

The Demand Management Opportunity in Perth, Western Australia

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Abstract:

Perth in Western Australia is a very car dependent city. This is a legacy of cars having been readily available and affordable for most of the period during which the city was developed. Not surprisingly then, Perth currently experiences the adverse consequences of high levels of private car use, which by comparison with other cities are disproportionately high.

There is concern that the situation could worsen, given that the population of the city is forecast to double within the next 30 years. It is therefore important to identify the road demand management opportunities for Perth.

The Paper examines the full range of road demand management techniques in terms of their potential application to Perth. The feasibility and time frames for implementation are considered from technical and social perspective. It is the social aspects that are seen to present the greatest challenge.

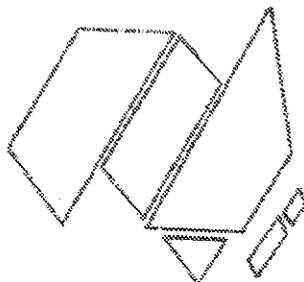
The principal road demand management opportunities relate to the basic land-use pattern of Perth and to private car use. Changes in land-use pattern will take some time to achieve and also there currently exists some controversy about the benefits it might provide for an urban region as a whole. By contrast, changed private car use has the potential to provide benefits in the short term and can be achieved through altered travel choice behaviour. It would allow the Perth road network to be better utilised and preserve all other demand management options until each can be adequately evaluated.

The road demand management opportunities in Perth provide a suitable context within which future road infrastructure investment can be considered.

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1. INTRODUCTION

The road network of Perth, the capital city of Western Australia, is a significant and vital public asset. Ongoing effort is required in managing its use, improvement and further development to ensure that it provides the maximum benefit to the people of Perth.

Management of Perth's road network must however be consistent with and contribute positively toward realising the ultimate transport goals for Perth. For this to be achieved, the road network related decisions and actions taken in the short term must be determined from an appropriate basis. It is this matter with which this Paper is concerned.

2. OUTLOOK FOR PERTH

Perth has a low population density and high private car ownership and utilisation rates. This has resulted from the low cost of land development of the flat coastal sand plain on which Perth is located [Martin 1991, as cited by Newman and Mouritz 1991] and cars having been readily available and affordable.

Perth has in effect been developed in ways which have readily accommodated and so encouraged use of the private car. The extent to which this has occurred can be gauged from:

- All day parking in central Perth is provided at the rate of 1 bay for every 2.5 central area workers, whereas by way of comparison Brisbane has 1 bay per 4.1 central area workers [Johnstone, 1992, p1]
- Cars account for 73% of all central city access trips [ibid]
- For metropolitan Perth in 1986, approximately 92% of weekday motorized travel was by car, and only 8% by public transport [Department of Transport, 1993, p4].

It is the travel time advantage of the private car compared to the alternatives that make it the preferred choice and so dominant transport mode [DPUD 1990 (Dec), p 58]. This has provided high levels of personal mobility [ibid, p 62]. Indeed for the period 1976 - 1986, the private car in Perth was increasingly used and at decreasing occupancy rates [ibid, p 57]. Not surprisingly then Perth has in recent times been cited as having the highest rates of car ownership and travel of all Australian capital cities [State Plan Comm. 1987, pp 57-58]. Perth has now become very dependent on the private car.

This has resulted in some adverse consequences, for example:

- Almost all of the carbon monoxide and over 60% of the hydrocarbons and oxides of nitrogen emitted to Perth's atmosphere were contributed by cars [EPA 1992].
- Perth's air was found to have exceeded the World Health Organisation's recommended maximum ground level ozone concentration on 7 days of the 1990-91 Summer with road transport being considered to be the most significant cause [ibid]
- Perth has the highest per capita use of gasoline (non-renewable) fuel in Australia [Newman and Mouritz 1991]
- Compared to cities studied across all of Australia, Europe and Asia, in 1980 Perth had the highest per capita level of carbon dioxide from transport [ibid].

