the pedestrians walk, only where they walk.

An additional advantage of this concept is that it does not require the development of trip end and trip distribution models and consequently eleminates the need for costly personal survey data for calibration purposes.

Utilising a multiple linear regression analysis method, a relationship was sought between the dependent variable (numbers of persons walking past a point during one hour of lunch) and an array of independent variables at and around that point.

The following independent variables were input to the model development:

CATE. = catering employment
DEPS. = employment at department stores
ORET. = other retail employment
OFIC. = office employment
PRIV. = private parking spaces
COMM. = commuter parking spaces
BUSI. = business and shopping parking spaces
NBUS. = number of buses (or trains expressed in bus units)
PATH. = footpath width (in centimetres)
MALL. = indicator for pedestrian malls (1 or 0)
ARCA. = indicator for pedestrian arcades (1 or 0)

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The pedestrian flow at a point is, in most cases, not only a function of the attractors at that point but also the attractors surrounding the point. This would be the case for most points in the study area as they attract both terminating and through trips. An analysis of a trip length distribution for walk trips could therefore provide an indication of the size of the area around a point affecting the flow at a point.

A personal interview survey conducted for the Perth Central Area Parking Study provided the source of information on walk trip patterns. The observed survey data together with walking time information obtained from the footpath network developed for the study was used to construct a frequency distribution of walk trip lengths. From this distribution a decay curve was developed which was applied to the planning variables resulting in "weighted" data as input to the regression analysis. The weighting emphasises the influence of nearby planning variables and weakens that of more remote variables. This had the following effect:

Employment and parking spaces one walking minute away from a specific point were weighted with a factor of 0.83. The factor for two walking minutes was 0.52. The factors for three, four and five minutes walking time away from a specific point were 0.28, 0.11 and 0.03 respectively. Any attractors six or more walking minutes away from the point were considered to have no effect on the pedestrian flow of the point.

The footpath width and the indicators for malls and arcades were not weighted and only the values at the specific point were used.

A standard computer programme was utilised to develop the equation. The programme computes a multiple linear regression equation in a step sequence, adding that variable at each step which makes the greatest reduction in the error sum of squares, provided that the reduction is statistically significant. Several equations were developed and the final selection was based on statistical indicators as well as an assessment of the overall logic of the variables in question. The Perth Noon Density Model selected has the following form:

Volume = 7.6387 CATE. + 1.8160 DEPS. + 1.8160 ORET. +
2.7813 PATH. + 6337 MALL. + 1261 ARCA. - 1165

Statistics:	Number of Observations	=	82
	Coefficient of Correlation	=	0.944
	Standard Error	=	1010
	Coefficient of Variation	=	39.5%

Noon Model Analysis

Two variables, office employment and the number of buses and trains, surprisingly did not enter the final density equation. Office employment consistently exhibited a negative sign as well as showing an insignificantly low correlation. This is not unrealistic, meaning that an office building all on its own and not surrounded by attractors such as sandwich bars, etc. would not generate noon walk trips. In practice, however, the implications are that the equation may underestimate the pedestrian flow on facilities which are relatively unattractive but used as thoroughfare between office establishments and the major retail areas. The exclusion of the number of buses as a variable from the equation may have similar implications.

For the application of the model to future planning variables, two points are worth mentioning. Firstly, the present uniqueness of the Hay Street Pedestrian Mall may have produced an attractiveness factor which could be optimistic if other malls are being created in the future. On the other hand, it is quite conveivable that the loss of uniqueness could be counteracted by the fact that potential pedestrian malls such as Forrest Place and Murray Street could be developed into more attractive facilities due to the wider right-of-way available. Secondly, the model does not directly distinguish between more or less attractive arcades.

Evening Peak Period Model

As mentioned before, the pedestrian flow during the evening peak hour is, in most cases, substantially lighter than the flow during the lunch period. Nevertheless an analysis of the evening peak volumes is desirable for two reasons:

1. Facilities leading to the major transport terminals may generate the highest pedestrian flows during the evening peak period; and
2. Pedestrian facilities along the major public transport routes such as St. George's Terrace may not necessarily show the heaviest pedestrian flows, but contain the highest concentration of pedestrians with conflicts between waiting public transport passengers and through-moving people.

With the above points in mind, the analysis was basically confined to footways leading to major transport terminals and footways along major public transport routes.

