THE BICYCLE AS AN EFFECTIVE TRANSPORT MODE

R Campbell
Co-ordinator
Bikewest
Perth, Western Australia

T Adams
Associate Director
Feilman Planning Consultants
West Perth
Western Australia

ABSTRACT

The transport policies of the 1970's and early 1980's, in favour of cars, are now being replaced with more pro-cycling and pro-public transport policies. To predict and provide for the continued growth in bicycle transport during the 1990's more relevant techniques will have to be developed by transport planning professionals. It will be necessary to separately plan for the diverse bicycle user categories, to monitor and predict growth areas and to integrate behavioural science and engineering professional opinion. None of this is possible without a focus to guide both Government policy and professional development.

The paper seeks to provide that focus, suggesting some key directions which urban bicycle transport research and development should take in the next few years. Using Perth, Western Australia, as a case study, the authors identify three areas of market potential and how each could be developed for cycling. The first is to increase local area cycling (0-5 kms) by provision of beginners' pathways, the second is to provide for bike to work travel along major roads, and the third is to integrate bikes and rail to permit metro-wide travel (up to 50 kms).

Much work needs to be done to advance bicycle planning and this will be assisted through professional research, experimentation and monitoring in real urban environments. With a major transformation of road policies and rail infrastructure now under way in Perth it would seem to be a good venue for pursuing practical demonstration opportunities in bicycle transport.

INTRODUCTION

Public opinion and transport policy worldwide is now swinging against cities that are built on single mode transport systems. The dominance of the private car is increasingly being castigated for its destructive effect on the environment and its gluttony for energy and land resources, as well as the human and financial cost burden of escalating traffic chaos. (Lowe, 1988; Newman and Kenworthy 1988.)

Many cities, including most Australian cities, are now being caught up in a traffic spiral of increasing pollution, congestion, trauma and road construction which is hard to reverse. Other cities such as Toronto, Canada, have however anticipated these resource and social constraints and have diversified their transport systems before reaching that point of no return (Cervero, 1986). They have recognized the role of other travel modes - trains, buses, bikes and taxies - integrating them to provide a viable alternative to the car for most types of travel needs.

The bicycle has played an important part in the revitalization of urban transport systems in the 1980's, largely because of the flexibility and economy it offers users. This growth in cycling was largely unpredicted by transport planners who tended to favour automobiles and to a lesser extent public transport. In spite of this, the public has rapidly taken up cycling for transport and recreation; in Australia more bicycles are now sold each year than cars (Campbell, 1987). Cycling participation rates in Australia are also increasing, but at a slightly lesser rate than bicycle ownership. This indicates a large number of casual cyclists, users who could quite rapidly increase their cycling levels (and distances), given more convenient and safe cycling facilities (ABS, 1982; Spectrum, 1985).

Numerous studies and bike plans have identified the potential opportunities for cycling, the technical ways to achieve this (Bikewest, 1988; NAASRA, 1987, Replogle, 1983) and the major safety and economic benefits that result (Geelong Bike Plan Committee 1984; Campbell 1988; US Environmental Protection Agency, 1974). Due to limitations in cycling data and methodologies, much of this work has to use existing cycling demand levels and public opinion as the basis for determining service provision levels for cycling programmes. This tends to understate the potential for cycling by not recognizing the suppressed demand for cycling which is being held back by both a lack of cycling facilities per se and the poor interconnectivity between transport modes (eg. bike-rail). Transport planners have therefore tended to provide for cyclists only where they are seen, and cyclists, being generally young, have tended to not speak up.

Transport authorities must therefore take the initiative to encourage and provide for cycling, based on an improved knowledge of the bicycle market. Very little research has been done on assessing the bicycle market potential (Spectrum 1985) and in developing methodologies to estimate, monitor and evaluate

cycling demand in conjunction with other travel modes. This is especially needed so that a variety of bicycle transport options appropriate to different cyclists can be planned and provided in a rational and cost-effective manner. This will involve the development of cycling data bases, forecasting models and on-going evaluation of cycling growth and service provision in relation to changing transport economics, environmental and social factors. Whilst at present most cycling programmes are based on a commitment to reverse the neglect of previous decades toward cyclists, a more thorough analytical structure will be required in coming years to maintain and guide that commitment to bicycle transport. This paper also seeks to outline the case for bicycle transport, and suggests some areas where greater research and marketing is currently needed to provide cities with a multi-modal transport system.

