



Orbital motorways in Sydney and Melbourne: policy questions

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Abstract

Orbital motorways are common in many large metropolitan areas. Many cities, particularly in North America and Europe, have developed major motorway standard roads, variously designated as orbitals, beltways, ring roads, or circumferential roads.

No Australian city yet has a completed orbital motorway, but recent decisions in Sydney and Melbourne will mean that both metropolitan areas will have a complete (or near complete) orbital motorway in place within the next few years. The Western Sydney Orbital and Melbourne's Scoresby Freeway are both major pieces of infrastructure which will serve not only the corridors in which they are built, but form vital links in a 360° circumferential road.

The RACV and NRMA as the auto clubs for Victoria and New South Wales respectively, have both strongly advocated for the above projects. Their advocacy has been based on the expected benefits that these roads will bring, in terms of the economic development of the metropolitan areas, mobility of people and goods, road safety, and orderly land use planning. The roads however must be developed as part of an integrated transport system.

However, to ensure that these benefits are delivered, it is important that the appropriate policy settings be established. This paper, based on a review of the experience of other cities in the world, outlines the policy issues that be addressed by State and Federal Governments and their road agencies in their decision-making about orbital motorways. The broad policy objective should be to maximise the community and road user benefits which can result from a decision to proceed with an orbital motorway, while any potentially negative outcomes are foreseen and taken into account in the policy and decision-making process.

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Introduction

Orbital motorways are common in many large metropolitan areas. Many cities, particularly in North America and Europe, have developed major motorway standard roads, variously designated as orbitals, beltways, ring roads, or circumferential roads.

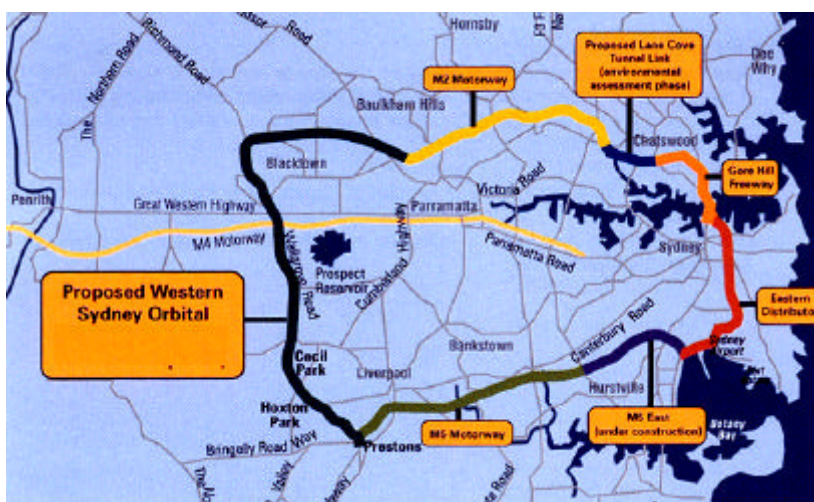
No Australian city as yet has a completed orbital motorway, but recent commitments to construct the Western Sydney Orbital and Scoresby Freeway in Sydney and Melbourne respectively mean that these two cities will, within the next few years, have a near-complete orbital motorway.

The Western Sydney Orbital will connect all of Sydney's existing orbital motorways (the M5, M2, Gore Hill Freeway, Harbour Tunnel and the Eastern Distributor). The Sydney Orbital allows access from all parts of Sydney by means of a network of consistently high standard roads (see Figure 1).

The Western Sydney Orbital will provide a new 39 km road from the M5 Motorway at Prestons near Liverpool to the M2 Motorway at West Baukham Hills. In the south it will link to the National Highway to Canberra and Melbourne and in the north to the F3 Freeway to Newcastle and Brisbane via the M2 and Pennant Hills Road.