The evening peak period model developed to estimate future pedestrian volumes consisted of three components:

1. An estimate of trip-ends (attractions) at public transport stops and public car parks;
2. An estimate of the above trips at the generation end, that is at office and retail establishments; and
3. A model to link both the attraction and generation end of the trips and determine the flow on the critical links in the footpath network.

The 1975 walk trip attractions at public transport stops and public car parks within the study area were determined for the evening peak hour from counts made during the inventory phase of the study. The future walk trip attractions at public transport stops were estimated using information from the Perth Central City Railway Feasibility Study.

1975 walk trips attracted to public car parks were also derived from counts. Private car parks were not considered as they would not be likely to generate walk trips outside private properties. It is estimated that a total of 22,386 persons arrived at public transport stops and public car parks on foot during the evening peak hour on an average weekday in 1975. The walk trips attracted to future public car parks were distributed using the attraction rates developed during the inventory phase.

The 1975 walk trip generation rates from offices, catering establishments, department stores and other retail establishments were determined from observed volumes.

Table 8 shows the generation rates for each employment category, the number of people employed in each category and the number of trip origins for each employment category.

Table 8

1975 TRIP GENERATION
Evening Peak Hour 4:30 P.M. to 5:30 P.M.

EMPLOYMENT CATEGORY	GENERATION RATE	TOTAL EMPLOYMENT	TRIPS GENERATED
Department	3.48	3,570	12,424
Retail and Catering	4.93	12,593	62,083
Office	0.44	44,085	19,324
		64,248	93,831

The estimated number of generated trips (93,831) is larger than the number of attracted trips (22,386). Due to shopping, business and recreational activity in the Central Area during the evening peak hour, more people are leaving their offices than arrive at the terminals.

The 19,324 trips generated from offices were distributed to the analysis zones in proportion to the office employment in each zone. The difference between the number of trip attractions and the number of trips generated from the office employment was 3,062 and represents shoppers who leave the study area during the evening peak hour. These shoppers may be people who entered the study area for the purpose of shopping or people who work in the study area who have left work before 4:30 P.M. and are shopping before leaving the study area. Table 9 shows the final generation rates after shop to shop trips have been removed.

Table 9

1975 TRIP GENERATION RATES

EMPLOYMENT CATEGORY	GENERATION RATE	TRIPS GENERATED
Office	0.44	19,324
Other	0.19	3,062
TOTAL		22,386

These generation rates were used to estimate the future walk trips generated for each analysis zone in the study area. Having established both initial trip generations and the final trip attractions, the spatial linking of these trip ends was accomplished with the well-known interactance or gravity model.

The calibration of the relative distribution rates was performed with a self-calibrating trip distribution programme of the standard transport planning package.

Having distributed the estimated trip generations and attractions, the trips were assigned onto the footpath network using a conventional minimum time path method. To check the performance of the model, estimated link volumes for 1975 could then be compared with ground counts. This comparison shows that the model produces good estimates for the total number of pedestrians using a route when both footpaths are added together along routes to major transport terminals.

The model was only used to simulate direct trips to transport terminals; it does not reflect behavioural patterns of non-terminal trips.

PEDESTRIAN CIRCULATION PRINCIPLES AND STANDARDS

Pedestrians, by their nature, move, react and change course and purpose at many points along their trip routes. To plan and design for changing conditions requires flexible principles and guidelines that, through their use, will enable planners and designers to create or enhance an attractive pedestrian environment.

Pedestrian Planning in Perth

Present pedestrian planning in Perth is documented by the pedestrian policy of the Perth City Council as put forward in the 1971 City Planning Scheme Report. Pedestrian design principles and standards as recommended by the Perth Central Area Pedestrian Study are discussed in the following.

Pedestrian Policy

The Report of the City of Perth City Planning Scheme recognises that "pedestrian movement is an integral part of the City's overall transportation considerations, as it completes many patterns of circulation and distribution, and fulfils many functions which are critical to social and business life." The City of Perth aims to promote a lively, thriving and attractive Central Area by making it safe, convenient and amenable to pedestrians.

Only within the last decade, a rapid intensification of the Central Area development caused the overcrowding of pedestrian facilities and intensifying conflicts between pedestrians and vehicles. To check this problem, the Perth City Council created the Hay Street Mall as the first stage of a pedestrian precinct.

The pedestrian precinct that the City of Perth envisages is to form the heart of a pedestrian network which will eventually tie the different elements of the city together. The development of this network is to be dynamic in nature as well as open-ended in scope so as to allow its detailed implementation to be related to future development opportunities, economic trends and the evaluation of the total transport network.