A STRATEGY FOR PERTH

Recent and massive policy change in Perth, Western Australia toward greater public transport and cycling provides an ideal case study. As a car based city Perth is now seeking to diversify it s transport system and is supporting the integration of cycling into transport planning activities. The Western Australian Government through Bikewest has chosen to fully integrate cycling within the current transformation of Perth's transport system. Research to identify how cycling can increase its current 6% share of transport trips has focused on providing for 3 types of journeys which currently rely heavily on private cars. The three journey types presented in Figure 1 are:

a LOCAL School and shopping trips, using paths (up to 5 Kms)
b INTER DISTRICT trunk-route commuting, using roads (up to 15 Kms)
c METRO-WIDE travel, using bike-rail or bike-bus (up to 50 Kms).

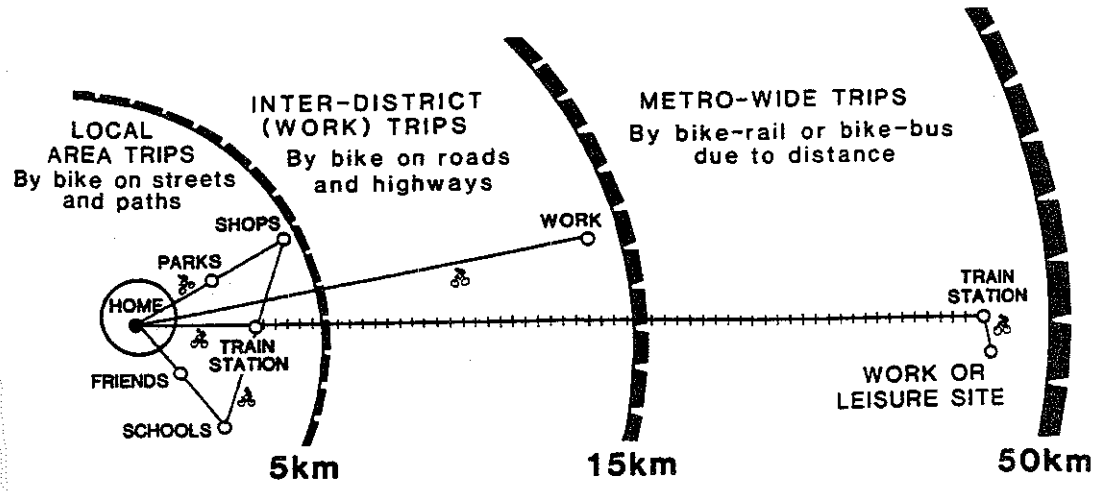

FIGURE 1: A BICYCLE TRANSPORT STRATEGY FOR PERTH

This paper looks at each of these three transport alternatives. It first examines the personal choices an individual traveller makes when deciding how to travel, and then considers the role of the bicycle in relation to other modes Opportunities for identifying and increasing the bicycle market share in such journeys are then explained, outlining the current work underway in Western Australia to cater for cyclists needs in relation to other modes

THE CHOICE OF TRAVEL MODE

The mode of transport chosen for a particular purpose is the result of a variety of factors including time, cost, comfort and cultural factors like fashion and status. In a modern city like Perth nearly all these factors have favoured the automobile, so that per capita usage of the car is now second to none in Australian cities, if not the world (Newman and Kenworthy 1988).

In recent years the public has recognized the negative impact of this automobile dependence, both through the global greenhouse effect and local traffic problems. Whilst Government policy can help provide transport alternatives to the private car, individuals are nevertheless resistant to changes In a democratic society, unless these alternative transport modes are perceived to offer greater comfort, speed and spatial flexibility than the private car, then it will not compete in a market free from excessive Government control and negative constraints

In low density cities such as Perth where roads are comparatively free flowing, no other mode, on its own, will be able to compete with the private car for all journeys. A multimodal approach is therefore required between bikes, trains, buses, walking and taxis to adequately compete for those types of trips where continuing private car usage is undesirable

Table 1 attempts a comparison of travel mode characteristics over a variety of trips, in order to demonstrate the capacity of a multi-modal approach. The methodology used is largely a subjective analysis based on Perth travel surveys such as Socialdata (1986) Interactive Surveys and personal experience.