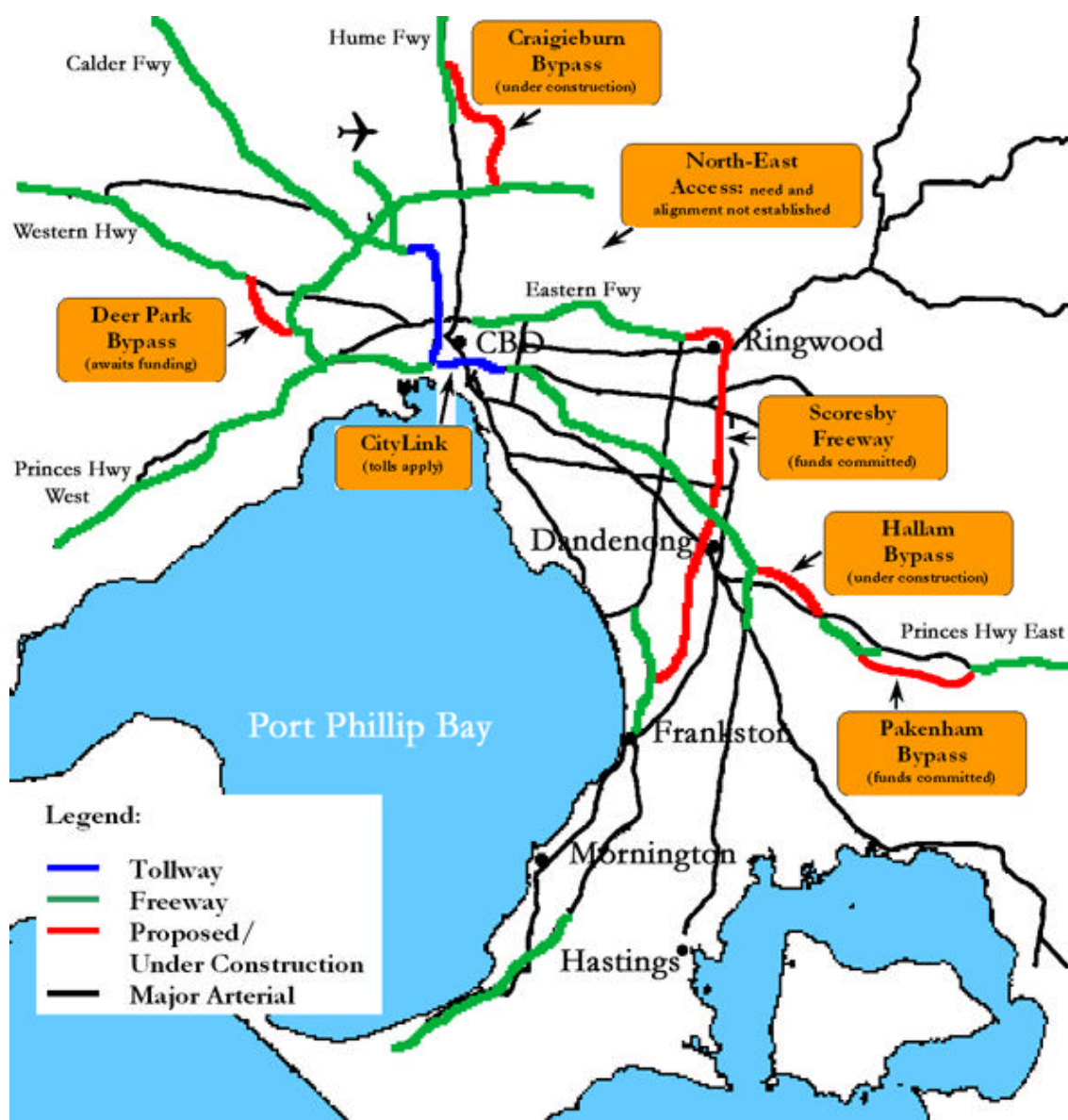
In particular the Western Sydney Orbital will connect western Sydney to the rest of Sydney and beyond in a way that has been discussed since the 1960s but not yet achieved. At the moment the focus of travel in metropolitan Sydney is on the east because of the east-west motorway system. With the Western Sydney Orbital it would be easier and more convenient to travel within Sydney and and from western Sydney.