In addition to these environmental impacts, there is also the damaging effect on economic competitiveness of traffic congestion, given the important contribution of the road network in the delivery of goods and services, particularly so for Perth. Adverse impacts on both environmental and economic well being of Perth have the potential to become very much worse given that it has been forecast that within the next thirty years the population of Perth will double to 2 million [DPUD 1990 (Nov)]. It is unlikely that the travel needs of the forecast increase in population could be accommodated at the current high usage rate of the private car. It is therefore becoming increasingly apparent that it is not appropriate to allow past trends to continue. The high private car dependence of Perth is not sustainable.

Changes are required which will accommodate the travel needs of a very much increased population. This must occur in ways which will be more sustainable than continuing to cater for the current high level of private car use and yet seek to preserve, if not enhance, the high quality of life that has made Perth an attractive place to live. The outlook then is that there is a considerable challenge for those responsible for managing Perth's road network.

3. CHANGES TO BE ADDRESSED

It is the adverse impacts of private car use that must be targeted. These result from the combined effects of the characteristics of the particular vehicle and of its use. For example the emission of damaging pollutants is a consequence of the engine design, of the fuel type it requires and of its economy, and of the amount and operating conditions of its use.

Some of the required changes therefore relate specifically to minimising the adverse impact potential of the car itself. To some extent Perth is seeking to adopt these changes. For instance a target has been set for the year 2015 to reduce the average car fuel consumption from the current 11.2 litres to 6.5 litres per 100 Km [Johnstone 1992, p14]

Such changes are possible largely because car manufacturers are responsive to the dictates of the authorities in the large developed cities of the world, more so than just for Perth. As advances in technology make these type of changes more readily available and affordable they would be expected to be essentially automatically reflected in the private car fleet of Perth and so are not considered further in this Paper.

Other required changes relate to minimising private car use and these would complement any improvements in the adverse impact potential of the car itself and so provide a net overall benefit. These concern:

- eliminating avoidable private car use
 - by either removing the need for travel such as through telecommunicating or meeting the need by use of other travel modes.
- reducing the amount of unavoidable private car use
 - by reducing the distance travelled and/or increasing the occupancy rate.

The adverse impact of private car use can be further minimised by seeking changes which have its unavoidable use occur under 'free flowing' operating conditions. It is the slow 'stop-start' operating conditions resulting from traffic congested roads that is the most detrimental.

The required changes must then simultaneously minimise private car use and maximise the efficiency of that which does occur. A reduction in private car use would lessen traffic congestion and increase the efficiency of the road network. This would raise the service level afforded by use of the private car and so continue to make it the preferred choice of travel mode! The changes that are required must address this paradox. Collectively these changes constitute Demand Management of private car use, with the predominant focus being that which is of low occupancy and occurring during periods of peak demand for road space.

4. ADDRESSING THE CHANGES

The demand for private car use does not occur in isolation from the overall demand for travel. It is therefore important that its context within the full spectrum of travel demand be considered.

Some of the basic themes relating to travel demand that are apparent [Rooney 1993 and Richardson et al 1993] include:

- **Complexity**
 - Transport is a derived need that is inextricably linked to land use and life style patterns
 - Transport simultaneously seeks to serve economic efficiency and social needs which at times have competing if not conflicting requirements

- **Constraints**

- The high level of personal mobility afforded by private car use is generally considered by the community as integral to a high quality life style and so any reduction is liable to be viewed as regressive.
- High levels of accessibility do not necessarily require high levels of personal mobility but can be addressed through increasing the relative proximity of the places between which travel is required, however considerable time and effort is necessary to alter the current low density urban forms.

- **Considerations**

- The equity of access and sustainability of transport can be compromised to the extent that 'all-in' total costs are not charged of users:
 - this occurs in regard to private car use in that pollution and other costs are not directly charged.
 - it also occurs in regard to public transport which tends to be heavily subsidised by the general public yet disproportionately used by the more 'well to do' workers commuting to the CBD (Central Business District)
- The current transport system is not ecologically sustainable.
- Social and political acceptance is currently insufficient for some of the available technical solutions to be adopted which can provide for more sustainable transport consumption behaviours.