Though a subjective and crude technique, Table 1 nevertheless demonstrates several things, not the least being the supremacy of the private car option to the individual traveller. Very importantly, however, it also shows how the greater total benefits from combining travel modes, bike and train for example, can yield total benefits greater than that for the car alone

Trip Type	Mode	Personal Travel Choice Factors 2 = Strong Incentive 1 = OK 0 = Disincentive				Total Benefits
		Comfort	Speed	Spatial Flexibility	Cost $	
LOCAL trips	Car	2	1	2	2	7
0 - 5 kms	Bike	1	1	2	2	6
School and	Train	0	0	0	0	0
Shopping	Bus	1	1	0	1	3
	Walk	1	0	2	2	5
INTER DISTRICT	Car	2	2	2	1	7
0 - 15 kms	Bike	0	1	2	2	5
Work type	Train	2	2	0	1	5
purposes	Bus	1	1	1	1	4
crowded roads						
METRO WIDE	Car	2	2	2	1	7
10 - 50 kms	Bike	0	0	2	2	4
Work &	Train	2	2	0	2	6
other purposes	Bus	1	2	1	2	6

Table 1 - Comparative Attractiveness of Transport Modes for Local, Inter-District and Metro-Wide Travel Patterns.

These relative benefits vary between modes according to the type of trip being undertaken. These are explained below:

LOCAL TRIPS are trips of 0-5kms in length, usually undertaken within the same or nearby suburb. The bicycle user has less comfort and similar speed but can travel almost anywhere at minimal cost. Shopping trips tend to be during non-peak hours and show greater potential for conversion from car use to cycling and walking, than to bus (and even more so rail). The concept of bike'n'bus would be relevant for the longer trips (5kms) only. The bicycle could displace many local car trips if comfort and speed were improved through provision of safe continuous networks of paths and cycling roads.

INTER-DISTRICT TRIPS of 0-15kms in length which usually end at worksites and CBD'S are only marginally better when made by car than by bike or train. These trips, usually in peak hours on congested roads, are rapidly becoming less comfortable by car, slower, and more expensive (eg parking and car costs). With some improvements to the trunk road system, the bicycle could readily compete with the car on it s own merits for such trips. Nevertheless, a link with public transport would greatly strengthen that position and allow public transport to overcome it s spatial inflexibility through bicycle park'n'ride promotion, especially to CBD's.

METRO-WIDE TRIPS are made for a variety of reasons, including work, and involve travelling from 10 - 50kms either across, or to the centre of cities. In this context, a strong alternative is therefore needed to shift from private car use which provides maximum benefits to the user. The bicycle clearly does not, on its own, provide that alternative; however, it can be used to feed the public transport network, especially trains. As Table 1 shows, the bike-rail combination could provide greater travel speed and comfort, equivalent spatial flexibility, and for much lower cost than private car travel over the longer metro-wide distances. Bike-bus combinations offer similar benefits to the users.

In developing a transport strategy for the future of Perth, it is vital that an alternative means of travel be provided to the public, which is much more attractive than private car usage. Unless this is developed and aggressively promoted, there will be no substantial shift away from the use of private cars, which, on a collective basis, cannot be sustained indefinitely.

The bicycle should play a vital part in Perth's proposed future multi-modal transport network. Attention should be focused on THREE MAJOR TRANSPORT STRATEGY TASKS;

TASK 1 - To have many more LOCAL TRIPS (0-5kms) made by bicycle through provision of beginners' pathways and safe access.

TASK 2 - To predict potential demand and provide convenient INTER DISTRICT (0 - 15kms) opportunities for Bike to Work within on-going road planning procedures.

TASK 3 - To identify the market for METRO-WIDE BIKE-RAIL TRIPS (up to 50kms) and to satisfy that demand within the electrification programme.

TRANSPORT STRATEGY TASK 1 : LOCAL TRIPS BY BIKE

To have many more local trips (0-5kms) made by bicycle through provision of "beginners' pathways" and safer access.

This task recognizes the significant number of short private car journeys which could, potentially at least, be made by bicycle. In Perth in 1986, one third of all daily car trips were less than 3kms in length, and one half were less than 5kms. Most of these short single purpose journeys which are 'home based' are done

during off-peak times when traffic levels are not a deterrent to cycling. Thirteen percent of all car driver trips are undertaken to serve passengers, 36% of which are also less than 3 kilometres (Socialdata, 1986).

