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Appendix

Bicycles & The Conservation of Oil Reserves

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BICYCLES & THE CONSERVATION OF OIL RESERVES

INTRODUCTION

Bicycles are an untapped oil conserving resource that are being used by many Australians and many more would use them, if better and safer facilities were provided.

It is obvious that bicycles can be used instead of the car for many short trips and help conserve Australia's limited oil reserves. However, far more oil is used for making long commuter trips, so the crucial question is how can bicycles be best used to replace the long car trip in urban areas.

This article shows how this could be achieved, and how bicycle dual mode travel could be a most potent weapon in the nations energy conservation arsenal.

DUAL MODE BICYCLE TRAVEL

Throughout the world the necessity to have national energy conservation policies is being realised and in many countries these involve transportation strategies that include the promotion of bicycling, bikeways and dual mode bicycle travel.

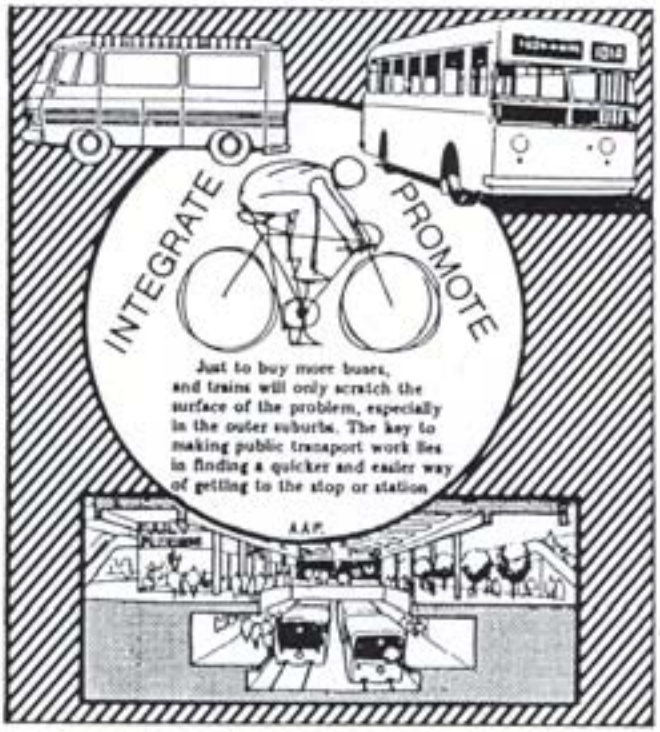
In the U.S.A., Japan and Europe it has been long realised that dual mode bicycle transportation has the potential to greatly increase the catchment area of public transport corridors and to alter the model split. In some of these countries, rail and bus operations do provide for this form of travel and in the U.S.A. federal funding is now provided in the form of Mass Transit grants to encourage the various forms of bicycle dual mode transportation.

Bicycles can also be used with shared vehicles such as cars and mini-buses and greatly increase the flexibility of private shared vehicle systems. Dual mode transport planning is about encouraging the use of bicycles to feed public transport systems or privately shared vehicles, on a 'park and ride basis' and about the carriage of bicycles on other forms of transport. The term 'dual mode' is used to describe a whole range of possible uses for bicycles in conjunction with other vehicles.

OIL CONSERVATION

It is quite possible that Australia will not be able to acquire sufficient oil for transport and the economy some time during the nineteen eighties. However, the extent of the deficiency of oil supply is unknown. Therefore, it is imperative that a "fail safe" approach to Energy Conservation planning be adopted, so that the delicate and fragile political and economic system can survive an shortages of oil.

Perhaps the most important decision made by any government about the potential of bicycle transportation, is the incorporation of the encouragement of cycling into the United States National Energy Act. The "Bicycle Amendment" to the



National Energy Act states the following;

NATIONAL ENERGY ACT BICYCLE AMENDMENT, U.S.A.

In the policy: **"Congress recognizes that bicycles are the most efficient means of transportation, represent a viable commuting alternative, provide health benefits through daily exercise, reduce noise and air pollution, are relatively inexpensive, and deserve consideration in a comprehensive national energy plan." Within one year the Secretary of Transportation must "complete a study of the energy conservation of potential bicycle transportation, determine institutional, legal, physical and personal obstacles to increased bicycle use, establish a target for bicycle use in commuting, and develop a comprehensive program to meet these goals". Consideration is to be given to educational programs, federal demonstration, planning grants and construction grants.**

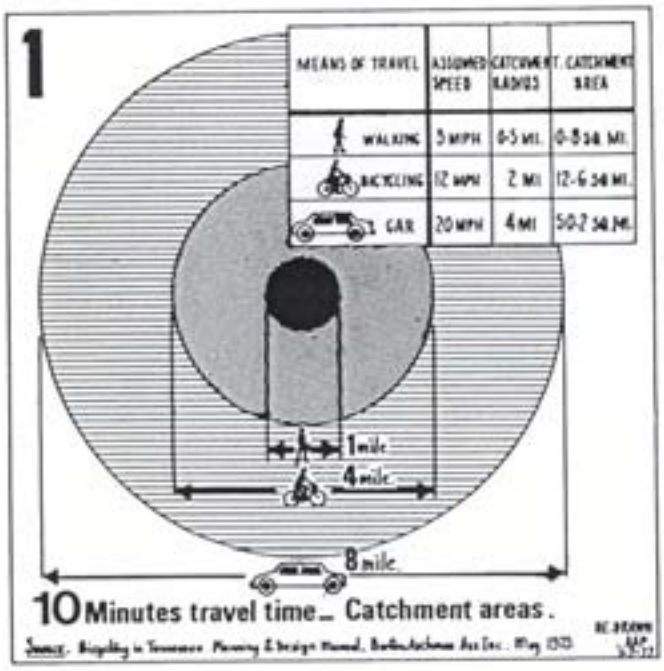
It is vital that a similar commitment is made here in Australia by the National Energy Advisory Committee when it formulates National policy recommendations.

