

The end of the urban freeway

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Support for the construction and maintenance of freeways has decreased

The collapse of the Los Angeles freeways could be a symbol of the end of this technology as the basis of city transport. Some of the 13 LA freeways which lie in ruins from the recent earthquake are being rebuilt, but the most damaged could be removed forever. The two in San Francisco which collapsed five years ago have not been rebuilt. The community has demanded something different.

Since Hitler built the first autobahn in the 1930s, the freeway has been controversial. The gigantism of the architecture appeals to macho empire builders – only the high-rise building has similar massive proportions. Nature has tended to level such gigantism throughout history. It has now revealed the limits of the highway engineer and in doing so makes us look again at how we should build cities.

Even before the earthquake in Los Angeles, the freeway was receiving substantial criticism. 1993 saw the opening of the last new freeway in Los Angeles. The Century Freeway, costing some US\$200 million per km to build, revealed that such structures had exhausted the political and financial will of citizens. Only 18 per cent of people in a Californian survey believe that freeways solve the traffic congestion problem (Franz, 1989). Robert Reinhold concluded a story on the Century Freeway in the *New York Times* by saying: "...few cities will soon try again to build highways through their urban cores". Some of the LA freeways will no doubt be rebuilt and reopened, but the back of the urban freeway is now broken figuratively as well as literally.

This article will examine some of the trends in providing alternatives to the urban freeway in the UK, USA and Australia where there appears to be the acceptance (perhaps a little reluctantly) that a new paradigm is emerging on how to build cities. These countries are significant as they are probably the ones which in the past, have shown the greatest commitment to the freeway.

Little reference is made to European and Asian cities as the majority of these moved some decades ago to this different paradigm though exceptions can always be found.

What is the alternative?

In San Francisco, the Embarcadero Freeway and the Cypress Freeway have not been rebuilt because the community has revolted against their impact and because alternative approaches do exist. Traffic demand management is now seen as necessary and, together with innovative public transport, is providing access in ways which are much more in tune with community ideals, particularly when it is provided in close association with sensitive land development that promotes pedestrian and bicycle access. This three-sided approach – demand management, upgraded transit and non-car-based land development – is the basic alternative to the urban freeway.

Business interests in San Francisco were desperately demanding the Embarcadero Freeway was rebuilt after it was damaged five years ago. After a few years, however, they found their trade was not diminished and could in fact be improved, along with the whole city, if the waterfront freeway was removed. The role of public transport in a city is usually underestimated as is the ability of land uses to adjust to new constraints.

Los Angeles once had the most extensive and efficient public transport in the world. In the 1930s, the famous red trolleys (along with the transit systems in 44 other cities) were bought up by General Motors, Firestone Tyres and Standard Oil – and closed down. The LA freeway era was born in the wake of this decision. It was not however a community decision but a commercial one and illegal at that. The consortium was found to have broken anti-trust laws and was fined \$5,000.

Public transport once worked well in LA and continues to provide a softer and more sustainable solution to a city's accessibility. In particular, modern light rail can provide the city centre and cross-city destinations that are required. European cities such as Zurich and Stockholm

and Asian cities such as Singapore and Hong Kong have shown that there is no shame in showing a preference for public transport other than freeways.

For freight, these cities (particularly in Europe) do have good roads, though rarely do they have freeways passing through their cities. In The Netherlands, there is a strong emphasis on limiting car use so that freight can have better access, and limiting freight movements by ensuring that high freight intensity land uses are kept to areas with good road access rather than having to build more roads. At the same time, they have strong land use planning regulations which ensure high people-intensity uses are built around good transit. This process is called "The right business in the right place" (Ministry of Housing *et al.*, 1991). Dutch cities are wealthy, yet they have much fewer cars in use than most cities and have no plans to build a massive freeway network in their much-loved cities. Such a concept would be seen as destroying their major economic asset. Instead there are a number of Dutch cities which see their future as so far away from the urban freeway scenario that they are leading members of the Car Free City movement.