The potential exists to convert at least 25% of these short, 'single car driver' and 'passenger drop off' car trips to bicycle (Bowden, Campbell and Newman 1984). This study showed that 100% conversion of the existing 1 million short car trips to bicycle represents 2.5 million car kilometres per day less, and a petroleum saving of 333,000 litres per day valued at $133,288 per day. Even a 10% real reduction in car trips would represent substantial savings. Since 1976 this potential would have only increased due to higher housing densities and a 27% increase in daily trips made (Socialdata 1986).

The average bicycle trip distance of 2.5 kms takes only 8 minutes based on the touring speed of 19.2 kms per hour (Whitt, 1971) but is more likely to be 10 minutes for local trips. The 5.0 kilometre threshold for local area trips therefore represents a maximum 20 minutes of cycling, well within the cycling capacities of the schoolchildren and parents for whom, and by whom, many of these short car trips are made. With increasing pressure for traffic restraint in local streets and shopping precincts, such cycling promotion is highly desirable, as well as being likely to result in quicker and more convenient travel (Jordan, 1986). At present the average speed of education and shopping trips, by all modes, is 19 kmh and 23 kmh respectively, averaging 6.4kms and 5.0km travel distances respectively (Socialdata 1986).

For the following types of local trips the bicycle could replace car use:

- convenience shopping of 1-3 stops
- passenger drop-off and pick-up at schools, sporting and shopping venues
- visiting friends and local recreation sites.

While many of these trips are currently made by bicycle (33% of all bike trips are for education), there can be adverse local traffic conditions, or even socio-economic/psychological factors in some local areas, which create higher than necessary car usage levels. These barriers to bicycle usage should be identified and removed. A range of measures have been identified by Bikewest to introduce people to cycling, and to also enable more cyclists, especially children, to ride safely to schools, shops, etc. (Bikewest, 1988).

Research has clearly shown that, for the inexperienced 'beginner cyclist', the road traffic environment is a strong disincentive to cycling and alternatives are sought. For example:

- **children** under 9 years old are not well enough co-ordinated to handle complex on-road traffic situations.
- **adults** taking up cycling prefer to learn on paths separate from traffic, and

'more cycleways' is the primary incentive they require to take up cycling (Socialdata 1986).

- **women,** especially, feel more at risk in heavy traffic and are therefore more reluctant to take up cycling.

To encourage more cycling at the local level (0-5km), local authorities have quite correctly been providing extensive pathway systems. Whilst many of these are useful in attracting beginner cyclists, they often cater for safety at the expense of route continuity, and also inadvertently create confusion among cyclists, pedestrians and motorists. Bikewest is currently researching and pursuing a new hierarchical structure for path provision which will safely cater for the three quite distinct classes of cyclists, as well as pedestrians. This would result in the three levels of path as recommended in the Perth Bikeplan:

- **footpaths,** which would be opened up for legal cycle use by children under 13 years of age (currently it is illegal for all ages). This will provide safer local access to schools, shops, recreation sights by young children. Pedestrians will have priority

- **dual use paths,** built to a higher standard, will be provided where both cyclist and pedestrian demand exists, especially for recreation and longer journeys. Pedestrians would continue to have priority.

- **cyclepaths,** a new category, may be introduced where a fast continuous high standard cycling route is required. Cyclists would have priority over pedestrians.

Extensive research has been undertaken in Western Australia and other states of Australia to identify the safety implications of the current high level of usage and potential conflicts on paths. Survey data has been collected in 1989 for Perth's extensive pathway network, to develop policies and criteria for path planning and design which will adequately cater for the future growth in cycling. This research by Bikewest is trying to identify the ratio of cyclist to pedestrian use (which will, in part, define the type of paths required) as well as assessing the extent of bicycle-pedestrian conflicts occurring on paths. Table 2 presents some of the results from surveys taken along dual use paths and footpaths in Perth on weekdays and weekends.

The conflict ratio seems to be strongly related to the ratio of cyclists to pedestrians. The use of footpaths by pedestrians and cyclists involves few conflicts, whilst on dual use paths, used mostly by cyclists, more conflicts are occurring. To increase the usefulness of paths, the change to allow footpath riding by children and to improve the cycling quality and status of other paths is well justified.