- **Concepts**

- A long term holistic systems approach is required
 - fragmenting and compartmentalising the various aspects of managing the transport task is inappropriate.
- Sustainability of society as a whole and so of the overall transport system is required
 - this has as its basis ecologically sustainable development (ESD) which must be articulated in the form of a vision of the particular city, one that is underpinned by shared beliefs and values
- Integration is required
 - of transport planning with that for land use and life style.
 - amongst the various transport modes.
 - of local transport planning with that for the region

The key implications of these basic themes for managing the demand for private car use is that it must occur through a long term holistic systems approach to ensure that benefits achieved in the area of private car use are not short lived or otherwise negated through transfer of problems to other travel modes. Also that increased community participation and so political support is required to develop a future vision of the city and then to implement the required technical solutions.

The holistic systems approach is appropriate to address essentially any such complex and dynamic problem [Senge 1992]. Of particular note is that it can be practised at the level of whole communities and not just to respond or adapt to change, but rather to be generative and so create the future [ibid] - the shared vision of the city

The aspect of community and political support has been recognised in terms of the various Travel Demand Management interventions having been identified as being either 'passive' (voluntary options) or 'active' (imposed and unavoidable) [Wayte 1991]. In general it is the 'active' interventions that potentially offer the greatest contribution yet are not well accepted by the community and so cannot attract the political will necessary for implementation. Of particular significance in this regard is that both Wayte [1991] and Ogden [1992] identify the need to develop a more appropriate awareness and attitude on the part of the user.

In terms of the holistic systems approach, the need to change awareness and attitude is synonymous with the need to exploit the dynamic aspect of a complex system, as distinct from focusing on the detail of any of its components [Senge 1992]. To achieve a change in the dynamism of a complex system requires suitable 'leverage' [ibid]. For private car use, the key points of 'leverage' are the current '*concern for convenience*' (mobility) which is predominant to the more desirable '*concern for conservation*' (sustainability).

Ogden [1992] has however identified another useful point of 'leverage' - that of '*concern for cost*'. This involves creating a greater awareness in the mind of the user of the true and total cost of the various travel alternatives - of the traveller receiving adequate (pricing) signals about the cost of travel. To the extent that adverse environmental impacts can be costed and are included amongst travel charges (on a 'polluter pays' basis), so 'leverage' from '*concern for cost*' would in effect also serve that from '*concern for conservation*'. However, until this occurs the '*concern for cost*' and '*concern for conservation*' must be considered as separate points of 'leverage'.

The community has an undoubted '*concern for cost*', particularly should the associated charges be made quite apparent and payable direct by the user. Fortunately most of the community also have '*concern for conservation*' [Wayte, 1991, p28] and this has been specifically noted for the people of Perth [Newman and Mouritz 1991, p15]. The costs of travel would not therefore necessarily need to include direct charges for the adverse environmental impacts caused by that particular travel mode in order to effect appropriate changes. However additional non-monetary information (and so awareness) would need to be provided regarding such impacts. The combination of direct user charges and environmental impact information would together provide a powerful basis for effecting the preferred changes toward ecologically sustainable travel behaviour.

In essence, in seeking to adopt Travel Demand Management it is a matter of creating community awareness of the difficulties associated with current arrangements so that attitudes might be attuned toward the notion of a sustainable yet high quality life style society. Then making timely provision of appropriate transport alternatives. By this means Travel Demand Management should proceed as a progressive and deliberate series of interventions that directs change toward the vision for the particular city. Truly a case of thinking long term and globally but acting short term and locally!

How does the holistic systems approach and its attendant 'leverage' relate to the particular interventions that might comprise a Demand Management strategy for private car use?

The numerous interventions relating to managing the demand for private car use have been variously reported, however a quite comprehensive categorisation of them has been developed for AUSTRROADS [Ogden 1992, p 183] and this is given overleaf in Table 1. An overview of this categorisation and of Travel Demand Management generally has been given by Wayte [1991], which together with particularly the work of Ogden [1992] and Zupan [1992] indicates that there are many issues relating to managing the demand for private car use. The more significant of these are:

- Much tends to be proposed but little is implemented.
- The various interventions are seldom discrete, often overlapping and at times interdependent.
- Inadvertent or unintended consequences can result, at times of a detrimental nature. These may be
 - the translocation (in place and/or time) of existing demand
 - the easing of traffic congestion being offset by releasing latent demand
- Success is generally dependent on the close and continued co-operation of many stakeholders.
- There is less than clear convincing evidence of the effectiveness of some interventions
 - evaluations have tended to relate to specific interventions applied at a local level.
 - the aggregate effect on travel demand at the macro (total urban region) is not yet well understood.
 - the impact of urban form and public transport are relatively long term and may not produce the aggregate improvements claimed by proponents.
 - evaluation methodologies need to be further developed, particularly in regard to predictive modelling.
- Road pricing is attractive in an engineering and economic sense, technically feasible and is being used in some parts of the world, yet is not well supported socially or politically.