In the immediate future the success or failure of public transit and oil conservation lies in producing a major shift towards public transport usage, particularly rail usage. The use of bicycles, mopeds and power assisted bicycles to feed the rail system, is an area of transport planning and transport marketing that needs

to be given top priority. In the longer term many other interesting possibilities are opened up if these vehicles are planned for creatively.

THE IN-BETWEEN MACHINE

For the same physical effort as walking, cyclists can get 3½ times as far and cover 10 times the area. Using bicycles to feed the rail system increases the catchment areas of railway corridors 4 to 10 times depending upon the spacing of the stations. Typical catchment areas for 10 minutes of travel for pedestrians, cyclists and motorists in urban areas are shown in Figure 1.



The distribution of many trip generators, shopping centres, libraries, schools, are usually too far apart for walking, but most are near enough for bicycle access. The use of the bicycle enlarges the catchment area of personal access sufficient for many purposes but with the conviviality of the pedestrian mode, because the cyclist can stop and talk to people and really experience his environment.

Figure 1 shows that the bicycle is the in-between machine, that provides an alternative to pedestrian isolation on the one hand and motorised anonymity on the other. Of the home base car trips approximately 40% are less than 4 miles in the capital cities so that there is great potential for substituting bicycle trips for car trips.

Figure 1 is useful for comparing the different modes but a more detailed analysis reveals that the cycling catchment areas vary with the type of bicycle used and Fig. 4 gives more detail and shows the underlying ergonomic data base behind these figures. This data can be used with all kinds of Bicycle dual mode usage. The significant fact about cycling, not that it is 3½ times as fast as walking but that it increases the catchment area between 9 and 14 times depending on the machine used and posture of the rider. Fold up bicycles with small dia wheels are slightly less efficient and the enlargement of the catchment area would be between 8 and 9 times. Actual catchment areas in cities with grid-iron street layouts will be more square than round as is shown in Figure 4. Each section of figure is derived from the section above it.

BICYCLES & TRAINS

Dual mode bicycle transport on the rail systems, is concerned with two forms of dual mode travel.

The first is the use of bicycles to and from stations at one or both ends of a journey and this is by far the most common at present. The second is the use of standard large frame bicycle or portable fold-up bicycles carried on the train. The standard bicycle is limited to off peak hours due to its bulk, but the portable fold-up bicycle has great potential for carriage by rail in the peak hour. Several types of these bicycles are now widely available, including two that are fitted with bags that the bicycles are put into. Using bicycles to feed the public transport system in Melbourne, Sydney, Adelaide, Perth and Brisbane is a practical substitute for many, but not all long urban commuter trips.

Relative to the United States the potential in Australia is much greater as all the Capital cities except Canberra have intact rail systems. Irrespective of improvements to the rail system, such as the underground loop, more stations, grade separated crossings, improved rolling stock and more frequent services, the major impediment is that the rail services do not go where people want to go.

In a low density area such as Melbourne only 15% of Melbourne's population is within convenient walking distance of a station, but 85% of Melbourne's population are within convenient cycling distance, as is clearly shown on Figure 1A.

A PERSONAL EXPERIMENT

Living in a typical Melbourne "middle" suburb as a pedestrian I have access to only one rail line, leading south east and north to the city and the primitive bus services do not allow convenient access to others.

Using a bicycle three rail lines are accessible in 3, 8 and 14 minutes easy cycling, enabling commuting trips of over 10 miles to be made all over the Metropolitan area, but I have commuted this way over the Melbourne Metropolitan area and have found the use of two bicycles to be necessary in most cases for maximum convenience. One bicycle has to be a fold-up machine, that can be left overnight at the stations in the parcels office as most stations will not store large bicycles. Using two bicycles is a very flexible system.

After 3 years of experimentation with this dual mode form of transport I have concluded that it is far more convenient than using connecting bus services for several reasons.

Firstly, connecting bus services are only available at some stations and even when available only cover part of the potential 3 mile diameter catchment area.

Secondly, many bus operators are so incompetent that the buses fail to connect with the trains and are allowed to regularly run early or late at the whim of undisciplined drivers.

Thirdly, many of the buses don't operate on the weekends or out of the peak hour, so working weekends or overtime at night become a travel problem. Another important factor is that a pedestrian working in a suburban location can't get odd jobs done at lunchtime because he has no car or bicycle and the suburban services are so spread out and bus services cannot satisfy this need. Some of these disadvantages

are not inherent to bus systems as such, but most are an inherent part of bus systems with low levels of patronage.

In the off peak period, long social trips can easily be made, especially with a fold-up bicycle because often a party fold-up bicycle can be put in the boot of a taxi and the cyclist can get home at any time of night.