TABLE 2 - Cyclist/Pedestrian Path Usage and Rate of Conflicts

	Dual Paths	Footpaths at Schools	Footpaths at Shops
Cyclists	81.3	23.1	20.5
Pedestrians	18.7	76.9	79.5
	100%(3810)	100%(539)	100%(1268)
C/P Ratio	4.4	0.30	0.26
Conflict[(1)] Rate	0.72	0.37	0.19

Note (1): Total observed actual & potential conflicts on path / total no. of peds. & cyclists

Source: Bikewest 1989, unpublished Cycling on Paths Report, prepared by Graat & Pakker for Bikewest, Department of Local Government, W Australia, June 1989

The Solution for Local Area Cycling

To have more local car trips made by bicycle (and by foot) local authorities and road authorities will need to adopt a 'door to door service' approach for cyclists. A safe route utilizing quiet local streets (40 km/h), footpaths, dual use paths, and safer intersections and road crossings will be required all the way from the cyclists home to the shop or school. This would not involve extensive new pathway systems in local streets, paths will only be needed where congestion and safety requires their provision, as Figure 2 below explains:

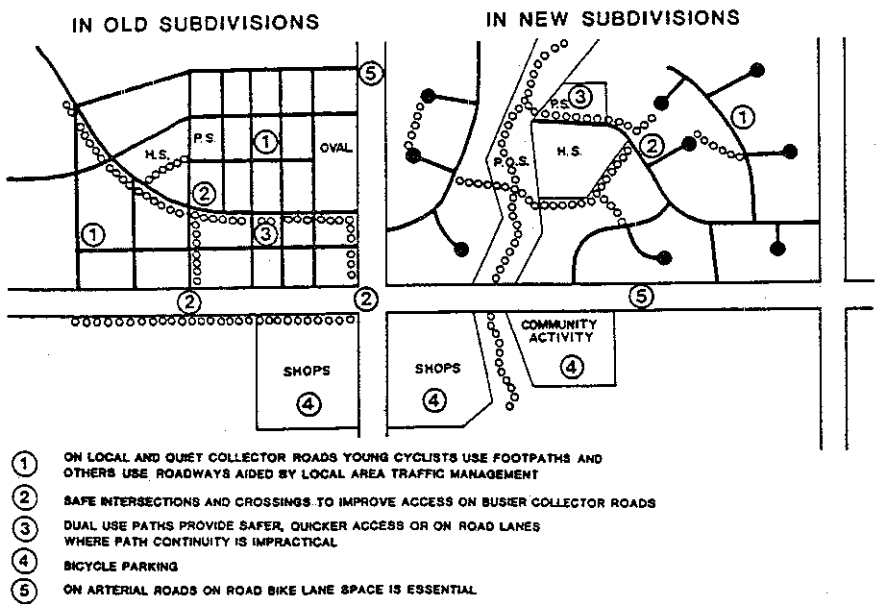

FIGURE 2: LOCAL AREA PROVISIONS FOR CYCLISTS

TRANSPORT STRATEGY TASK 2 : INTER DISTRICT BIKE TRIPS

To forecast and provide for high speed inter-district bike to work opportunities within the on-going road planning processes.

This task seeks to capitalize on the increasing level of frustration and cost incurred by car drivers who commute to work at peak hour on congested main roads. With the average Perth worker now spending 80 minutes travelling each day, and knowing that it will increase, many are looking to cycling as a more productive use of their travel time (Socialdata, 1986)

Whilst this cycling growth and potential is obvious to the observer, there is little data on the existing bicycle commuter volumes and, more importantly, the growth rates on main roads versus off-road cycleway path usage. What is known is that 10% of all bicycle trips are to work, although the bike is used for only 2% of all work trips. This compares with the 1% of work trips made by train, 6% by bus/ferry and 71% by private car (Socialdata, 1986). The bike to work rate of 25,000 trips per day in Perth is not insignificant and strong efforts should therefore be made to reduce the 71% car usage rate in favour of cycling.

To achieve this will require significant investment by road authorities in road and cyclepath improvements designed for commuter cyclists. Since these facilities are not yet in place in Perth, the path alongside Kwinana Freeway and the kerbside lanes on West Coast Highway, Swanbourne being the rare exception, there is much to be done. This involves research and monitoring as well as practical policy development and implementation. A clear understanding of where the actual and potential commuter cycling levels are highest and where facilities are most urgently required, will be essential in achieving this goal of catering for commuter cyclists equitably. A structured analytical approach by the road authorities would be required, involving at least these key components:

1. **An Existing (and Future) Facilities Inventory** - to determine the road system constraints and opportunities for commuter cyclists, and to record on-going improvements as they are made This should be integrated with bike-map stress level data, to direct cyclists to the safer routes, and must be continually updated as a function of road construction reporting.