Figure 1 Proposed Sydney Orbital



The Scoresby Freeway is part of the Scoresby integrated transport corridor, which runs from Ringwood to Frankston (Figure 2). The 34 km motorway will be the major north-south transport infrastructure in a corridor with a population in excess of 1 million people. However, in addition to this important regional role, it forms the second last link in Melbourne's orbital transport corridor. With the Monash Freeway, southern link of CityLink, Westgate Freeway, and the Western Ring Road complete, and work to start soon on the outer section of the Eastern Freeway to Ringwood, Melbourne's orbital motorway is already more than 75% complete. The northern part of the Scoresby Freeway, together with the connection between the Western Ring Road and the Eastern Freeway, will complete the motorway.

Figure 2 Scoresby Corridor



Both State and Federal Governments have committed to jointly fund the Scoresby Freeway as a Road of National Importance, and construction is expected to start in 2002-03.

This paper, based on a review of the experience of other cities in the world, outlines the policy issues that should be addressed by Governments and their transport agencies in the policy and planning stage of orbital motorway development. We suggest that the broad policy objective should be to maximise the community and road user benefits which can result from a decision to proceed with an orbital motorway, while ensuring that any potentially negative outcomes are foreseen and taken into account in the policy and decision-making process.

The specific policy issues to be addressed are:

- Economic development
- Rural and regional areas
- Urban land use
- Travel patterns
- Public transport
- Safety
- The environment
- Social effects, including new employment opportunities

Economic development

It is clearly in the national interest that Australia has modern, reliable and safe transport infrastructure. Ongoing investment in transport infrastructure must recognise the role of the road system in providing for the movement of all vehicles, and the freight, people and services they carry. In particular, business use of the road system must be recognised, since it accounts for around two-thirds of total resources consumed in the road transport sector (Cox, 1994).

About half of the national road freight tonnage moves within the 8 capital cities (Bureau of Transport and Communication Economics, 1995) so there is a clear national interest in fostering efficient transport infrastructure for intra-urban and intra-state movements, as well as interstate movements.

Of course, road investment must take place in the context of integrated, multi-modal, transport infrastructure strategy. This includes integration of infrastructure (eg modal interchanges, integration of services, and integration of information). Nevertheless, road-based transport modes dominate the movement of both people and goods within Australia, and account for over 70% of the resource consumption in transport (Allen Consulting Group, 1993).

At the project level, it is well known that investment in judiciously selected road infrastructure projects pays handsome dividends. Analysis of the benefits and costs of many individual road projects show that the benefits can vastly

outweigh the costs, i.e. the nation is better off to invest in these projects than not (RACV, 2001; Austroads, 1995).

At the strategic level, using techniques that are somewhat controversial but which nevertheless demand to be taken seriously, it has been demonstrated that there are significant additional national benefits from investment in road infrastructure over and above the benefits to road users that are taken into account in project appraisal. These additional benefits accrue in terms of higher economic growth, employment, and improvements in the balance of payments (Cox, 1994).

Analyses conducted by the Allen Consulting Group (1993) show that road investment can be self funding from a government budgetary perspective, with the returns from taxation revenue generated by higher levels of economic activity more than off-setting the costs of the original investment.

From a policy viewpoint therefore, the orbital motorway (or a project comprising it) should not only demonstrate that it is a worthwhile project in itself as appraised with the usual road project appraisal procedures (Austroads, 1995). In addition, it should be planned and implemented in such a way that it provides benefits over a wide geographic area, including rural and regional hinterlands. This implies good connections with regional routes. In the case of both the Sydney and Melbourne Orbital Corridors, this requirement is clearly met, since there are quality links to rural and regional centres from both of these metropolitan areas, radiating from the orbital motorway (see Figures 1 and 2).