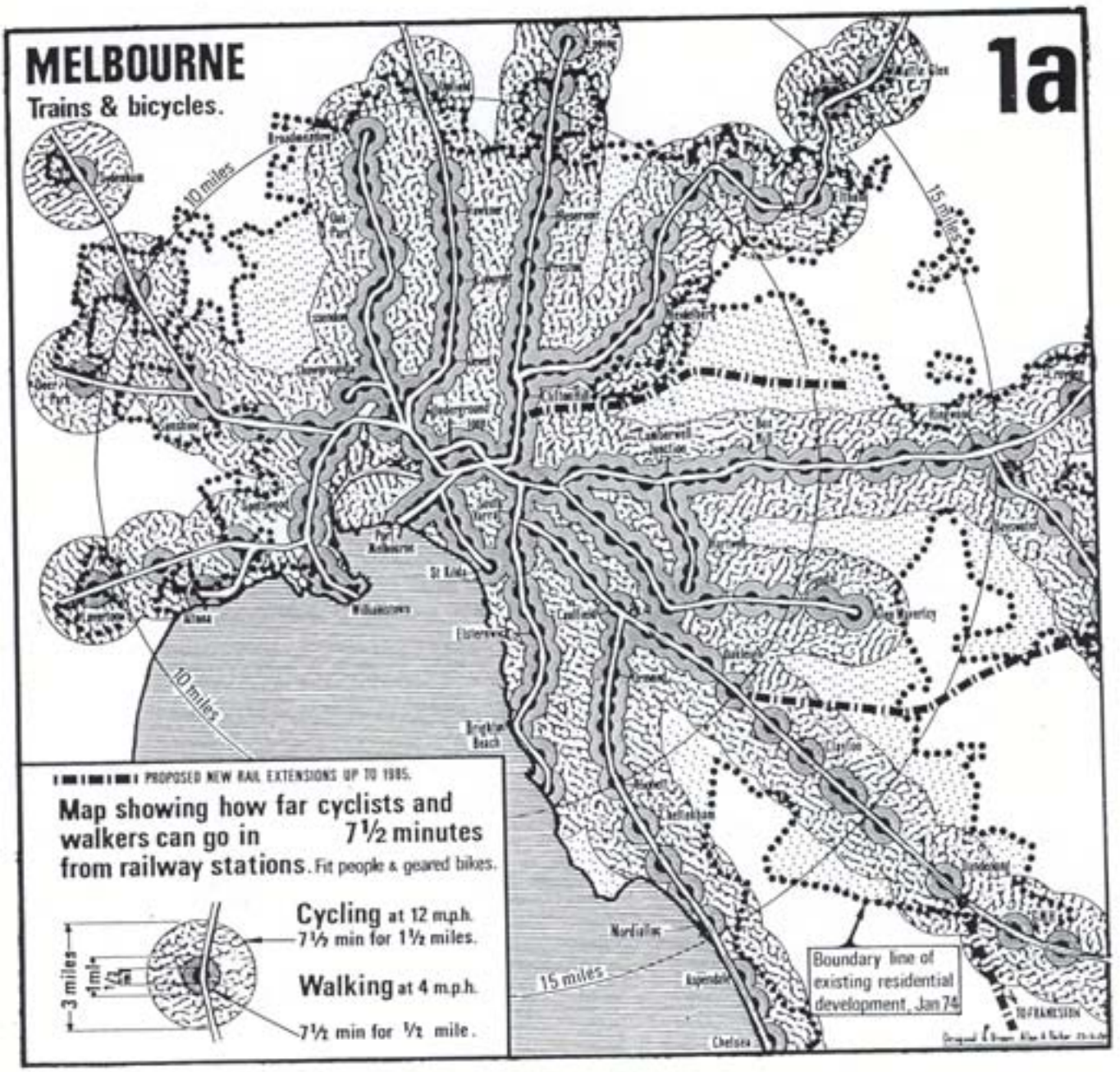
ENCOURAGING CARS IS NO SOLUTION

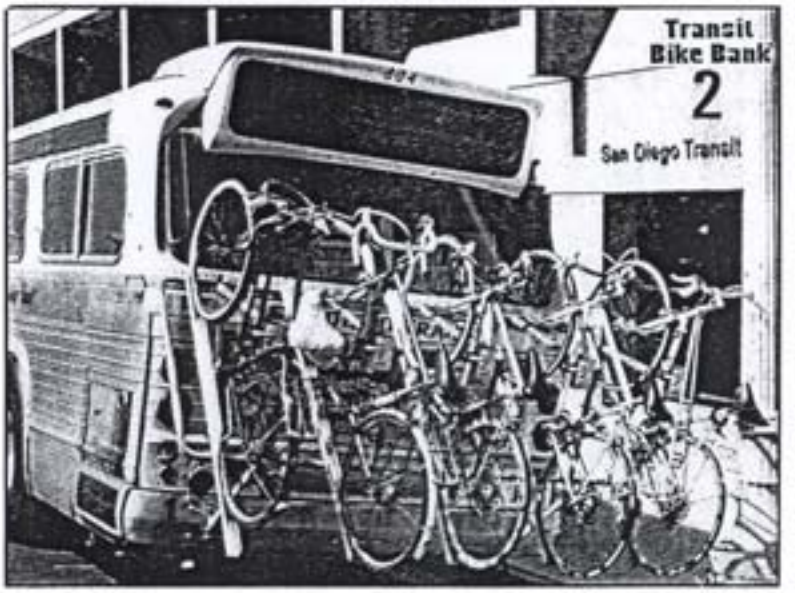
Encouraging the use of cars to feed the rail system is very wasteful of resources, unless parking places are reserved for shared car users. Studies done in Victoria by Waverley Council of railway users who park their cars at or near the three stations at the eastern end of the Glen Waverley line show that 50% of them travel less than 1½ miles to the station. Most cyclists, being able to park nearer the station, would be able to get to the station nearly as fast as the motorist for trips of 1½ miles and under and would not create a parking problem as 16 bicycles can be parked in the space of one car.

There seems to be no understanding of the simple fact that, existing rail services have to be improved, otherwise railway patronage will continue to fall. For instance, many of the existing rail patrons are "floating commuters" who, like the floating voter, come and go but could permanently be hooked on using the train, if they started using a bicycle to get them to the station much more quickly and conveniently.

As a rough rule of thumb, there are more railway patrons further than 6 minutes walking distance than there are patrons who walk for less time. Up to about 12 minutes walking the number of passengers is proportioned to the sqaure of the distance, as figures 1 and 4 indicate.