Design Principles and Standards

The main pedestrian circulation design principles and standards as suggested in the Pedestrian Study are discussed here. These standards are based on collated standards from different sources and on observations made during the study.

Levels of Service

Design standards based on capacity flow or pedestrians per lane per minute are applicable to pedestrian links which are used predominantly as a thoroughfare. The links in Perth, however, have a unique character derived from their mixed use as centres of activity and as thoroughfares, thus a standard based on pedestrian density seems more appropriate. Pedestrian density varies with effective footpath width, number of pedestrians and the type of activity as well as pedestrian speed.

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Table 10 shows the levels of service or pedestrian density range with their characteristics applicable to Perth.

Table 10

LEVEL OF SERVICE

LEVEL OF SERVICE	DENSITY RANGE (Pedestrians/m^2)	CHARACTERISTICS
1	0 to 0.3	Free moving flows
2	0.3 to 0.45	Free moving flows with occasional delays
3	0.45 to 0.6	Restricted flows with frequent delays
4	above 0.6	Restricted flows with frequent stops and forced streaming

The desirable level of service for footpaths is 1, however, level 2 is acceptable. For very short periods of time, say five minutes, levels 3 and 4 may be tolerated.

Design Speed

Pedestrian walking speed varies according to the trip purpose and the prevailing density.

Design speeds of 3.5 kilometres per hour and 5 kilometres per hour should be used for shopping orientated trips and work trips respectively. Design speeds between these two values should be used where the walk trips have mixed purposes.

Footpath Width

Footpath width should be based on pedestrian volumes, walking speeds and desired levels of service. Allowance must be made for ineffective areas of footpaths, particularly in shopping areas where "window shoppers" may reduce the effective footpath width by one metre. To determine the effective width of the footpath, a certain width has then to be added for such items as rubbish bins, signs, seats, poles and such, to arrive at the total footpath width.

Ways of Increasing Footpath Width

There are three main ways of increasing the width of a footpath. Firstly, by eliminating kerbside parking and paving over the parking lane.

Secondly, to redevelop along the building line so that space is transferred to the footpath at ground level. This method can either operate along the entire length of a footpath or at selected points. An example being where an arcade meets a street and the two conflicting streams of pedestrians cause congestion at this point which could be alleviated by the provision of extra space.

The third method is to eliminate vehicular traffic and extend the pedestrian area across the entire street.

In addition, recommendations were made regarding ramps, stairways, overpasses, crosswalks, etc.

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EXISTING CIRCULATION DEFICIENCIES AND POSSIBLE IMPROVEMENTS

It is only too convenient to assume that pedestrians behave in an orderly, straight-forward manner similar to automobile traffic. People, by the nature of their daily activities, create a variety of journeys for different reasons depending on personal interests, weather, their companions, time available and so forth.

Pedestrian Circulation Deficiencies

As mentioned earlier, Perth is fortunate to have an accepted long-range view to pedestrian planning. However, in the day-to-day management of the pedestrian system, some problems do occur.

Footpath Overcrowding

Several important footpaths were found to be congested and providing unsatisfactory levels of service.

For example, the footpath on the southern side of Murray Street between William and Barrack Streets has noon hour pedestrian demands of 3,356 and 3,028 pedestrians per hour between Barrack Street and Forrest Place and between William Street and Forrest Place respectively. The footpath width varies from 2.80 metres to 3.65 metres but this width is substantially reduced by obstructions on the street-side of the footpath and also by window shoppers on the building side of the footpath. The effective footpath width is at least 1.3 metres less than the actual width. Noon peak hour densities on this footpath were found to be between 0.43 and 0.68 pedestrians per square metre. These densities represent restricted pedestrian flows with frequent stops and forced streaming.

Pedestrian-vehicle Conflict

Perth's pedestrian network, due to its parallel alignment to the road network, has many intersections where pedestrian vehicle conflict is a problem. The degree of conflict at the major intersections in the study area has been reduced by the use of traffic signalization which includes a pedestrian walk phase.

Pedestrian-pedestrian Conflict

The results of pedestrian-pedestrian conflict are less obvious than those of pedestrian-vehicle conflict. Pedestrian-pedestrian conflict causes crowding and confusion for pedestrians and should be overcome where possible. Pedestrian-pedestrian conflict within the study area was observed where the major arcades intersect the major shopping footpaths.