Even in Los Angeles today the new order is under way. At the same time that it had begun to see the impossibility of building ever-greater capacity for automobiles, the first evidence of the new paradigm was appearing. In 1993, its new subway opened, light rail is being built again along old trolley routes and heavy rail passenger trains are being introduced onto freight lines. When the freeways came down, the new rail systems (all of which survived) were flooded with passengers, many of whom the LA transit operators believe are there to stay. Tollways and parking controls are being phased in to reduce traffic, together with other demand management and the first plans for transit-supportive land use are appearing. As the new order gains momentum, the rationale for the urban freeway is losing its last shreds of credibility, particularly in the light of new economic analyses.

New economic awareness

There has always been an awareness that urban freeways cause environmental and social damage (with some confusion about their role in causing more emissions and fuel use, see Newman and Kenworthy, 1988). But this has been acceptably traded off by decision makers who saw the economic gains of the extra mobility. Now there are significant questions about the economic benefits to be gained from urban freeways, even if a government is able to find the huge capital like that associated with the Century Freeway.

The accepted myth for most governments, at least in the English-speaking world, has been that transit systems

are inherently a waste of money, while road funding feeds the economy. The reality appears to be the opposite, at least in cities. Yet it appears that in most countries, the acceptance of this myth has not come about from analysis or evaluation but merely from assertions, often dressed up in scientific form in the guise of a model – particularly in the UK, USA and Australia.

In the UK, Oliver Tickell tried to find the economic basis of the Government's "Roads for Prosperity" programme (Tickell, 1993). He examined the direct employment and the economic flow-ons. He found "very poor value for money as a job creator" compared with other investments – £66,000-80,000 was needed to employ one person in road building compared with £30,000-50,000 for railways and £20,000-40,000 for building houses and just £9,000-18,000 for installing domestic insulation. "Roads are built by machines not men" was the comment from the employment secretary Lord Young.

Even with a poor record in employment, roads may still lead to prosperity through improving economic activity. Unfortunately the economic flow-ons are not so obvious either. Tickell (1993) examined the claim that congestion is costing UK business £15 billion a year (similar claims are made in the Industry Commission report in Australia). He found only "anecdotal" support for the claim, and the Department of Transport was "equally short on hard data to back up its view that prosperity follows where roads lead". For example, no part of Birmingham is more than five miles from a motorway but as Tickell says: "If access by road is the key to economic prosperity then Birmingham should be the wealthiest city in Britain. It is not". You can go even further and see that Liverpool, Britain's most advanced economic basket case, is well served by roads. The UK Department of Transport are now saying: "the effectiveness of transport policy in stimulating regional growth may be somewhat limited". This very guarded comment is not the conclusion of most "roads-based recovery" approaches which have been standard fare from this Department for the past 40 years.

Whitelegg (1993) examined a series of major UK road building projects (M58 and M62 in particular) which have failed to materialize economic benefits and concluded: "There is simply no evidence of the claimed link between access and employment or economic prosperity. The emperor has no clothes".

Whitelegg concludes that the factor which most attracts businesses to a locality is "a high quality environment". He says:

My advice to local authorities is to go for clean air, protected countryside and quiet residential areas. These are the assets that stimulate economic development. Unfortunately, too many authorities are providing the opposite: an area with

terrific accessibility, but which is noisy, polluted, and criss-crossed with motorways.

He points out that areas such as Covent Garden in London or York are thriving economically but have very poor road access. The same experience has been well known in Europe for some time. Roberts (1989) found that those European cities which had slowed their road systems and not expanded capacity had all benefited economically. Cities, says Roberts, must be “user friendly” and users in the end are pedestrians. In Australia, this link between controlling the automobile and economic success can now be seen in many cities, for example the revival of Fremantle owes as much to the stopping of major road proposals as anything, because several roads were planned which would have destroyed its unique heritage and character.

The mechanism for how improving the urban environment rather than building roads leads to a better economy is not difficult to understand. Road construction leads to dispersal of land uses and, together with the greater road capacity, facilitates a rapid growth in car use. The resulting congestion sets up a never-ending spiral in demand for road space. As Phil Goodwin from Oxford's Transport Studies Unit says, “to try and build our way out of congestion is impossible, since the rate at which traffic levels are likely to increase will far outpace any realistic construction programme”. But even before the limits to construction are met, the city will have experienced significant reductions in the quality of its urban environment, which today translate directly into reduced economic performance.