Beyond 12 minutes walking distance the number of rail patrons rapidly declines and very few walk more than 20 minutes. There is very little exact data on this but sufficient to say that it seems obvious that the

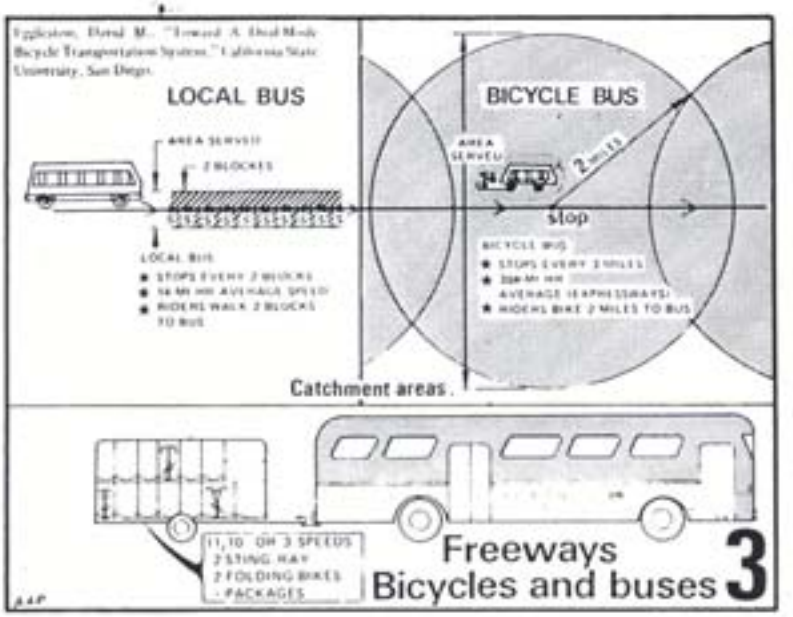


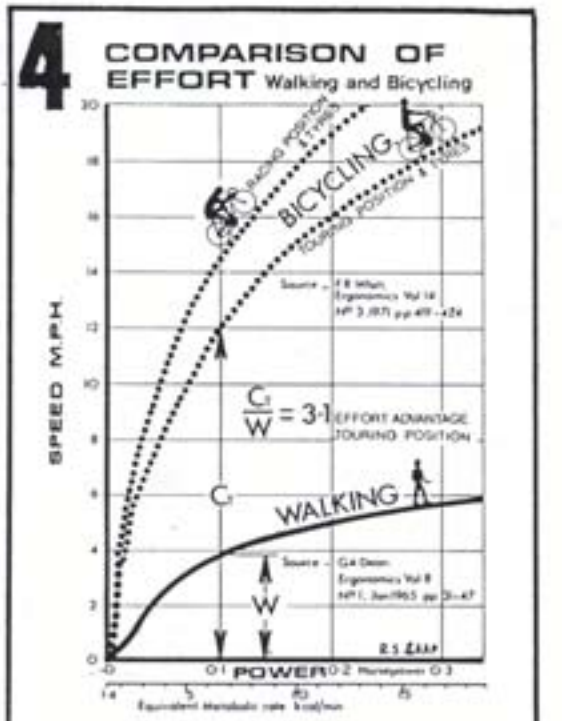


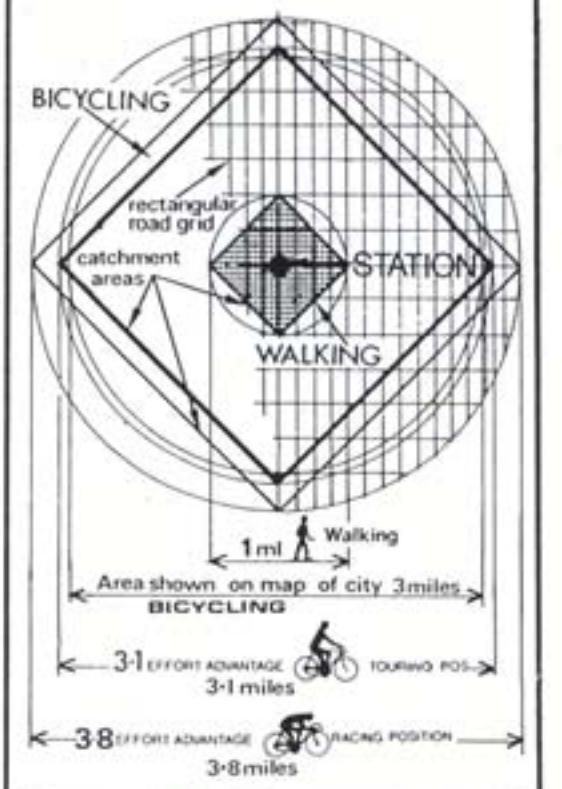
majority, who walk between 6 and 12 minutes to a station may want to use their car to save time on a regular basis or merely just when they are late for work, so enabling them to use a bicycle for this purpose is very convenient.

Reliance on the bicycle dual mode system of transport, given the infrequent rail services prevailing today, cannot compete with the private car on a time basis, however, compared with trying to use public transport, without using a bicycle it is an enormous improvement. The level of service provided by public transport systems in the middle and outer suburbs of the large Australian cities is so bad that no-one will use these services unless they have to — which seriously disadvantages a whole section of the population.

A major shift towards public transport over a ten year period, would give the able bodied adult, using the dual mode form of bicycle travel a level of convenience similar to that of the car. The significance of dual mode bicycle travel lies in this long term potential.







Station catchment area data for constant output of physical effort (0·1 Hp) for 7·6min

Data. FOR RECTANGULAR ROAD GRID			
EFFORT ADVANTAGE	1·00	3·15	3·82
SPEED M.P.H.	3·80	12·00	14·30
DISTANCE MILES	0·50	1·55	1·91
CATCHMENT AREA SQ MILES	0·50	4·80	7·30
CATCHMENT ACCESS RATIO	1·00	9·60	14·60

Rail lines unfortunately all lead to the C.B.D. and many people do not want to go there, but sideways across the radiating rail lines. In the long term Express bus routes running across the rail routes but integrated with them provides the solution to this problem. Using bicycles with the train allows some of the suburban cross travel to be done this way, but the long term need is for Express bus services.