2. **Bicycle Commuter Demand Modelling** - as with other traffic planning it is vital to compile, on a city wide basis, base-line locational data on bicycle usage, and from this and other parameters to extrapolate future demand for bicycle facilities Bicycle/pedestrian counts taken by Main Roads Department at controlled intersections during peak hours could, for example, be plotted together to form a computer based survey for Perth metro. The gaps

could be identified and given priority for monitoring. To the computer model could be added relevant growth factors such as population trends, land-use zonings (worksites, housing densities, subdivisions etc) and other traffic pressures, all of which influence the priority and time frame to be chosen for provision of cycling facilities in major road works. This model would need to distinguish between trip generation, trip distribution and trip assignment approaches.

3 **Establishing Warrants for Cycling Provisions** - while the fundamental principle must be to at least allow for safe, convenient passage by cyclists on all roads, the level of provision and expenditure must be subject to warrants. At present the road authorities have no system in place for comparing the merit of one situation against another. Since the use of existing cycling volume figures does not fairly reflect the long term needs or the 'suppressed demand' (due to lack of existing safe cyclist thoroughfare), any warrants system will also need to be guided by the use of both the inventory and the modelling predictions outlined above. A range of criteria is needed to evaluate individual projects which form part of a total route, and might include:

- current and projected cycling demand for the total route (based on data not opinions) against other routes.
- strategic importance and urgency of the respective part of the total route in question.
- location of the project, in particular its proximity to CBD and for population centres where demand is greatest and potential conversion of car trips is highest (eg the average trip distance to work by all modes is 14.2kms)
- potential impact of cycling improvements on accident rates, risk exposure and stress levels for cyclists (eg. intersections versus uninterrupted stretches of road)
- relative benefit/cost ratio for the various design options (eg subway versus at-grade crossings).

4 **Implementation and Evaluation of Trial Projects** - to refine both the predictive models and the warrants outlined above for bicycle provision, some practical experience over several years will be necessary. A willingness among road authorities to innovate and experiment with both on-road and off-road cycling facilities and to evaluate their successes and failures from cyclists' and other road users' perspectives is important. Bicycle planning is many years behind automobile planning; the knowledge and experience gap cannot be bridged without some trial and error. As soon as a Facilities Inventory is established a number of trial improvements should proceed to provide a practical edge to the work and to generate awareness within the community. The removal of on-road squeeze points and intersection improvements are two examples where an immediate profile could be pursued, and lessons learnt

5 **Development and Promotion of a Bicycle Transport Policy** - to advise and help educate road planners and engineers the road authorities will need a

policy statement and design standards on provision of cycling facilities with road and intersection work, both new and old.

The Solution for Inter-District Bike Trips

To predict and provide for high speed inter-district bike to work opportunities it will be necessary for transport planning authorities to allocate resources to:

1. Better understand the existing level of cycling usage and facilities for bicycle commuting, in terms of location, growth and acceptability.

2. Identify how to make cycling improvements to maximize current and future benefits for minimum cost.

3. To experiment, by building some on-road cycling facilities now, which can be promoted and evaluated.

4. To see cycling as capable of further reducing the impact of private car dependence on our cities and roads.

A number of analytical and technical constraints need to be overcome. A bold approach is required, based on the knowledge that bicycle transport is here to stay. Road authorities must not only catch up on the backlog of previous neglect but must also plan and provide for cyclists in future years.