Table 1: Travel Demand Management Interventions
Source: Austroads, 1992

Strategy	Method	Technique
A Improved Asset Utilisation	A1. Peak Spreading	A1.1 Staggered hours A1.2 Flexible hours A1.3 Working week changes A1.4 Fare or toll differentials A1.5 Parking cost differentials A1.6 Parking availability differentials
	A2. Vehicle Occupancy	A2.1 Ride sharing A2.2 Van pools A2.3 HOV lanes (Road lanes for exclusive use of high occupancy vehicles) A2.4 Parking priority A2.5 Park and ride schemes
B Physical Restraint	B1. Area Limitation	B1.1 Traffic cells B1.2 Traffic mazes B1.3 Area Licences/permits B1.4 Cordon collars (Deny or constrain entry to a specific area)
	B2. Link Limitations	B2.1 Access metering B2.2 Signal timing B2.3 Reduced capacity B2.4 Public transport priority
	B3. Parking Limitations	B3.1 Parking space limits B3.2 Parking access controls
C Pricing	C1. Road Pricing	C1.1 Tolls C1.2 Area entry fees/licensed C1.3 Congestion pricing/electronic road pricing
	C2. Parking Prices	C2.1 Short term priority policies C2.2 Higher entry costs
	C3. Taxes	C3.1 Higher fuel taxes C3.2 Parking taxes C3.3 Higher ownership taxes
D Urban and Social Changes	D1. Urban Form	D1.1 More compact cities D1.2 Efficient urban development
	D2. Social Attitude	D2.1 Community information and awareness D2.2 Community education
	D3. Technical Change	D3.1 Communication substitutions (Use of telecommunications) D3.2 Transportation development

A generic Demand Management strategy for private car use which accommodates these issues is evident [Ogden 1992, Wayte 1991 and Zupan 1992] In essence it is the adoption of the proven 'passive' Demand Management interventions that provide immediate benefit, such as:

- increasing private car occupancy rates
 - car pooling/sharing
- controlling parking in the CBD
 - combination of concessions and penalties to discourage 'all day' parking of particularly low occupancy vehicles
- continued provision of inter suburban arterials (ring roads)
 - allow through traffic to efficiently bypass the CBD and other busy centres.

The adoption of improved vehicle and highway technology as it becomes available would also progressively occur. Changes to the appropriate user awareness and attitudes would then be required before the more 'active' interventions such as road pricing could be implemented.

Such a generic strategy seeks to address the problems of private car use which are with us now and is not reliant on the Travel Demand Management interventions of urban form and public transport which might provide improvement over the long term. In effect it preserves options until such time as there is adequate research into the effects of those interventions about which there is some doubt. Indeed for Ogden it seems that at best, the 'jury is still out' on the issue of the long term aggregate effect of the urban form and improved public transport interventions. Travel pricing (for all modes) to him it seems is a more fundamental, robust and so appropriate approach to pursue.

The situation is though somewhat more complex than is portrayed in this generic strategy, a consequence of the interdependencies that exist amongst the various interventions. For example, it is likely that for the more 'passive' intervention of carpooling/sharing to be widely adopted, the 'active' intervention of 'real time' road pricing would need to be applied. It is the meshing of all of the various interventions, both amongst themselves but also within the greater fabric of public policy that matters. That is, 'tinkering' at the level of individual interventions to address specific localised problems can portray a sense of progress but in reality may provide no net benefit and indeed it may produce an overall detrimental effect!

A preferred generic Demand Management strategy for private car use that accommodates such complexities is one that explicitly addresses the change to the more appropriate user awareness and attitudes. It is based on the three components of:

- **PLANNING**
 - to determine and communicate the shared vision of the city.
- **IMPLEMENTATION IMPETUS**
 - to address the matter of 'leverage'
- **IMPROVEMENT**
 - the sequence of specific interventions.