BICYCLES & BUSES

Compared to cars, buses make better use of roads, and express buses make better use of Freeways, so any publicly acceptable change in behaviour that will lead to people being able to better utilise buses needs to be encouraged.

The steady increase in bicycle usage, that has been competently documented in several planning studies throughout Australia shows that people will use bicycles, given the right opportunities, but as yet this has not been investigated in Australia.

Express buses and suburban rail systems in low density suburbs have one thing in common, which is the long distance people have to travel to the stop or station. The Key element in making Express bus systems work is in making it easier to get to and from the bus stop. Using local buses as feeders is not practical for the reasons stated previously but using bicycles, mopeds or power assisted bicycles solves the problem.

AMERICAN SYSTEMS

Several years ago, Dr David Eggleston, Professor of Engineering at San Diego University started to investigate and study bicycle/express bus systems and in 1973 published a major study on the subject. The system shown in Figure 3 illustrates Eggleston's ideas for express buses using trailers to carry bicycles. This system was experimented with and found to be successful in California and Figure 2 illustrates the latest idea for carrying bicycles.

The new system incorporates the 'Bike Bank' manufactured by Sunshine Recreation.[13] The bike is rolled up a ramp and slipped into the 'Bike Bank'. A coin is then inserted and the key rotated to the lock position (It's similar to a coin-operated locker). Bicycles are loaded only at designated Bike/Bus stops. The bus line is averaging about 150 bicyclists per week.

In the next issue of the new bicycle planning journal BICYCLE FORUM ISSUE No. 2, 1978, a detailed description of these experiments will be available in an article 'bicycle/bus experiments'.[14]

Eggleston's approach is opposed to that of a hard core of planners who seek capital intensive solutions to the air pollution and transportation problems. Several billion dollars have been wasted throughout the Western world on research and development on projects such as elevated guideway systems, magnetic levitation systems and remarkable little has been gained by this vast expenditure.

Eggleston believes that a very modest expenditure on extending the ways in which the humble bicycle can be used can be far more effective.

As resource depletion problems become more acute and the long run costs of resources become apparent, the labour intensive transportation solutions, will become increasingly attractive. Basically the problem in transportation is not technical but political.

Dr Eggleston notes, **"When I began work on this project about four years ago, I thought that the engineering and construction of the trailer would be the most difficult problems in getting the system going. It turned out that the political and financial problems were much harder and took much longer to solve."**

THE CASE FOR EXPRESS BUSES

The long term "generative effect" that increases in bicycle/Express bus patronage makes possible, will undoubtedly result in highly favourable benefit/cost ratios for such projects when costed over 15 years.

The curious thing about Freeways is that the maximum carrying capacity is at speeds between 35-40 mph because when people drive faster they leave a lot more room between them and the next car, thus reducing the number of cars on the lane at any one time. Today, in the U.S.A., buses are beginning to realise their full potential as a versatile and economical link in a balanced transportation system. Bus transportation has been the plodding work-horse of many metropolitan public transport systems for a long time —now it is being transformed into an effective Rapid Transit System.

Once the buses get their own right-of-way and can operate without the interference of other traffic or pedestrians at a good average speed, then it compares favourable with the high carrying capacity of other mass transit systems, such as underground railways, and express suburban railways. The American Federal Government is enthusiastic in its support of bus systems, both in words and hard cash. It sees the bus as being an off-the-shelf device that can solve today's problems today, and is aware that way-out technical

solutions will come along sometime, but for the present, it wants action with what is available now.

Apart from its very high carrying capacity, a bus Rapid Transit System is seen as having other great advantages over other Rapid Transit Systems:

1. It makes better use of existing roads and freeways
2. Low capital cost investment
3. Flexible routing, that could be very responsive to commuter needs especially if operated in co-operation with commuter bus clubs and computerized monitoring systems
4. Single vehicle pick-up and line-haul
5. Energy and fuel savings
6. Off-peak use for charter operations

In all Australian capital cities express bus services are essential and bicycle/bus facilities will be crucial for their success.

Assuming that over a period of ten years transport marketing programs and existing socio/cultural trends come together to encourage the widespread use of bicycles with express bus systems, these further increases in bus usage will generate more usage as the frequency of the services get better.

The provision of a "core" of buses with trailers that operate at all hours of the day would provide a similar flexibility to bicycle/Express bus users, although as with the rail system "park and ride" would be the basis of bicycle/Express bus system in the peak hours.

BICYCLE BUS SYSTEMS FOR CANBERRA

As with Bicycle/Train dual mode there is considerable scope for using the "park and ride" system as well and Figure 5 shows a proposal for using an extensive park and ride system in Canberra. Even with the limited route shown on high speed arterial roads it can be clearly seen that most of Canberra's population are within easy cycling distance of the proposed express bus stops. For several years the cycling community in Canberra has been asking for secure bicycle storage facilities at places like Woden town centre and there is some possibility that these will be provided in the near future.

A combination of both "park and ride" and the transport of bicycles on the bus itself would be the best solution in a new area such as Canberra, in which bicycle trailers are practical due to adequate road widths and road curvature.

Bicycle trailers have limited application in narrow city streets such as in Central Sydney and would be impossible to operate during peak hour conditions.

Bicycles mounted on the front of the bus are more applicable. These and bicycle trailers can be crucial in providing that extra flexibility for users. For example bicycle/rail commuters in Melbourne can easily put their bicycles on the train during the evenings and on the weekends and this gives them a lot of flexibility in using their bicycles for long social and recreational trips they would otherwise have to make by car. This also applies particularly to long trips in and out of the C.B.D. in off peak hour and allows cyclists to use their bicycles a lot more.