Additionally, the economic benefits of an orbital motorway are multiplied where they facilitate access to other modes, to provide a continuous, seamless transport service. In the case of both Sydney and Melbourne, it is valuable to note that both orbital motorways provide significantly enhanced access to the respective airports, seaports, rail freight terminals, and road freight depots.

Given that the individual project is worthwhile, and recognising the multiplier effects resulting from the above actions, it follows that the community is not only better off to do these projects than not do them but will be better off the earlier they are done. Therefore, governments should ensure that the project is completed in the shortest possible time, so that benefits may flow early.

This has led some governments to consider the involvement of the private sector in some form of public-private partnership, with the private sector raising the funds and delivering the project, with a cashflow from either direct or shadow tolls to service the loan.

However, direct tolls have a number of problems. They detract from the overall benefit of the project, since they have the effect of diverting traffic to "free" roads in the vicinity. For example, a toll on the Western Sydney Orbital would have the effect of attracting less traffic away from residential streets such as Abbott Road currently used as a de facto link road between other motorways.

Moreover, motorists and other road users consider that they have already paid enough in taxes and charges to ensure an adequate level of road provision. For example, in 1997/98 (the latest year for which consistent data are available, Australian road users paid \$13.7 billion in motoring taxes and charges, while the total expenditure on road construction and maintenance in that year was \$7.0 Billion (Bureau of Transport Economics, 1999).

There may be scope for shadow tolls in some circumstances, where it is desirable to accelerate construction of the process. (A shadow toll is an arrangement whereby a road authority pays the road operator an amount of money over time, for example for each vehicle that uses the road. This provides a cashflow to the road operator, to offset financing charges for the provision of the road.) However, shadow tolls are not a panacea. Being funded by the private sector and carrying a risk to them, it is likely that the cost of borrowing will be higher than would be the case for public sector borrowing. In the case of a project like the Scoresby Corridor, where the Commonwealth and State Governments have committed to fund the project over a 5-year period, there would seem to be no point in adopting shadow tolls.

The economic benefits of an orbital motorway largely stem from the travel time savings that they produce, particularly in a non-radial direction. The travel time savings from modern urban motorways can be considerable. Surveys conducted by the NRMA for both the M5 and M2 motorways demonstrated major savings in travel times when compared to the pre-existing alternative arterial roads. In fact 54 minutes were saved on the M2 for its full length as compared to the alternative routes. Not only did this saving benefit motorists but it also benefited the viability of express bus services to the Sydney CBD from the northwest sector.

Travel times between King Georges Road and Port Botany were halved (30 mins to 15 mins) when the M5 east was constructed. The construction of the M5 east also relieved congestion on nearby arterial roads that resulted in a 10% travel time saving on those alternative routes. These savings in turn would have benefited local bus operations.

To ensure that these benefits continue as the transport task grows, traffic on the motorway must be actively managed, and an adequate public transport system be developed.

Impact on rural/regional areas

Orbital motorways provide high levels of connectivity between radial highway/freeway routes, while allowing traffic to/from rural and regional areas ready access to a broad band of destinations within the metropolitan area. This can provide very significant benefits to rural and regional industry in accessing markets in the metropolitan area, while facilitating personal travel to/from a much broader range of origins/destinations within the metropolitan area.

Similarly, the combination of orbital motorways and radial rural highways greatly expand the level of access to inter-modal terminals (port, airport, rail terminals). This is particularly advantageous again to rural industries, enabling them to get products to interstate and overseas markets more quickly, more cheaply, and perhaps in better condition.

Alternatively, orbital motorway routes provide a means for vehicles to by-pass the metropolitan areas by directly linking the radial inter-city routes with a high standard road. Interestingly, this is the rationale for designating sections of Melbourne's Western Ring Road (between the Hume and Western Highways) and the whole of the Western Sydney Orbital, as parts of the National Highway System.

Benefits may also result for outer suburban or near city rural townships, providing opportunities for new industry which will benefit from their proximity to the orbital motorway. An example of this is the township of Melton, west of Melbourne, which has successfully attracted manufacturing to its' industrial estates due to their access to the Western Ring Road.