Vehicle Servicing

On every street in the Central Area, the Pedestrian comes in conflict with service vehicles crossing the footpath to gain access to the rear to the stores and shops. In some instances, pedestrians are warned of the vehicle by flashing lights or signs but more often not. While this problem is recognized as a major pedestrian concern, it is symptomatic of a greater Central Area servicing and goods movement problem.

<u>Short Term Circulation Improvements</u>

In the study of pedestrian movement in central Perth, many items and aspects were quantifiable, however, other aspects that were observed were qualitative in nature. The combination of quantitative and qualitative short term improvements should bring about a better environment for the pedestrian. Short term improvements represent benefits and amenities that every-day pedestrians can utilize immediately. Only two of the many recommendations are mentioned here.

Murray Street

Murray Street is discussed here as an example of improvement of pedestrian circulation since the solution has implications that not only effect pedestrian circulation, but also private and public transport aspects.

Today along Murray Street, between William and Barrack Streets, noon pedestrian demand ranges from 8,600 to 11,600. When compared to the Hay Street Mall pedestrian demand of 13,000 to 15,000, Murray Street accommodates approximately 70 to 80 per cent of the Mall pedestrian activity, along foot-paths that are nearly 60 per cent narrower.

As discussed in the previous section on pedestrian deficiencies, pedestrians moving along Murray Street footpaths are attempting to circulate through facilities that have an average density of 0.57 pedestrians per square metre. While pedestrian density at the arcade entrances and pedestrian crossings are even greater. This level of congestion inhibits movement thus creating momentary halts in circulation, as well as temporary queuing. This high level of congestion is due to the combined effects of narrow footpaths, arcade entrances, window shopping and obstructions on the footpath.

An immediate action that could be taken to relieve the overcrowding and create a more enjoyable pedestrian atmos-phere on Murray Street, would be to:

1. Eliminate the 33 kerbside parking spaces.

2. Widen the footpaths by three metres by using the space previously occupied for parking.

3. Keep two traffic lanes open for private and public transport.

4. Create loading lay-bys in the widened footpaths for servicing and taxis.

Following the above mentioned improvement, the density of the pedestrian environment in Murray Street would be decreased by approximately 50 per cent to an average of 0.29 pedestrians per square metre. The decreased density would generally allow for freedom of movement, with occasional delays at the arcade entrances.

For the shopper and worker, this would mean a major improvement in the facilities of Murray Street. Public transport stops, taxi ranks, as well as seating and rest areas for shoppers, could be designed into the widened footpaths. The existing 12 loading zones in the street could be incorporated into 3 or 4 zones along the street. This improvement would not, however, solve the problem of delivery trucks servicing shops by driving across the footpath to a rear entrance.

Murray Street is an example of a pedestrian oriented improvement which would require the detailed study of traffic implications before implementation.

Street Market

As a way of gaining a better understanding of pedestrian activities and the effect on the central area, it is finally suggested that planners should look for a street which possesses the potential for pedestrianisation, or a street market, at least on an experimental basis.

The width of the street and scale of the adjoining buildings should be appropriate for pedestrian activities. It should contain a variety of uses that generate pedestrian traffic such as restaurants, boutiques, retail stores.

It is suggested to use a street block as a test situation by temporarily closing the street during the lunch period, say from 11:00 P.M. to 2:00 P.M. for one day a week. Parking restrictions would need to be enforced during this period with only taxis providing access.

Activities and facilities which could be considered for the street market would include movable landscaping floats containing flowers, shrubs and trees; street barrows for fruit and flowers; portable seating, flags and banners advertising the street; sidewalk cafes and retailers and craftsmen showing their products on portable display systems.

Observations could then be made of the attraction of people to an item of the street. By recording, observing and interviewing people, an estimate of the degree of pedestrian activity generated by pedestrian oriented facilities could be attempted.

While many elaborate and comprehensive studies have been made in transportation, economics and regional urban development, extensive research into how pedestrians react to the street environment has been limited. The temporary street market could provide not only better insight into planning for pedestrians but also immediate benefits and additional pedestrian interest in the Central Area.

Conclusion

When compared to vehicular traffic, pedestrian movement is undisciplined. It moves at slow speeds, stops, starts and cuts across vehicular traffic to find a more direct route. People avoid steep slopes to keep from expending more energy than necessary. The space allocated for pedestrian activity in the Central Area is gradually being reduced to give the car more circulation space. Short-term improvements in the pedestrian system can therefore be viewed as the initial step in the longer pedestrian planning activities.