TRANSPORT STRATEGY TASK 3 : METRO WIDE TRIPS

To identify the market for metro wide bike-rail trips (10 - 50 kms) and to satisfy that demand within the imminent electrification programme

The concept of increasing rail patronage by providing for and encouraging bicycle access to stations has been under discussion in parts of Australia and overseas for a long time. In many European countries and in Japan it is an accepted aspect of public transport provision. The subject was discussed in the Perth context by Bowden, Campbell and Newman (1984). This research indicated that there was considerable potential for improving rail patronage by increasing bike-rail coordination. They found that 41% of the Perth population live within 10 minutes (3.2km) cycling distance from a railway station (see Figure 3), and estimated a potential for 59,000 bike rail trips each day (a 176%

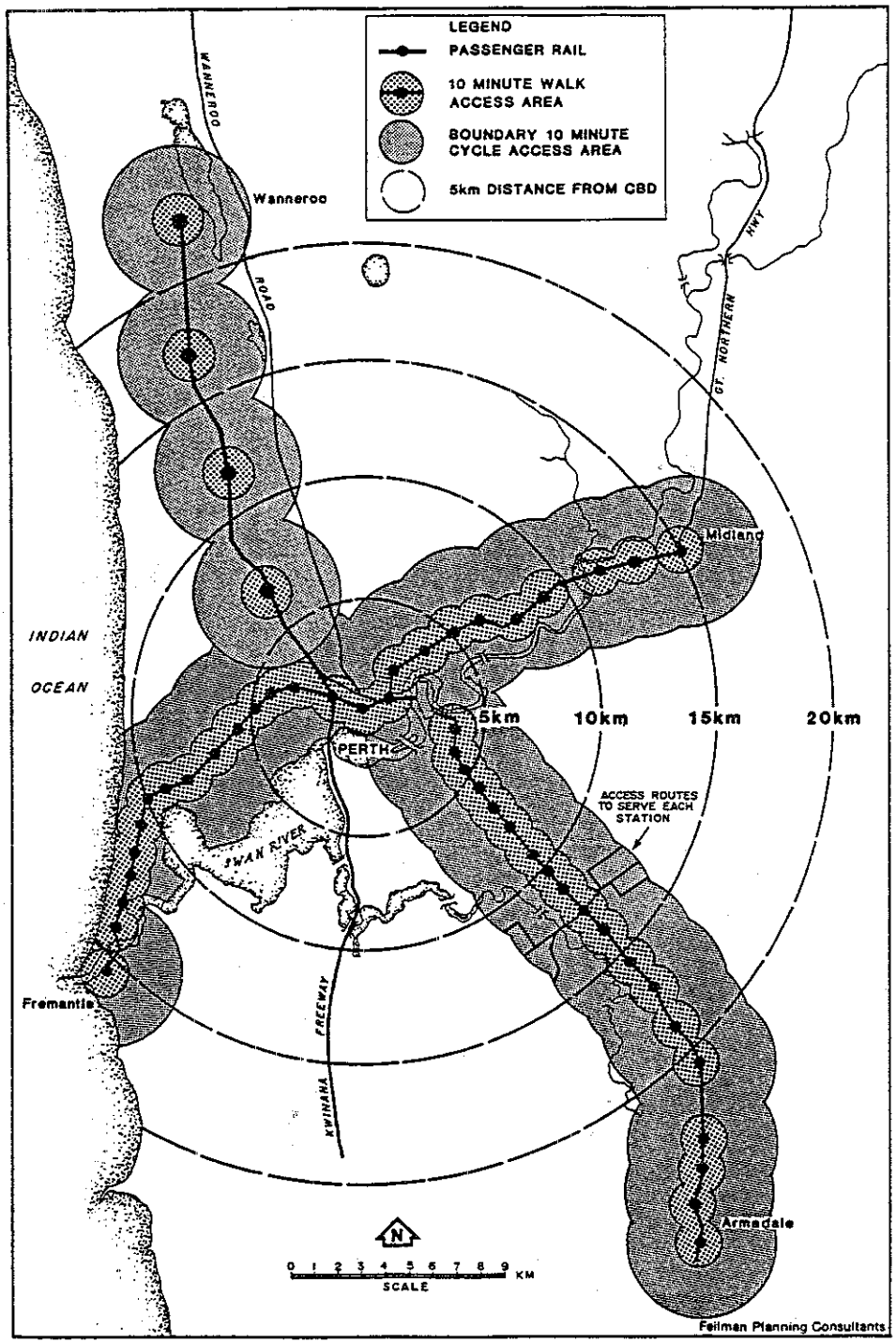

FIGURE 3: BIKE-RAIL PASSENGER CATCHMENT AREA FOR PERTH (10 MINUTE CYCLISTS ACCESS TO RAIL STATIONS)

rail patronage increase). Changes in attitude to the role of the rail network in Perth are now occurring and major upgrading and expansion programmes are underway. These include the elecrification of the existing three lines and the construction of a new line in the north west corridor. All of these involve unprecedented capital investment.