BEATING THE BIKE THIEVES

To "Park and Ride" at a railway station is simple for motorists to do, because built into a modern car is a lot of security features that are taken for granted. Fear of theft is a major detterrent to bicycle users and has to be combatted otherwise the potential of bicycle transportation will never be realised.

What is happening in Australia today is very similar to what happened in the United States five years ago. There has been a steady increase of adult bicycles in use and following in the wake of this increase has been a secondary increase in bicycle theft. Both of these trends are continuing here and according to the latest police figures recorded bicycle thefts will hit the 8,000 mark by the end of the year in Melbourne and this is only part of the loss because a large number of bicycle thefts are never reported to the police. What is happening in Melbourne is typical of what is happening in the rest of Australia.

PROFESSIONALS MOVE IN

According to a recent report in the "Melbourne Times" [10] some professionals have moved in with bolt cutters that chop through the useless locks and chains sold by Melbourne's bicycle retailers.

According to a study of bicycle facilities prepared by the Commonwealth Bureau of Roads [11] the basic requirements for bicycle storage are as follows:

"The most important feature of an effective storage unit is that it secures both wheels and the frame. It is also highly desirable that bicycle storage units be under cover, as close as possible to cyclists' destinations and in clearly visible locations to deter petty thefts and vandalism."

What's wrong with the few storage racks at most public buildings is that they only lock the front wheel and sometimes that is the only part of the bicycle left in the rack after thieves have undone the front wheel nuts. The great cost saving in getting existing users who come by car to come by bicycle is saving in car parking which can cost between $800 and $3000 per car parking space depending on the location. Multi storey car parks average out at $4000 per car parking space. The cost of new racks and installation costs should be no more than $50 per bike parking space. Between 12 and 16 racks can be provided in one car parking space.

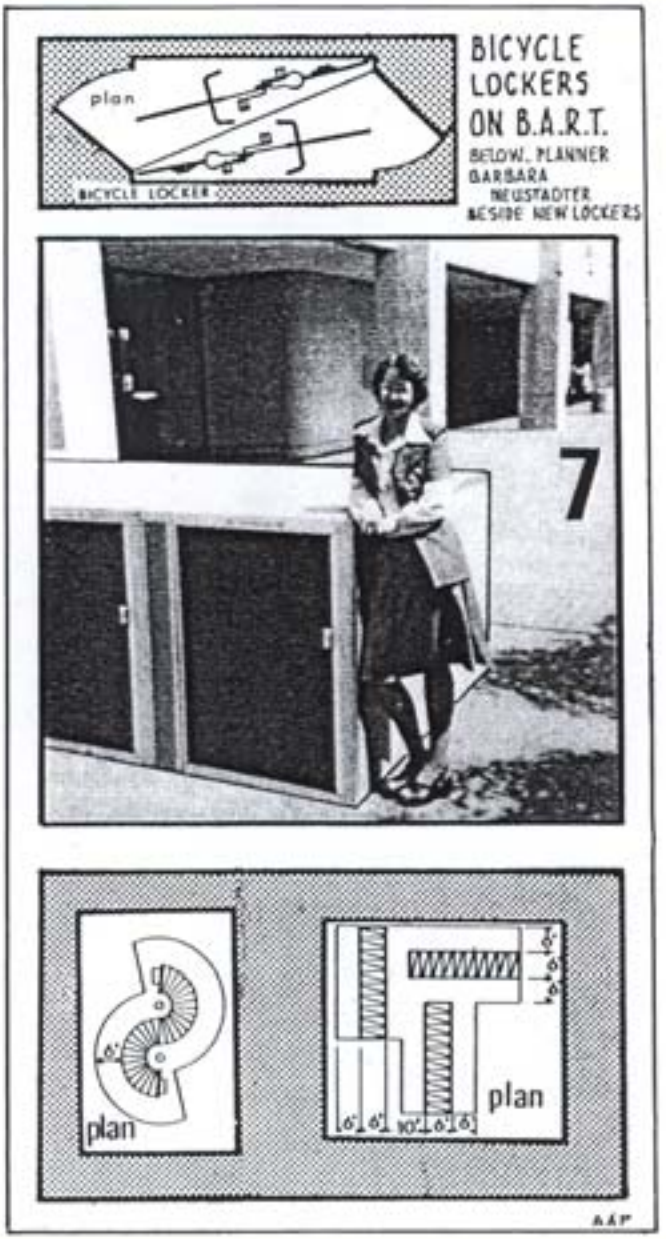
BICYCLE STORAGE EQUIPMENT

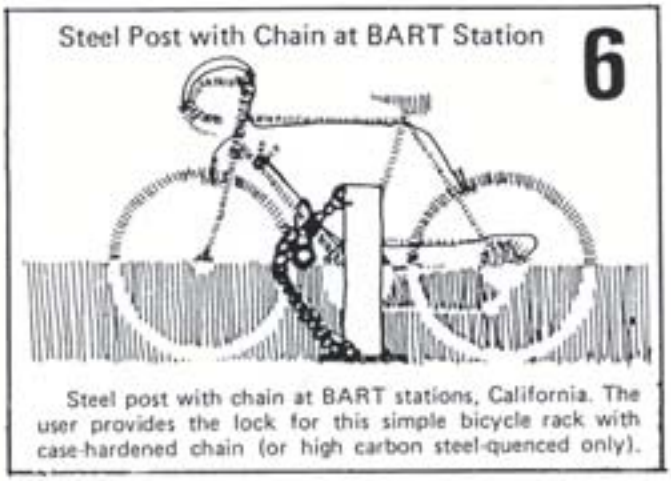
The drawings show a variety of bicycle storage facilities all of which are American and can be used as a guide to indicate what kind of equipment needs to be developed in Australia. What is lacking in Australia, at present, are locally made products or agents to handle American products. The manufacturers of the rack and locking devices in Figures 8 and 9 would like to sell these devices here.