From a policy viewpoint, it is important to recognise that significant beneficiaries of the metropolitan orbital motorway include industries in rural and regional centres. Therefore, quality access between radial rural highways/freeways and the orbital motorway must be provided. In political terms, there has always been a strong push for road investment in rural areas, but in fact it may be that the best road investments for rural industry may include those that facilitate access to markets and inter-modal terminals in the metropolitan area, particularly via the metropolitan orbital motorway. This political issue must be handled sensitively and intelligently. For example, the government's "Regional Australia: Our Commitment" (Commonwealth of Australia, 1998) highlighted the importance of transport infrastructure to rural competitiveness and the quality of life of those living in rural areas, and the importance of lower transport costs to the growth of Australia's exports, investments, and job opportunities in rural Australia.

Land use

The relationship between land use and transport hinges upon changes in accessibility. However, any urban area is dynamic, and changes in accessibility brought about by one single project, even a massive one such as an orbital motorway, can be difficult to isolate.

Nevertheless, there is ample evidence that a completed orbital motorway will lead to significant redistribution of land uses, and attraction of land use activities that might have otherwise been located in another city, or even another country. The increase in economic activity in Melbourne's west, in proximity to the Western Ring Road, following the construction of that road, is a case in point.

Therefore, appropriate land use planning controls, and careful consideration of the location of the interchanges on the orbital motorway, are both needed to maximise the benefits of the investment. Desirably, this should include constraints on the scattered growth on the fringe of the city, and measures to encourage concentration of development in nodes around the orbital's interchanges, particularly to encourage those industries that will most benefit from the high accessibility locations. This might include such land uses as regional shopping centres, inter-modal freight terminals, export-oriented manufacturing, business parks, and hotels.

Conversely, developments which provide services to the immediate region, or which provide a local distribution function, are likely to attract short distance movements on the orbital motorway, possibly contributing to congestion which will detract from the benefits of the motorway to longer distance traffic (Simmonds, 1990; Kirby, 1990). The development of an adequate public transport system integrated with the Orbital network to help cater for these shorter trips is important.

The frequency of interchanges provides a means to limit the effects of the orbital motorway on adjacent land uses, but this needs to be offset against the benefits to motorists of being able to maximise their time on the motorway itself. An appropriate supporting arterial road network is essential. Lathrop and Cook (1990) noted the importance of the arterial road network in discouraging the use of the orbital for short trips.

Given the very significant level of investment in an orbital motorway, ideally it should be considered as an integrated multi-modal transport/land use corridor, rather than simply a motorway or freeway corridor. This requires integration of transport/land use planning at the highest level, and active involvement in planning activities by local government.

Travel patterns

Following from the previous point, new development results in changed travel patterns, with a magnitude depending on the accessibility and attractiveness of the development. Moreover, new transport options can greatly influence travel patterns, and thereby affect travel times, congestion, and travel behaviour.

Simmons (1990), in a review of London's M25, noted that this orbital corridor could be seen as:

- An inter-urban route that is part of the national highway network, providing a by-pass of London,
- A regional motorway, channelling London-bound traffic around the outer edge of London to the most appropriate access point, or
- A primary urban distributor for trips between origins and destinations within London.

Simmons suggested that the travel patterns associated with each of these purposes were quite different, and that at a strategic level it was important to determine which was the predominant use and ensure that planning and operational decisions reinforced that purpose.

In addition to the early and clear definition of the strategic function of the proposed orbital motorway, it is important that this objective be upheld during the planning and design process to ensure that it is not compromised.

Similarly, an orbital motorway is not an end in itself, but a part (albeit a significant part) of the incremental transport network development for the region. To support the strategic goal, the orbital must therefore be supported by an arterial road network (to minimise the risk of congestion from local traffic and commuter movements) and active traffic management (e.g. ramp metering, variable speed limits, incident detection).