The situation in Los Angeles illustrates this well, with the most extensive set of freeways the world has ever seen and yet the city has huge problems with traffic. It is also now facing serious economic decline as its military spending is cut back and a middle class flight from the city over the past decade is now apparent, owing to its poor environment (Gobor, 1993).

In a post-industrial city, the quality of the environment is critical to a city's success and the role of transport is crucial to this – an overemphasis on road building and an under emphasis on public transport and a pedestrian environment, can spin a city into a decline phase, whether it be Bangkok, Los Angeles or Sydney.

For Britain, the conclusion to this debate on how transport impacts on the economy was a new Government approach summarized by Tickell (1993) as:

a transport strategy that restrains traffic, that reduces the need for travel and provides high quality transport alternatives.

Such statements are not always appearing from UK public servants and politicians but it is obvious from major reports such as *Sustainable Development: The UK Strategy* (Secretary of State for the Environment, 1994)

and the abandonment of most of London's controversial motorways, that the paradigm has substantially shifted.

Similar economic work to that in the UK has been going on in the USA. Aschauer (1989) has calculated that for every \$1 million invested in road funding, private sector capital productivity increases 0.24 per cent and private sector total factor productivity increases by 0.27 per cent. This has been highlighted by the road lobby group Australian Automobile Association in its recent report on road funding (AAA, 1994). However they do not record Aschauer's (Aschauer and Campbell, 1991) later study on transit investment where he concludes:

Within the broad category of transportation spending, the evidence indicates that public transit spending carries more potential to stimulate long run economic growth than does highway spending.

The major findings of Aschauer and Campbell's study were:

- Transit spending has more than twice the potential to improve worker productivity than does highway spending:
 - A ten-year, \$100 billion increase in transit investment would yield improved worker output valued at \$521 billion; a comparable expenditure on highways would yield \$237 billion.
 - The highest annual level of net benefits from such an increase in transit would be \$15 billion in the year 2000; the highest annual level of net benefits for highway spending would be \$7 billion, also in the year 2000.
 - In the peak year, the productivity of each American worker would be increased by \$185 from transit spending versus \$87 from highway spending.
- Net economic benefits from transit expenditures occur sooner for the economy as a whole than do net benefits from highway expenditures.

As well as these critical assessments of road funding there is a growing movement to account more correctly for the total costs of transport, in particular how to account for the full costs of feeding government money into the increased use of private motor vehicles. Table I is a summary of the studies we have collected, mostly from US cities but also from Europe.

Our own calculations on a comparison of the total costs of transport also reveal a very different story to the above myth concerning transit's inherent economic problems. Table II shows how car, bus and rail costs vary when their total costs are considered.

These costs do not consider the added benefits due to land development which is inherently more concentrated around transit rather than road systems. There are some who do not accept that road developments lead to more

Table I. *Costs of the automobile from various studies*

Country	Estimate per car in US\$ per year	Source
USA	4,220	Ketcham and Komanoff, 1992
USA	2,965	Litman, 1993
USA	2,312	MacKenzie <i>et al.</i> , 1992
USA	2,1850-3,636	Moffet, 1991
USA	3,647	Voorhees, 1992
Switzerland	2,813	VCS, 1991
Germany	3,376	UPI, 1991
Australia	3,868	Laube and Lynch, 1994

Note:
Costs include all public and external costs

dispersed cities, though the evidence is very suggestive of this in historical studies and in correlations between levels of road provision, levels of road use and levels of urban dispersal as well as urban concentration related to good transit levels (Naess, 1993; Newman and Kenworthy, 1989, Newman *et al.*, 1992). The study by Naess (1993) confirms all the patterns of our global cities comparison through a study of 22 Nordic cities.

The first outlines of theory showing how transit helps to slow urban dispersal and thus make the city more economically efficient, or on the other hand, how extensive road systems lead to dispersed cities which are not so economically efficient, has been suggested by Jacobs (1984) and Frost (1991). They suggest this is due to excessive commitment to suburban infrastructure which is a significant opportunity cost as well as the costs outlined above. We have summarized the possible mechanisms in Figure 1.