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- **PLANNING**
 - to determine and communicate the shared vision of the city
- **IMPLEMENTATION IMPETUS**
 - to address the matter of 'leverage'
- **IMPROVEMENT**
 - the sequence of specific interventions

The *Planning* component concerns the determination and communication of the vision for a sustainable city. This should be participatively developed with a wide spectrum of community involvement and be supported by a suite of well integrated plans, specific to each local area and travel mode. The vision for the city and the support plans should be related to say a 30 year time horizon and be subject to periodic review. Progressively the vision and plans will reflect widely shared and appropriate community values and beliefs. *Planning* will progressively promote user awareness of the changes that are required.

The *Implementation Impetus* component concerns the development of awareness and attitudes that move the community toward more sustainable travel behaviours. This is reliant on cost and conservation information being incorporated into the travel decision making process. *Implementation Impetus* will promote user preparedness to adopt the required changes.

The *Improvement* component includes all of the various interventions that enable the user to eliminate avoidable private car use and to reduce the amount of that which cannot be avoided. This concerns the provision of other transport modes and increasing the occupancy rates and route efficiency of that private car use which does occur. *Improvement* is achieved through the timely provision of appropriate travel alternatives so that users can exercise their preparedness to adopt the required changes.

This preferred generic strategy offers a basis from which the adequacy of Demand Management activities relating to private car use can be assessed.

4. APPLICATION TO PERTH

Perth has various initiatives that relate to the demand for private car use. These are considered in terms of the preferred generic strategy that has been determined. By this means any deficiencies in current or proposed actions can be identified. Such deficiencies in fact represent the Demand Management opportunities for Perth!

The *Planning* component it seems is being particularly well addressed. Several key planning studies have been undertaken in recent times, these include:

- Transporting Perth into the 21st Century (1990)
- METROPLAN: the Metropolitan Strategic Plan for Perth (1990)
- Road Reserves Review (1990)
- Report of the Transport Strategy Committee for Future Perth (1992)
- East Perth Project Outline Development Plan (1990)
- Northbridge WA Study (1991)
- Perth Foreshore Urban Design Competition - in essence a study (conducted in 1991)
- City Living (1992)

Other planning studies are underway, those of:

- Review of the City of Perth Planning Scheme
- Proposal to provide an electrified passenger rail service from Fremantle (the sea port of Perth) south to Rockingham and possibly further to Mandurah
- Review of car parking policy in the CBD, with a possible outcome being an upper limit on the aggregate number of parking bays allowed
- Proposal to provide a northern bypass of the CBD, inclusive of an additional crossing of the Swan River.

Of particular relevance however is the current study seeking to prepare "Getting There - A Metropolitan Transport Strategy". The objective of this study is to further progress the broad directions determined in earlier studies into more detailed and compatible operational programs of the various transport agencies.

The planning studies collectively provide comprehensive coverage of Perth's transport needs. A notable feature of most is the breadth of the disciplines and interest groups represented within each of the particular Study Teams and the high degree of community consultation.

The *IMPLEMENTATION IMPETUS* component is somewhat less progressed!

The true costs of the various travel modes is not generally agreed and so is not widely communicated. Consequently the 'leverage' from '*concern for cost*' is largely dormant.

An exception however is in the area of CBD parking where reduced rates are charged for high occupancy private cars. This to some extent compensates for the limited scope afforded by Perth's road network for high occupancy vehicle (HOV) lanes - a consequence of a HOV lane requiring a reasonably long length of 3 or more lanes of heavily trafficked road link to be practical.

The 'leverage' from '*concern for conservation*' is also largely dormant, suffering from a lack of timely and relevant data on the adverse environmental impact of private car use. However this situation will hopefully soon be addressed through a proposed Perth Air Quality Study. The proposed study will provide valuable insight into the air pollution contributing and cleansing mechanisms so that appropriate control strategies might be devised.

There are numerous initiatives that relate to the *Improvement* component, the more significant of which are considered.