Given that an orbital motorway will serve a range of travel markets, it is possible that the effects of the investment may be rather different than was intended at the planning stage. This seems to have been the case with London's M25, where the traffic due to the first and second of the above three purposes was envisaged at the planning stage, but the third was not. The result was significantly more traffic than expected (Simmons, 1990). This raises the question of induced traffic – trips that did not occur beforehand but resulted directly from the changed accessibility and opportunities for travel produced by the new facility.

It is a moot point whether induced traffic is a positive or a negative. On the one hand, some argue that induced traffic may diminish the value of the investment, since the benefits that were intended to flow (in this case to long-distance inter-regional traffic) are lost due to traffic congestion produced by the induced, short-distance traffic. On the other hand, others argue that the opportunities for

private and commercial interaction stimulated by the new facility (which in turn lead to the induced traffic) is a benefit of the investment, since people may be able to access previously inaccessible work opportunities, or businesses may be able to access new markets, etc. The key point in a policy context however is that induced traffic is included in the forecast and taken into account.

Public transport

As noted above, an orbital motorway must be considered as a component of an integrated multi-modal transport system as roads on their own will not solve the transport needs of modern cities. The public transport component of this system could take several forms.

Perhaps the most important contribution of an orbital motorway to a metropolitan public transport system is to enhance or enlarge the catchment area for the radial public transport systems, which in Sydney and Melbourne is provided by rail. Specifically, enhanced park and ride and modal interchange facilities at railway stations near the orbital's interchanges should be encouraged in the planning of the corridor. This should extend to integrated information systems on the motorway, for example, noting the availability of car parking spaces at the modal interchange facility.

Similarly, express bus services on the motorway itself, perhaps linking activity centres around the orbital, and providing bus access to railway stations, could be developed. These would need to be integrated with route bus services providing a pick up and delivery function within residential areas. By encouraging high-density development around orbital motorway interchanges, the patronage of express bus services using the orbital motorway to link to activity nodes in a circumferential direction is facilitated. In fact, along Sydney's M2, there is a very successful and growing express bus service that travels along the exclusive bus lane within the M2 corridor. A public transport facility is also to be ultimately developed within the Western Sydney Orbital corridor.

The necessity to consider the broader corridor, not just the motorway route itself, is underlined when it is realised that provision of the motorway will have the effect, at least in the short term of taking traffic off parallel arterial roads. (For example, in the case of the Scoresby Freeway, a significant short-term reduction in traffic on Springvale Road and Stud Road would be expected.) This provides the opportunity to resume some of the road space thus created for an exclusive bus lane, or even perhaps light rail. Since the parallel arterial roads are much closer to the origins and destinations of most trips than interchange along the motorway, the public transport benefit of concentrating the improvement on the parallel arterials, rather than the motorway itself, is obvious.

As well as the circumferential public transport services (whether on the orbital motorway or on parallel arterial roads) and the use of the orbital to access radial public transport routes, the other public transport component worthy of consideration is enhanced radial public transport services. For example, in the

context of the Scoresby corridor, the provision of a transit way along Wellington Road is being considered. The link here is via land use changes; if the orbital motorway stimulates land use change to the extent that additional radial public transport services are required, then it is important that this is integrated within the overall planning for the orbital corridor, even if there is no major direct linkage between the orbital motorway and the enhanced radial public transport service.

Road safety

Access-controlled motorways are several times safer than arterial roads (Ogden, 1996). It is unlikely that orbital motorways are any more or less safe than radial or other urban motorways.

The NRMA's investigation of the safety impacts of the M2 Motorway shows that the impact of such motorways on local arterial roads is considerable. Using NRMA Insurance claims data, crash statistics were compared for the 2 years before and 2 years after M2 opening. The results of the analysis indicated that collision claim frequencies reduced in all postcodes considered following the opening of the M2. The magnitude of these decreases ranged from 11% to 26% as shown in Table 1.