The role of public transport (particularly rail) in helping to reverse this process is strongly supported by Cervero (1992), who concludes that rail systems provide the market incentive for concentrating land use so often desired by cities. He suggests that car-based cities are having to move to extraordinary levels of control over private enterprise to try to minimize the impacts of the car (e.g. forcing firms to introduce ride sharing or risk substantial fines) but rail-oriented development can be left to the market to produce the necessary land use integration that reduces travel needs.

In Portland, Oregon the new light rail system has not only been successful in transport terms (doubling transit share in the city) but also it has been the catalyst for a rejuvenation of the Downtown (from 5 per cent to 30 per cent of retail trade), the development of subcentres (most

Table II. *Capital, operating and external costs of rail, bus and car modes in Australian cities (cents per passenger km, 1991)*

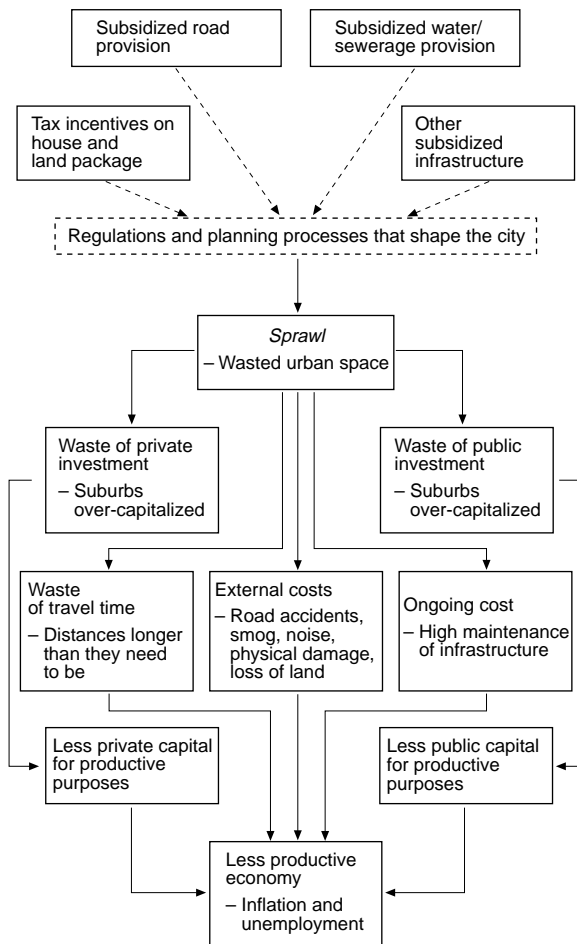
Cost item	Rail	Bus	Car
Capital and operating	27.06	21.51	26.65
Depots/car parking	–	1.09	3.42
Roads	–	–	8.89
Road maintenance	–	0.03	0.00
Fatalities	0.12	0.03	0.35
Injuries	0.00	0.00	0.11
Property damage	0.01	0.00	0.18
Air pollution	0.00	0.25	0.43
Noise pollution	0.00	0.20	0.08
Total	27.19	23.11	40.11

Notes:

1. The data represent the costs for any additional passenger kms of travel added to the Australian urban transport system.
2. The data are mostly Australia-wide averages for the five main Australian capital cities (excluding Canberra), based on information from the BTCE and Rail Industry Council adjusted by McGlynn and Andrews (1991) for inflation and other factors such as petrol tax and insurance for cars.
3. Capital and operating costs for urban rail show a range of 21.24 cents per passenger km to 50.35 cents per passenger km. The low figure is based on the incremental or marginal costs of adding new passengers to existing rail systems, while the high figure is for new light-rail systems for which the incremental costs equal the average costs because entirely new systems must be built. The figure used here is based on 80 per cent conventional rail and 20 per cent light rail to recognize the increasing interest in light rail and prevalence of LRT proposals around Australia and the likelihood that at least some new rail systems in the near future will be light rail.
4. The bus data in McGlynn and Andrews (1991) show a figure of 18.17 cents per passenger km for busways (in line with the Rail Industry Council's work). However, this cost dominates the bus data and seems excessively large. It has been eliminated here since busways are relatively uncommon in Australian cities compared with the great bulk of services which operate in normal traffic.
5. Air pollution and noise costs are based primarily on health impacts and are likely to be underestimated owing to inadequate data in these areas. Also, there is the wider, and as yet mostly unquantified damage, from air and noise pollution (e.g. materials and crop damage from air pollution, psychological/social impacts of noise and reduced real-estate values owing to traffic intrusion).