In many cities, a move is underway to locate business in shopping centres, outside the Central Areas where pedestrian amenities are better. For the Central Area to remain viable and competitive, it must attempt to reverse this trend so that it present an attractive and interesting image to the shopper, worker and employer.

A short term pedestrian improvement programme can greatly enhance the atmosphere for pedestrian activity throughout the day and retail the vitality of the Central Area.

A programme of this nature involves coordinated planning effects in urban development, traffic, parking and public transport.

This paper does not discuss the testing of long term pedestrian situations; long term circulation deficiencies and recommended improvements since the methodologies presented above are also applicable for these situations.

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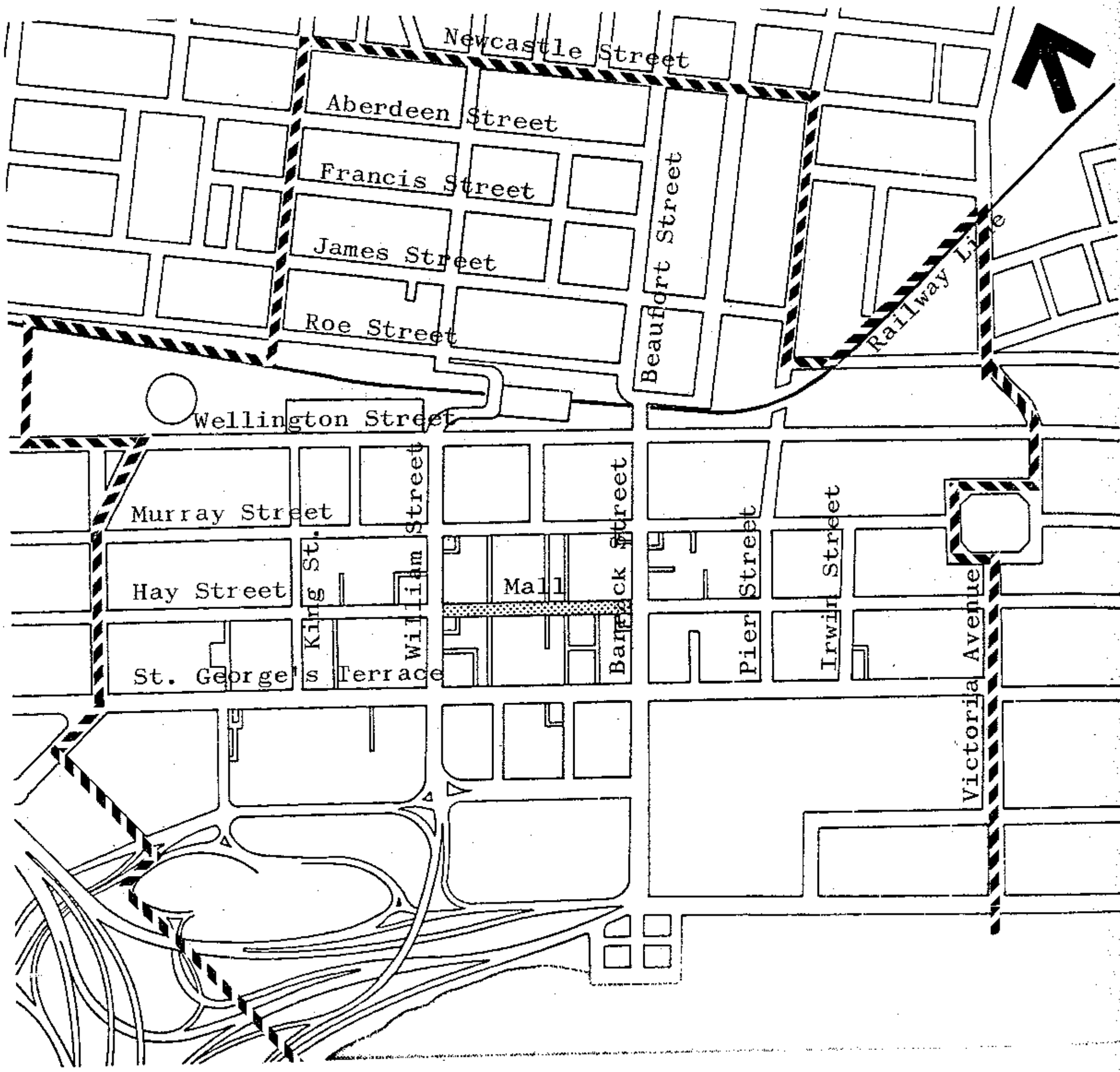

fig. 1 perth central area