Improvements in patronage may be expected to occur as the population increases and the level of service provided by the system improves. However, given the high capital costs, all measures that may supplement these increases should be explored. At present, access to the train system is generally limited to walking or car, with car access being divided into two groups, kiss-and-ride and park-and-ride. Providing for bicycles to become an additional viable access mode would have the following advantages:

- It would greatly expand the catchment area around each station for patrons who do not have access to a car.

- It has the potential to replace at least some park-and-ride access trips, which is desirable due to the high cost of parking space provision.

- It would achieve a range of environmental, energy conservation and social benefits that follow from increased bicycle usage

Work Programme

A work programme aimed at exploring the potential for bike-rail transport in Perth and developing trial implementation of routes to selected stations is set out below

1 Catchment Area. The propensity for the population to take up bike-rail travel will vary from area to area and between socio-economic groups. As a first step, the total catchment population should be identified for the rail network, as shown conceptually in Figure 3. This should based on work included in the paper mentioned above (Bowden et al., 1984), i.e., a 3.2 km radius from all stations. The boundaries of the catchment population should be adjusted to take into account physical barriers such as the river, and could be rationalised to postcode or other administrative boundaries for which statistical information is available. A statistical analysis of the population related to each station or small group of stations will then be possible, at the Census Collector District level.

2 Bike Rail Travel Potential. A study should be conducted to develop a method of predicting likely bike rail travel potential for various types of

population groups Factors will include income/occupation, work location, car ownership and population structure

Known bike ridership patterns, in terms particularly of age and trip type, should be compared to census data for various areas where the ridership data is available. The census analysis would be greatly facilitated by the recently available compact disc census data processing packages

The outcome of this exercise will be the establishment of a range of population profiles that have differing propensities for bike-rail travel, which can be matched against the existing populations around the Perth rail stations. The likely bike- rail patronage levels for each station can then be predicted.

3 Select Trial Stations Information should be prepared from tasks above for all stations on the three existing lines and the proposed fourth line. A selection of these should then be chosen for closer examination on a trial basis; field inspections will need to be conducted where appropriate The selection should include a range of stations serving the full range of population types This will enable sound judgements to be made as to the ultimate level and type of programme implementation that will be appropriate for stations over the whole rail network

4. Action Plans For Trial Stations For each trial station (estimated to be approximately six), a four level action plan should be prepared:

* Safe and convenient access to stations will be important in attracting the bicycle user For each station radial access routes which provide safe and convenient travel for the catchment population should be defined (see Figure 3) In some cases engineering works may be required to bring these routes to an appropriate standard. The aim would be to ensure that access is possible to the station from all parts of the catchment

* Appropriate bicycle parking facilities should be designed for each station. These are likely to include a mixture of enclosed lockers and open parking stands It is important that details of design and siting within the stations be specified, as these can be critical. Any necessary administrative arrangements concerning the management of lockers must also be developed

* The Concept of bicycle travel is relatively new to modern adult Australians and the notion of bike rail travel would be considered quite novel. The success or failure of the concept will be strongly influenced by the marketing. A marketing programme must be prepared which will specify:

  - The type of marketing which is appropriate
  - The marketing messages and target groups that should be concentrated on

- Timing and Budget estimates

* Ongoing evaluation of the trial will be necessary and an evaluation programme must be specified. This is likely to include monitoring of cyclist numbers, questionnaire surveys of cyclists, and other techniques

Following the implementation at trial stations, and a careful evaluation of the results, a full scale implementation programme for the complete rail network (including the proposed new north west corridor line) would be developed.

CONCLUSIONS

Like many other cities, Perth has a need to reduce its dependency on private car transport and to pursue a multi - modal transport strategy. To convince people to change their transport choice a multi - modal alternative to the car must be provided, offering greater overall benefits to the user. Depending on the trip purpose, different multi - modal combinations will be appropriate.

The bicycle is one of those alternatives available to the traveller which offers tremendous potential, both on its own and in combination with public transport. The paper shows that greater attention should be focused on public transport opportunities in three main areas. The first is the conversion of local area car trips to schools and shops to bicycle, the second is better planning for bike to work trips up to 15 kilometres long, and the third is for metro - wide bike-rail travel.

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