Source: Modified from McGlynn and Andrews (1991)

Figure 1. Possible mechanisms linking excessive provision of roads, urban sprawl and economic problems



development has been attracted to station areas, over US \$900 million in five years) and the prevention of urban sprawl (a green belt has now been possible to impose on the urban fringe) (Arrington, 1993).

It is these kinds of results that are beginning to show governments in UK, Australian and US cities that to revamp their urban public transport systems, link them to land development and move towards demand management, may be the basis of achieving sustainable economic development. This is now apparent in three government programmes in each of these countries, which will be briefly outlined.

US ISTEA legislation

The most significant transport and land use legislation in recent US history is the Inter Surface Transportation Efficiency Act (ISTEA) which was passed in the last year of the Bush Administration and now has the full support of Clinton. The key components of ISTEA are:

- a renewed Federal involvement in transit (including the funding of capital works for transit);
- increased funding;
- greater flexibility in use of funds for transit or highways (but subject to the provisions below) or demand management programmes;
- insistence on the use of planning processes involving the community to be adopted in cities before any funding for projects is allowed (i.e. no gun at the head of states to either accept the funds for a major highway or lose it altogether);
- tying of funding to achievement of Clean Air Act initiatives (i.e. no funds if smog levels are increased).

It is no wonder that with these provisions the balance of Federal funds is swinging towards transit. Many cities have been slow to catch on to the new order, but it is firmly in place and communities are beginning to see that it provides the opportunities to rebuild American cities in a more sustainable way.

The key component of having land development that is pedestrian friendly and transit oriented instead of automobile dependent has been the major problem in recent US urban history. ISTEA provides a chance to break that tradition but it requires local land use laws to be developed that are able to facilitate this. In California, there is a set of initiatives which is establishing the legal basis of transit-oriented development: the Transit Village Development Act of 1994 would establish all land within a quarter mile of rail transit stations as a transit-village development district if applied for by a local authority. The area would then be given the powers of a redevelopment agency and staffed to facilitate its transition into a mixed use, high density pedestrian scale urban environment. The district would have first priority for funding from state and Federal innovative transport-land use programmes. The Bill is in response to the US\$10 billion worth of planned transit investment in California due to ISTEA; as well as this there could be even further transit investment if a new citizens bill is passed to take a 4c/gallon fuel tax and direct it specifically into transit.

Transit/land-use linkage in the UK

A central concept in the new paradigm of city building is that transit funding should only be used as part of a totally integrated land use package. Thus any new line to be built or any old line upgraded can only go ahead if there is a coherent policy that increases housing, jobs and services in transit station precincts. This is the kind of process successfully undergone by the Toronto Transit Commission on their new lines and also on the Vancouver Sky Train. It is more or less standard practice in Europe, with Stockholm being one of the best examples of

planned land use/transit integration. However it has not been a feature of UK planning which opted for New Towns often without good transit links and with other development only loosely connected to transit.

This is now set to change with the UK Government's much applauded Planning Policy Guideline – PPG 13 Department of Environment and Department of Transport, 1994, which seeks to:

- reduce growth in the length and number of motorized journeys;
- encourage alternative means of travel which have less environmental impact, and hence;
- reduce reliance on the private car.