Table 1 - Change in NRMA collision claims along the M2 corridor

Postcode covering	Number of crashes
Marsfield/Eastwood (2122)	down 26%
Beecroft/Cheltenham (2119)	down 26%
North Ryde (2113)	down 25%
Epping (2121)	down 22%
West Pennant Hills (2125)	down 20%
Carlingford (2118)	down 17%
Baulkham Hills/Winston Hills (2153)	down 11%

The results equate to approximately 2700 fewer drivers being involved in crashes across the area each year. Across the area studied the crash reduction was 21%. The crash reduction results were linked to the reduction in traffic congestion on the nearby arterial roads once the M2 was constructed.

Another consideration in relation to crashes and road safety on orbital motorways relates to the management of the motorway to minimise crashes, and to deal with the consequence of crashes when they do occur.

It is important that the orbital motorway is designed as a "smart" road, with much of the intelligence being related to incident detection and incident management. The rapid detection of a crash, the management of traffic in and around the crash site, and the rapid deployment of emergency services all require a high level of monitoring and communication systems along the orbital

corridor. In this context, it is useful to recall that about half of the delay on roads in urban areas is due to incidents (including crashes) and half due to congestion. The management of incidents is therefore a very important component of ensuring maximum community and economic benefit of the investment in the orbital motorway.

Environment

Orbital motorway projects have the potential to produce a range of environmental impacts. These would invariably need to be assessed in the project appraisal, and there are established processes and procedures in place in every jurisdiction to ensure that this happens.

Nevertheless, some general comments can be made. For example, in relation to noise, it should be noted that vehicles travelling at low speeds emit noise mainly through the engine, transmission, exhaust and brakes. Conversely, at higher speeds interaction of tyres with the road surface and air disturbance become more significant causes of noise. Hence as vehicles move from more congested local road systems to orbital motorway systems, the nature of the noise generated by these vehicles varies. Specifically, orbital motorways are likely to produce localised noise increases adjacent to the proposed developments, but the pavement/tyre interaction noise can be minimised with the use of modern open-textured pavements.

Moreover, to the extent that the orbital motorway reduces traffic flow along other major arterials, a decrease in localised noise levels quickly expected.

To mitigate the noise associated with the orbital motorway, a variety of management measures may be appropriate, including sound barriers as well as quieter road services. It could be argued that because of the concentration of traffic onto orbital motorways, as opposed to the spread of this traffic through a myriad of major roads through the urban area, there are increased opportunities for the erection of sound barriers and other mitigation measures to reduce urban noise levels overall..

Similarly, with vehicle emissions, a decrease in overall emissions would be expected as a result of the improved traffic flow. However, the localised concentration of emissions could be greater along the route of the motorway itself.

Other environmental issues, such as direct cultural, social, and ecological impacts, are specific to individual sites. These would normally be managed through sensitive siting and design, community consultation during the planning process, and accommodated within the regular project planning and development process.

Social effects

Roads and transport are provided to meet the social needs for mobility, accessibility, connectivity, and interaction (Austroads, 1997). Therefore, to the extent that orbital motorways and transport corridors increase the accessibility of areas on the edge of the city to the total metropolitan area, there is potentially considerable social benefit. That is, people are not restricted to accessing jobs, schools, recreation and social facilities, etc locally or in a narrow radial direction, but rather are able to access these opportunities across a much larger part of the urban area.

Conclusions

Both Sydney and Melbourne are likely to have a complete orbital motorway in place within a few years. In each case, this will be developed as part of an integrated multi-modal transport solution, and the motorway component will cater for both intra-urban and through traffic needs. They will link land uses, and stimulate economic activity, particularly as they enhance access to ports, airports, freight terminals and link industrial land uses.

However, to maximise the economic, social and environmental benefits of the orbital corridors, it is important to address a number of key policy issues, and address traffic management, road design, and intermodal questions. Experience from other cities that have complete orbital motorways systems in place should assist in ensuring that major Australian cities maximise the benefits of their orbital motorways corridors.

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