Those requiring further information should contact the Bicycle Institute of Victoria.

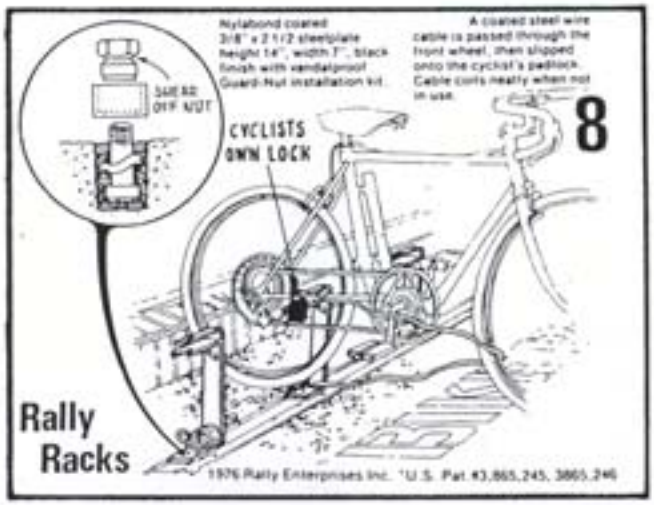
Drawing 9 shows a locking device that is fitted to an existing car parking meter and one variation of which is a coin in the slot machine and several other types of locking units area available.

Figure 8 shows a low cost unit that is highly effective because it locks the frame and rear wheel at the same time an optional extra feature of a coiled wire allows the front wheel to be locked as well. This rack has the same important feature as the rack on drawing 1, as the cyclist needs only to bring a lock to use them. The rack in figure 6 is the simplest device being based on a post





Steel post with chain at BART stations, California. The user provides the lock for this simple bicycle rack with case-hardened chain (or high carbon steel-quenced only).



with a heavy duty case hardened chain or hardened through chain attached however it is not the lowest in cost, but it does overcome the bolt cutter problem because the hardened chain on rack 6 and the heavy duty metal bars on rack 8 cannot be cut. Locks with hardened hasps are readily available to the ordinary bicycle user but hardened chain is not, so these devices fit in perfectly with the equipment the cyclist can actually buy. Even if heavy hardened chains were readily available, it would be too heavy to conveniently carry by cyclists, so providing it as part of the rack is a practical low cost solution.

A heavy duty lock with a 3/8 dia hardened hasp, is all the cyclists would have to carry and even this can be protected from the bolt cutter by a device attached to the end of the chain known as a lock protector, into which the users lock fits. Hardened chain is available in Australia for this application at a reasonable price if supplied in quantity. For a definition of what equipment thieves use and the growing problem of theft prevention see article "Bicycle Theft": page 68, ref. 6.

PAY LOCKERS

Both of these racks are suitable for use in areas open to public scrutiny however in areas away from public view the most secure facility is the bicycle locker.

Drawing 7 illustrates a double sided bicycle locker used on the Bay Area Rapid Transit System. This unit can be used in out of the way places and is very hard to break into, it also has the feature of denying the thief a view of what he might be stealing, which is an effective deterrent.

The double sided bicycle locker is an efficient user of space which can be linked to provide interesting layouts as is shown on the drawing, they can also be hired out to library users and will pay for themselves as described in the case study on page 66 of the appendices to ref. 6.

SECURITY AND DESIGN LIFE

Within the predicted design life of the bicycle storage facilities installed now and in the future, they will be attacked by professional thieves. Therefore it is imperative that bicycle storage facilities be tested out and developed to meet this problem, so that in future all public transport operations can use the designs and specifications developed to cater for the changing needs of their users.

BICYCLES AND MINIBUSES

The shared minibus with bicycle racks on the back is theoretically one of the most flexible transport vehicles ever designed. Standard trailers as shown in Figure 11 could also be used.

The integration with bicycles would greatly increase both the catchment area at the starting point of trips to work, and the area served along and at the end-point of the route followed.

It eliminates the length of the trip for the driver, who does not have to take everybody home except during periods of bad weather. This system offers the advantage of allowing people to be dropped directly at their destinations on days when the weather makes cycling unpleasant. The flexibility of the fully equipped minibus is a totally unexplored area in transportation planning.

BICYCLES AND SHARED PRIVATE VEHICLES

The most common form of bicycle/car dual mode is the carriage of bicycles in the boots or on the luggage racks of cars, taking them to recreational areas in or near the big cities or to country areas where a good metalled back road system exists carrying very little car traffic. Such dual mode uses are becoming increasingly popular with long distance touring cyclists and family groups going for short recreational rides. The boot of the car can take childrens bicycles, adult bicycles with their front wheels removed or fold-up bicycles, but as yet there are very few properly designed racks that fit on the rear or top of a car in use in Australia.

Bicycle racks for cars are just coming onto the Australian market and within a few years, will become very common as they are in California and many other American States. See Figure 10 which shows a patented Australian design. As with other forms of dual mode bicycle travel the potential of bicycle/car systems in general and the bicycle/shared car systems needs to be studied in depth.

As the recreational use of bicycles and cars gathers momentum and people become familiar with using their bicycles and cars together, a major marketing effort should be made to encourage people to share their cars with people willing to cycle to their homes for a pick up. Many people now travel to and from work with friends, and at least 10 times as many people could do so if the bicycle was used to get to the drivers home or rendezvous point. Ideally, such a study should be done within the context of an all embracing study

into making better use of motor cars, in particular making it easier for people to share cars.

Today in Australian cities the average car occupancy is only 1.3 (including the driver). If it was possible to raise this average merely by one passenger per car, freeways would become superfluous, road congestion would disappear, and petrol consumption and air pollution on busy streets would fall to about half their present levels.