The new regulations require housing to be located in present urban areas near to work and services especially good public transport, rather than incremental expansion of villages and small towns outside the main cities, or sporadic housing in the countryside that is “likely to result in car commuting to urban centres”(Department of Environment and Department of Transport, 1994, 3.2). They also require rail stations and light-rail stops to be the “preferred location for travel-intensive development” (Department of Environment and Department of Transport, 1994, 4.24). The transit/land-use package is designed to not only overcome deficiencies in the transport area but also to help overcome some of the spatial inefficiencies in cities and make them more attractive places for living, working, recreating and moving around. The paradigm shift is in seeing that this requires transit-oriented development not car-based development. As Robert Cervero (1992) says:

Creating transit-oriented pedestrian-friendly environments would reduce auto dependency and cleanse the air, not to mention enliven cities and bring people from all walks of life into daily contact. Those previously isolated by the auto society the elderly, the wheel-chair bound, the poor – could fully participate in society's offerings in a transit-oriented city.

Australian better cities program

In each Australian city, there are transport planning strategies that are recommending the new order. Each city has shown that they understand the new policy environment, that they must upgrade transit, create better land use linkages thus reducing the need to travel, create more pedestrian-friendly environments and implement demand management (summarized in Newman *et al.*, 1992). However the old order continues relatively unabated because they have the funds and the bureaucracy in place. There is considerable disenchantment being expressed at grass-roots level with sophisticated alternative proposals being developed, even linking up the isolated alternatives from across Sydney into a coherent, integrated alternative plan (Link Up,

1994). When imaginative, future-oriented exercises are undertaken, the results show a much reduced level of automobile dependence, for example the Greenpeace winning concept for the Sydney 2000 Olympic Village is a transit-oriented, pedestrian-friendly urban village. This all seems to suggest that the Australian city is ready for some legislative changes like those outlined above in the USA and UK (Newman, 1994).

There is a major initiative from the Federal Government that is putting demonstration projects into place designed to help Australians envisage an alternative, less car-dependent city. This is the Better Cities Program and it is a five-year A\$850 million exercise which is already beginning to bear fruit. Although few of the projects are complete, the state and local Government bureaucracies involved have begun to apply the principles of transit-oriented, denser, more mixed land use to other areas. There are also two cities, Sydney and Brisbane, which are developing small light-rail systems that are likely to set the standard for new transit options in Australian cities.

Several Better Cities projects in Perth are building transit-supportive urban villages around the newly electrified and extended urban rail system. The new service has been a spectacular success, in particular the new Northern Suburbs line has attracted 40 per cent higher patronage than the previous bus-only service and 25 per cent of patrons have switched from cars. Now that land uses are moving to intensify around the stations and that cross-city bus services are occurring through the integrated feeder links, the basis for a lifestyle that is much lower in its auto dependence is now apparent. This is quite an achievement for such a car-dominated city but like all changes that involve a substantial element of paradigm shift, the upgrading of the Perth rail system came about because of political intervention through grass roots processes rather than the transport professionals (Newman, 1993). The professional's preferred choice was a low-key bus option that essentially admitted the task of overcoming auto dependence was not winnable. Once given the direction, the professionals changed and produced an award winning railway, on time and on budget.

This is the great hope as the urban freeway era is ended, that the combination of political commitment and professional expertise can be harnessed quickly to implement the necessary package of transport and land use policies. The global information system can provide the expertise and the evidence is pointing to a rapid rise in the political will to move away from the urban freeway.

The urban freeway protest movement

A recent article in *The Economist* (19 February 1994) says that protesting about new roads in the UK has

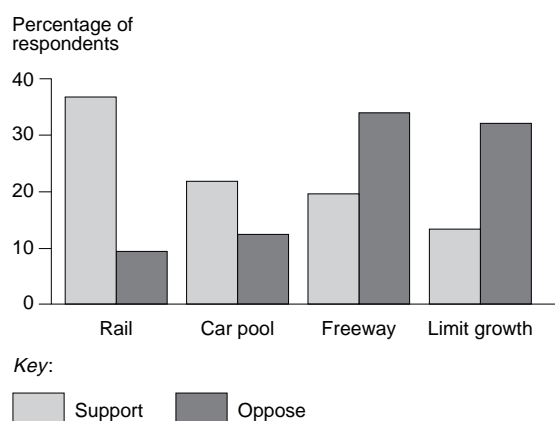
become a “truly populist movement drawing supporters from all walks of life”. The movement has strong support from the Tory Party, NIMBY groups and wider environmental groups. Their concerns are for the local countryside, the city’s environment and the global environment. The Department of Transport recently received 10,000 submissions on the M25 – only eight were in favour. *The Economist* article went on to say that “the pro-roads lobby, by contrast, draws upon a much narrower constituency – mostly road builders and car makers”. The alternative of shifting public money from high capacity roads into public transport is almost universally accepted.