Perth's passenger rail service has been subjected to considerable improvement effort. The existing Midland, Armadale and Fremantle lines have been electrified and re-equipped at a cost of \$190m. A new line, north from Perth to Joondalup, has been constructed at a cost of \$275m. This new line is proving very popular with patronage 7 years ahead on that which was forecast.

Integration of the passenger rail service with private car and public bus travel is also being improved through development of bus/train interchange stations and 'park and ride' facilities. Improved ticketing arrangements further assist in attracting both bus and train patronage. Within the central city there has for some time been 'free' bus travel and a \$34m busport has more recently been commissioned which assists passengers to transfer between bus services.

Land use has also been receiving attention. Urban renewal to effect increased population densities is occurring, most notably the East Perth Project. Allied to this basic change is the promotion of cycling through progressive extension and upgrading of Perth's cycle path network.

It is apparent that the major thrust of current *Improvement* initiatives is focussed on the central city area.

The configuration of Perth's passenger rail service is that all lines, including the new Joondalup line, radiate from the Perth Central Station, on the fringe of the CBD. The rail service together with many of the other initiatives are serving to encourage people to the central city either as a destination or as a point of public transport transfer.

Whilst people are being enticed to the central city, private cars are not. This change will be further promoted through the progressive development of Perth's principal road network - essentially completion of the outstanding links of the various inter-suburban highways and provision of the City Northern Bypass.

The risk however is that in primarily focussing on the central city area, the heavily subsidised public transport system will tend to promote the further sprawl of Perth into outer suburbs. Private car use could then continue at high levels for all except travel to the central city. The sprawl will tend to add to the length of the private car journeys that are undertaken and so in aggregate Perth may not be better off - the concern about effects on an urban region as a whole raised by Ogden [1992].

This risk (or deficiency) does though, represent a Demand Management opportunity to the extent that Perth's predicted population growth is accommodated in a more travel efficient land-use and life-style pattern. That such an opportunity exists was identified by Chambers and Ker [1992]. However it will take some time to realise this opportunity and indeed that of 're-accommodating' Perth's current level of population through Urban Renewal - notwithstanding the reservations of Ogden [1992] regarding the relationship between land use pattern and private car use!

More immediate and realisable opportunities however relate to the current deficiencies of the *Implementation Impetus* component. The Perth Air Quality Study will likely result in improved environmental monitoring and so information. For this to be useful it must be appropriately communicated to those using private cars so that their travel behaviour might be suitably modified. A similar opportunity exists for road use cost information especially if it can reflect the detrimental effect of congestion on economic performance.

The short term opportunity, if not imperative, would seem then to relate not to investment in specific roads or indeed other transport infrastructure, but rather to collecting and disseminating road use information to road users. Initially this could focus on improving the efficiency of private car use, from advising the most appropriate (least congested) route through to locating vacant parking bays. It could then be progressively developed to enable real time congestion pricing for private road use - the ultimate end which some experts [Wayte 1991 and Ogden 1992] promote as desirable if not inevitable.

6. CONCLUSIONS

Ultimately the travel needs of Perth must be met through changed transport infrastructure arrangements and so of the relative contributions of the various modes. It is the demand for travel itself that must be managed, in particular that for private car use of low occupancy and undertaken at peak periods.

Such changes are quite fundamental and will take some time to implement. This will require development of appropriate strategies which seek to achieve the desired 'end state' or 'Vision' for Perth and which capitalise on the available opportunities. The most promising of these opportunities concerns the communication of economic and environmental impact information relating to private car use. This would serve to provide the impetus necessary to hasten the required changes, especially those that are not currently palatable to the community.

The overall result being sought is for the road network to continue to provide value to the people of Perth.

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Intermodal Integration (Study of the Transport Network in Port of Melbourne)

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Technology

Abstract:

Having defined intermodal as the transfer of cargo from one mode to another (or others), the authors identify the different areas in cargo transportation which affect the efficiency of intermodal transport. The importance of investigating alternatives to truck transport in the intermodal link is discussed in view of the central position of the Port of Melbourne and the consequent congestion and pollution caused by trucks. The rail network would provide a viable alternative for large quantities of cargo to be transported over long distances.

The use of computer technology to simplify and speed up the numerous steps in the intermodal chain is also discussed.

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