Once political constraints are lifted, some way of providing an incentive for people to share cars will be found. Once this has been overcome, the way is open for using bicycles to overcome one of the main hassles that the drivers of shared cars have, that is picking up and putting down passengers at their homes. Using bicycles to get to the drivers home then putting the bike on a rack is one way of overcoming this problem.

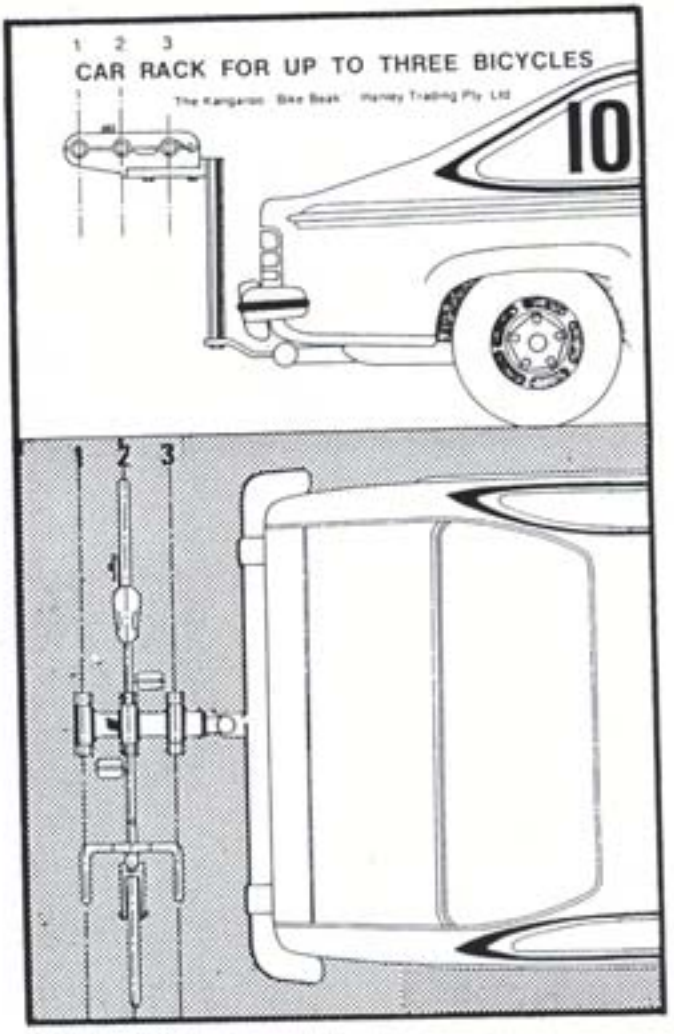
MARKETING DUAL MODE TRAVEL

The promotion and marketing of bicycle dual mode is a relatively inexpensive means of increasing public transport usage, and an examination of the detailed benefit/cost analysis made in the Geelong Bike plan leads me to believe that over a 15 year period a benefit/cost ratio of at least 6:1 would apply.

Given the ongoing changes in people attitudes towards personal exercise, the environment, pollution and other issues, a marketing programme selling the environmental benefits of using bicycles and public transport should generate enough increase in rail patronage to pay for itself on an ongoing basis.

Dual mode travel is one of the areas defined as needing future study by the full time bicycle planning group proposed to be set up by the Victorian Ministry of Transport. However, it seems unlikely that enough new civil service positions will actually be created to man the planning group and this may not happen. In any case the prime responsibility for this planning work should rest with Victorian Railways and MURLA. It is also their responsibility to investigate an idea which has proven itself in European countries, is hiring out bicycles from stations for various purposes.

Good quality machines can be imported for as low as $70 each, provided that they are imported in minimum lots of 200. It should be possible to make arrangements similar to this with Australian Manufacturers for large discounts on large orders. The Bicycle Institute has obtained quotations for the supply in quantity of good quality fold up bicycles from Germany, so the savings that could be made are not merely one of conjecture.



The most important factor in encouraging bicycle dual mode travel once the physical planning has been done and secure storage facilities made available, is selling the idea with the kind of skill normally associated with private enterprise, marketing campaigns and occasionally indulged by Government agencies, such as the "Life Be In It" Campaign in Victoria. So far increases in adult bicycle usage has taken place, despite the lack of facilities and lack of hard sell.

CONCLUSION

The central argument for the creation of a dual mode transport system, less wasteful of resources, particularly oil, is supported by the other arguments that have considerable force.

[1] ELIMINATION OF SOCIAL VIOLENCE

In the last ten years, 40,000 Australians have died violent deaths due to the use of the private car. Bicycle dual mode travel overcomes this because buses and trains are so much safer per passenger mile than car travel and a short trip to the stop or station by a cyclist is a minimal amount of exposure for the cyclist.

Ten miles by car is much more of risk than one mile by bicycle and 9 miles by trains despite the higher accident per vehicle mile by bicycle. The overall improvement in the public transport system that widespread bicycle usage would make possible, would reduce the amount of motoring done and more people would use the public transport system. This is the most important contribution to transport safety than can possibly be made because railways are over thirty times safer per passenger mile and modern buses are seven times safer per passenger mile. Bicycle dual mode transportation is the starting point for the creation of a non-violent transportation system.

Cycling itself can be made far safer and the Geelong Bike Plan gives a comprehensive means of doing this using engineering improvement, educational programmes and the correct enforcement of road law combined with the encouragement of cycling.

(2) ENVIRONMENTAL BENEFITS

The system outlined would in ten years greatly reduce air and noise pollution, reduce noise levels, conserve open spaces from being vandalised by freeway builders and generally bring about a more convivial street life, as more and more people walked and cycled instead of being locked into an anonymous tin box.

(3) SOCIAL EQUITY BENEFITS

The systems proposed will greatly increase the accessibility of public transport services to the able bodied section of the community that does not have access to a car. The carless, unemployed will be able to gain access to a greater number and range of jobs and carless young adults will be able to move around much easier.

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