In the USA, the movement to change priorities from road building to transit is very active. The Surface Transport Policy Project co-ordinates hundreds of organizations across the country and was a major force behind ISTEA. In California, the home of the freeway, only 18 per cent of the community believe that freeways help solve traffic problems, whereas 36 per cent believe in rail transit (see Figure 2).

In Norway a very revealing survey found a similar level of anti-freeway/pro-transit sentiment and when asked whether people believed their politicians had correctly judged the feeling of people towards private cars, their responses were: Yes, 19 per cent; No, 53 per cent; Do Not Know, 18 per cent (INRA Europe, 1991).

In Australia the tide is moving in this direction. The Community and Family Commission (1992), in their survey of attitudes in Perth, found a strong dislike for freeways, support for transit, and interestingly a powerful desire to try to create more diverse, village-style communities with close access to services. Across Australia there are many groups producing creative alternatives to large roads as well as opposing freeways. The Link-Up Conference brought together over 100 such groups just in Sydney. These groups have all the

Figure 2. California support and opposition for options to solve traffic problems



energy, vision and commitment of the early environmental movement. The one characteristic which they all express is that they receive little help from government in their work, that government is seen as their enemy, too closely allied to the road lobby and with virtually all government planners, engineers and administrators facilitating the problem, not the solution. This movement is now calling for a Commonwealth initiative on transit (similar to the US ISTEA approach) as it called for such action on the natural environment in the 1980s.

Conclusion

The kind of “modernist” thinking that produced the urban freeway with its grandiosity, its simplicity in the midst of complexity, its neglect of the social and environmental, its machismo, is now easily parodied by commentators. But the post-modern world in many other areas of human endeavour is still very confused about whether any alternative future can exist. With the urban freeway, it is now clear that the economic basis for its continuance is as shaky as its moral basis and alternatives do exist and are well-demonstrated in European and Asian cities. The English-speaking world have been slower to adopt the new paradigm but the evidence presented here suggests that the last days of the old paradigm are appearing in the UK, USA and Australia. This is not to say that the old way does not have some momentum left or that the political battles are over. What it does mean is that the tide has changed and cities which now build freeways will probably regret it.

References

- Arrington, G.B. (1993), “Transportation and land use – a shared vision”, *Passenger Transport*, Vol. 2 No. 3, pp. 4-14.
- Aschauer, D.A. (1989), “Is public expenditure productive?”, *Journal of Monetary Economics*, No. 23.
- Aschauer, D.A. and Campbell, E.J. (1991), “Transportation spending and economic growth”, Bates College, September, reported in *Earthword*, Vol. 4 No. 38.
- Australian Automobile Association (AAA) (1994), *Land Transport Infrastructure – Maximising the Contribution to Economic Growth*, The Allen Consulting Group, AAA, Canberra.
- Cervero, R. (1992), “Transportation shapes the city”, *Perth Beyond 2000*, Proceedings of City Challenge Conference, Challenge Bank, Perth.
- Community and Family Commission (1992), *Speaking Out, Taking Part*, Community and Family Commission, Perth.
- Department of Environment and Department of Transport (1994), *Reducing the Need to Travel*, Planning Policy Guidance PPG 13, Department of Environment, London.
- The Economist* (1994), 19 February.
- Franz, J.D. (1989), *Views of Bay Area Residents on Traffic and Growth Issues*, Metropolitan Transit Commission, July, San Francisco, CA.

- Frost, L. (1991), *The New Urban Frontier: Urbanization and City Building in Australasia and the American West*, University of New South Wales Press, Sydney.
- Gobor, P. (1993), "Americans on the move", *Population Bulletin*, Vol. 48 No. 3, pp. 1-40.
- INRA Europe (1991), "European attitudes to urban traffic problems and public transport", survey for ECG and IUTP, INRA Brussels, July.
- Jacobs, J. (1984), *Cities and the Wealth of Nations*, Penguin, Harmondsworth.
- Ketcham, B. and Komanoff, C. (1992), *Win-Win Transportation: A No-losers Approach to Financing Transport in the New York City and the Region*, Draft, New York, NY.
- Laube, F. and Lynch, M. (1993), *The Costs of the Motor Vehicle in WA*, Institute for Science & Technology Policy (ISTP), Murdoch University, Perth.
- Laube, F. and Lynch, M. (1994), *Costs and Benefits of Motor Vehicle Traffic in Western Australia*, Institute for Science and Technology, Murdoch University, Perth.
- Laube, F., Marinova, D. and Lynch, M. (1993), *Land Transport Infrastructure: Maximising the Contribution to Economic Growth; A Response to the AAA Report*, Institute for Science & Technology Policy (ISTP), Murdoch University, Perth.
- Link Up (1994), *Livable City Times*, Link Up, Darlinghurst, New South Wales.
- Litman, T. (1993), "Transportation efficiency and equity: an economic analysis", draft of master's dissertation, TESC Victoria, BC.
- MacKenzie, J., Dower, R. and Cheng, P. (1992), *The Going Rate: What It Really Costs to Drive*, World Resources Institute, Washington, DC.
- McGlynn, G. and Andrews, J. (1991), "The economic costs and benefits of urban scenarios that support ecologically sustainable development", internal ISTP report, September.
- Ministry of Housing, Ministry of Transport and Public Works, Ministry of Economic Affairs (1991), *The Right Business in the Right Place: Towards a Location Policy for Business and Services in the Interests of Accessibility and the Environment*, The Netherlands Government, The Hague.
- Moffet, J. (1991), "The price of mobility", Draft, National Resources Defense Council, San Francisco, CA.
- Naess, P. (1993), "Energy use for transport in 22 Nordic towns", *NIBR Report No. 2*, Norwegian Institute for Urban and Regional Research, Oslo.
- Newman, P.W.G. (1993), "The rebirth of Perth's suburban railways", in Hedgcock, D. and Yiftachel, O. (Eds), *Urban and Regional Planning in Western Australia*, Paradigm Press, Perth.
- Newman, P.W.G. (1994), "The rationale for a commonwealth role in public transport", seminar on "Urban public transport futures" by Australian Urban and Regional Development Review, Department of Housing and Local Government, Canberra, April.
- Newman, P.W.G. and Kenworthy, J.R. (1988), "The transport energy tradeoff: fuel efficient traffic versus fuel efficient cities", *Transportation Research*, Vol. 22A No. 3, pp. 163-74.
- Newman, P.W.G. and Kenworthy, J.R. (1989), *Cities and Automobile Dependence*, Gower, Aldershot.
- Newman, P.W.G., Kenworthy, J.R. and Vintila, P. (1992), *Housing, Transport and Urban Form*, National Housing Strategy, Background Paper 15, Australian Government Publishing Service, Canberra.
- Roberts, J. (1989), *User-friendly Cities: What Britain Can Learn from Mainland Europe*, TEST, London.
- Secretary of State for the Environment (1994), *Sustainable Development: The UK Strategy*, Cm2426, HMSO, London.
- Tickell, O. (1993), "Driven by dogma", *Geographical*, October, pp. 20-4.
- UPI (1991), *Umweltwirkungen von Finanzinstrumenten im Verkehrsbereich*, Umwelt- und Prognose-Institut/D. Teufel et al., Heidelberg/Germany.
- Voorhees, M. (1992), *The True Costs of the Automobile to Society*, Boulder, CO.
- VCS (1991), *Umwelt Verkehr Umkehr – Umweltgerechtes Verkehrsleitbild für die Schweiz*, Verkehrsclub der Schweiz/ Association des transports et environnement/Associazione traffico e ambiente, Herzogenbuchsee, p. 304.
- Whitelegg, J. (1993), *Transport for a Sustainable Future: The Case for Europe*, Belhaven Press, London.